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Dating the Hittites with Statistics: Ten Pottery Assemblages from Boğazköy-Ḫattuša

Ulf-Dietrich SCHOOP*

Abstract

Hittite pottery has proven not to be particularly well suited for conventional typological dating. Factors responsible for this are its general homogeneity and the slow evolvement of diagnostic vessel types. This contribution argues for a fully quantitative approach in Hittite pottery analysis. Some of the most important methodological prerequisites are discussed, advocating in particular a strict discrimination between the archaeological contexts to which such analysis should be applied. Ten pottery assemblages from Boğazköy-Ḫattuša, stretching from the late Karum period to the very end of the Hittite era, serve as case studies to demonstrate the validity of a statistical approach to the material. Examples are shown of single-type distributions, combined-type frequencies, and numerical patterning derived from the measurement of vessel parameters. The paper concludes with a discussion of the potential that quantitative analysis may provide in Hittite pottery studies and of its interpretative limitations.

Introduction

As in any assemblage of material culture post-dating the Stone Age, pottery forms the major category of finds from excavations at Hittite sites.[1] Some classes of Hittite pottery have experienced considerable interest in the past and even play a role in the common understanding of what defines Hittite material culture – one could think here, for example, of red-slipped beak-spouted jugs or relief-decorated vessels.

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[1] For a general overview on Hittite pottery, see Müller-Karpe 2002; Schoop *forthcoming*.

However, in contrast to research into other archaeological cultures, in Hittite research, pottery has not been used as a dating tool in any consistent fashion. Instead, there seemed to be much better alternatives at hand, the critical examination of which is the aim of the present workshop. One of the reasons for this seems to be the obvious redundancy of the Central Anatolian Middle and Late Bronze Age pottery inventory, dominated by the never-changing drab-ware fabric type and by shapes displaying extreme longevity. We are dealing here with an industry that had, it appears, an output of almost industrial scale.

Although this situation hampers conventional typology, it would make it quite suitable for statistical analysis. Despite its widespread application elsewhere, at least since the 1970s, such an approach has only been used sporadically in our field. The aim of the current contribution is to demonstrate that a statistical approach to Hittite pottery is, in fact, fruitful and may even be the only way to go. It will help us eventually to answer some of the questions that have remained unresolved, questions that are not only chronological in nature.

To achieve this, we will first have to consider some of the main methodological issues and prerequisites of this approach. Next, I will attempt to show what kind of results we are likely to receive, using data from recent excavations at Boğazköy to serve as a case study. Finally, I will discuss the potential and restrictions for their interpretation.

Methodological prerequisites

In order to conduct a quantitative analysis of any pottery ensemble, two basic requirements have to be fulfilled: First, one has to be in the possession of an assemblage of material that has dropped out of use in a very restricted amount of time and, secondly, the assemblage has to be large enough to produce a stable picture of its composition.

The first requirement is more complex in nature. The classic example for an archaeological assemblage in which all objects have been laid down at the same time is the so-called "closed find", e.g. a grave ensemble or a purposefully hidden collection of artifacts (cache). Also of great value would be *in-situ* inventories, i.e. artifacts that are found by the archaeologist in the condition and at the place where their last user abandoned them.[2] The kind of assemblages encountered most often, however, consists of ordinary settlement pottery, fragments broken into different sizes and dislocated from their place of primary origin, i.e. the place of breakage of the original vessel.[3] Settlement remains of this kind are extremely difficult to deal with. Above all, the ability to make some statements concerning the formation of the relevant deposits is essential. I will try to illustrate this using an idealized cut through an abandoned house (fig. 1a). We can see here the stumps of the building's walls (a), and its floor (b). The floor is covered by some build-up of sediment (d) upon which lies some erosional debris of the walls (e). Finally, the ceiling has come down (f), followed

[2] Here, we already enter into some methodological difficulties as the concept of the "*in-situ* find" is not as straightforward as it appears (Schiffer 1985; cf. Blum's observations made during his investigations in the abandoned village of Işıklar in the Troad [2003, 197–248]).

[3] On the complex issue of the formation processes involved in the creation of settlement deposits, see, e.g., Schiffer 1996; LaMotta/Schiffer 1999.

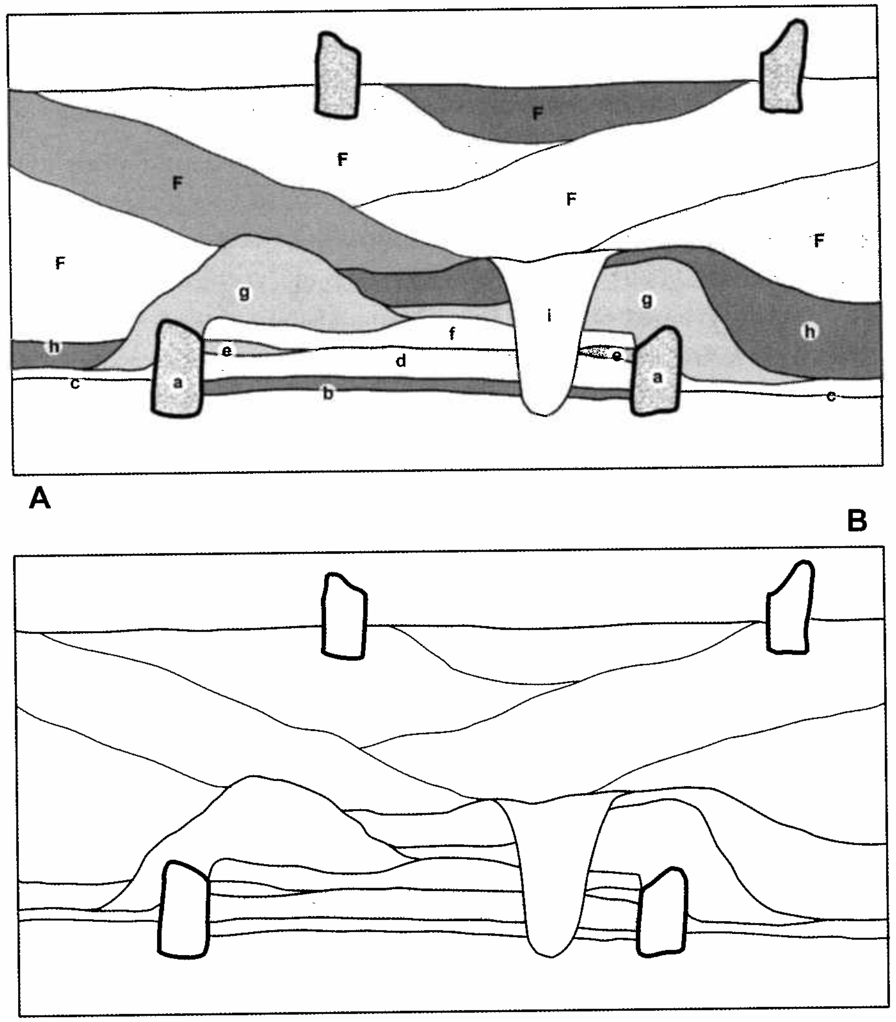


Fig. 1 Idealized section showing the stratification above a Hittite house. (A) Full stratification, (B) principal contexts suitable for pottery analysis.

by the collapse of the walls (g). Later, we have some sedimentation of soil covering the remains (h). At some stage, a water channel carved its way through the deposits (i). Ultimately, we may see fill from a building operation that served to level the ground for the erection of new habitations (F). This fill, brought from undefined contexts elsewhere, may contain the largest and most finely preserved pottery in the whole sequence. The element with the most immediate relationship to our building, however, and thus the principle one that we can analyze, is the deposit on top of the floor (of less value and only if we can establish a stratigraphical relationship with our building would be deposits that accumulated outside during its use [c]) (fig. 1b). We know here that it has formed between the last sweeping of the floor and the collapse of the building's structural elements. The erosional sediments on top of this debris and the fill, although obviously deposited later than our house's remains, may contain material that is considerably older. Worse still, their contents – brought in from different places – will often be of badly mixed composition. We have to consider this together with the fact that Hittite pottery types have a very long life and shapes that evolve slowly or sometimes not at all. This means that if we do not discern the nature of such a secondary deposit, we will create fictional assemblages that still have properties like any other, but properties with no relationship to the development of the ceramic sequence.

Let us turn now to the composition of the deposit covering the floor. As stated earlier, its formation will have begun immediately before abandonment of the house. We will have here some garbage no longer cleared away before leaving. Neighbors will have used the structure as a dumping ground. Natural agencies as well as animals and children will have brought in debris from the outside, which will have accumulated there both during use and after abandonment (including some residual material from earlier settlement if we have older cultural strata below). Before long, however, the deposit will be covered by the decaying superstructure. Thus, we have a deposit here that reflects not a point in time but rather a time-span. Additionally, some of the pots whose fragments we find will have been broken soon after acquisition, some after several years of use, while others will have been pieces of inheritance.[4] All of these factors add up and impose limits to our analysis. Two important points may be formulated here: temporal resolution will never be better than maybe 25 years at the best, and we will never get contemporary assemblages that are absolutely identical in their composition.[5] It should be emphasized, however, that the above does not necessarily imply that only top-floor deposits can be used for our purposes. It is perfectly possible to use others, i.e. those with a less restricted formation span, as well. The main point is that we have to be able to make explicit statements about these circumstances and thus evaluate the quality and the limitations of the results.

The question that now arises is how we might treat a successfully isolated pottery assemblage and how we can compare it to others.[6] This may be carried out on different levels of analysis.

1. The common approach would be a binary system, comparing the existence/non-existence of types in different assemblages. This, if made explicit, may be carried out by creating a composite table with entries for every known type. As mentioned earlier, Hittite pottery is not very well suited for this approach, which needs fast development of pottery types and the existence of type-fossil shapes. Research has shown that only a very coarse structure of the Hittite sequence can be achieved this way. To arrive at a higher resolution, quantitative data have to be used.
2. On the lowest level of analysis, we may investigate the quantitative distribution of single types over time. This presupposes that a new type, when introduced, first occurs in low numbers, then reaches a maximum peak, and eventually falls out of fashion. In other words, it should show a normal distribution. A prerequisite for this is that our initial typological classification is not based on functional types that are unlikely to behave in such a way.
3. On the next level, we may investigate the mutual behavior of two related types against each other. In the ideal case, we may see how one type is gradually replaced by another at a steady and fixed rate. Although semi-quantitative statements of this kind are often found in the literature, only fully quantitative data will provide us with index figures allowing comparison of different assemblages. Even if statistics quickly become more complicated, such an analysis can also be conducted with more than two types included.
4. On the highest level, quantitative data from all types may be considered. Our statistical tools in this case would be seriation and related methods such as correspondence analysis. To my knowledge, such statistics have not yet been applied to Hittite pottery assemblages. For the purpose of this paper, we will also stay below this level in the case studies presented below.
5. A somewhat different approach would be the analysis of metrical parameters on vessels from the same type, e.g. diameter, wall thickness, rim angle etc. Here, too, we are often confronted with semi-quantitative statements such as "bowls tend to get smaller with time" or "rims tend to get longer". Like in the cases above, absolute figures based on measurements will provide us with a much better basis for comparison.

[4] Ethnoarchaeological observations relating to this question may be found in David/David-Hennig 1971; David 1972; Hayden/Cannon 1983.

[5] Without delving too deeply into these matters, it should be kept in mind that the concept of "contemporaneity" is a rather hazy one under these circumstances, as it is impossible that the same formation processes act on two different locations exactly in the same way and for the same time. Here, we simply reach the limits of what can be achieved with settlement remains.

[6] For this and the following, see also the useful general discussion in Millett 1987.

Case studies: Ten pottery assemblages from Boğazköy

Over the last years, excavations at Boğazköy have targeted several areas that differ in date, stretching from the Early Chalcolithic to the Iron Age. Of these, ten complexes ranging from the final Middle Bronze Age to the end of the Hittite Empire Period are of interest here (figs. 2–3). As stated above, only a small fraction of the archaeological deposits encountered was used for quantitative analysis, with the discrimination based on the requirement that statements about their internal consistency must be possible. The complexes addressed here actually differ somewhat in quality and in size, but this should not be of concern here. Most of the complexes have been subjected to external, mostly radiocarbon dating. Details on the present state of the Boğazköy radiocarbon sequence may be found in another contribution in this volume. Radiocarbon dating and pottery analysis are still in progress, meaning that all figures presented here are preliminary. However, major changes in the results are unlikely.

A short characterization of the assemblages included in this analysis has to suffice here.[7] They all originate from the excavations at Boğazköy conducted since 1994 under the leadership of Jürgen Seeher. The oldest complex A18 consists of pottery recovered from

[7] Note that the numbering of the complexes followed here serves only the purpose of the present paper. The designations indicate the relative positioning of the assemblages and their approximate absolute dating according to the current state of investigation.

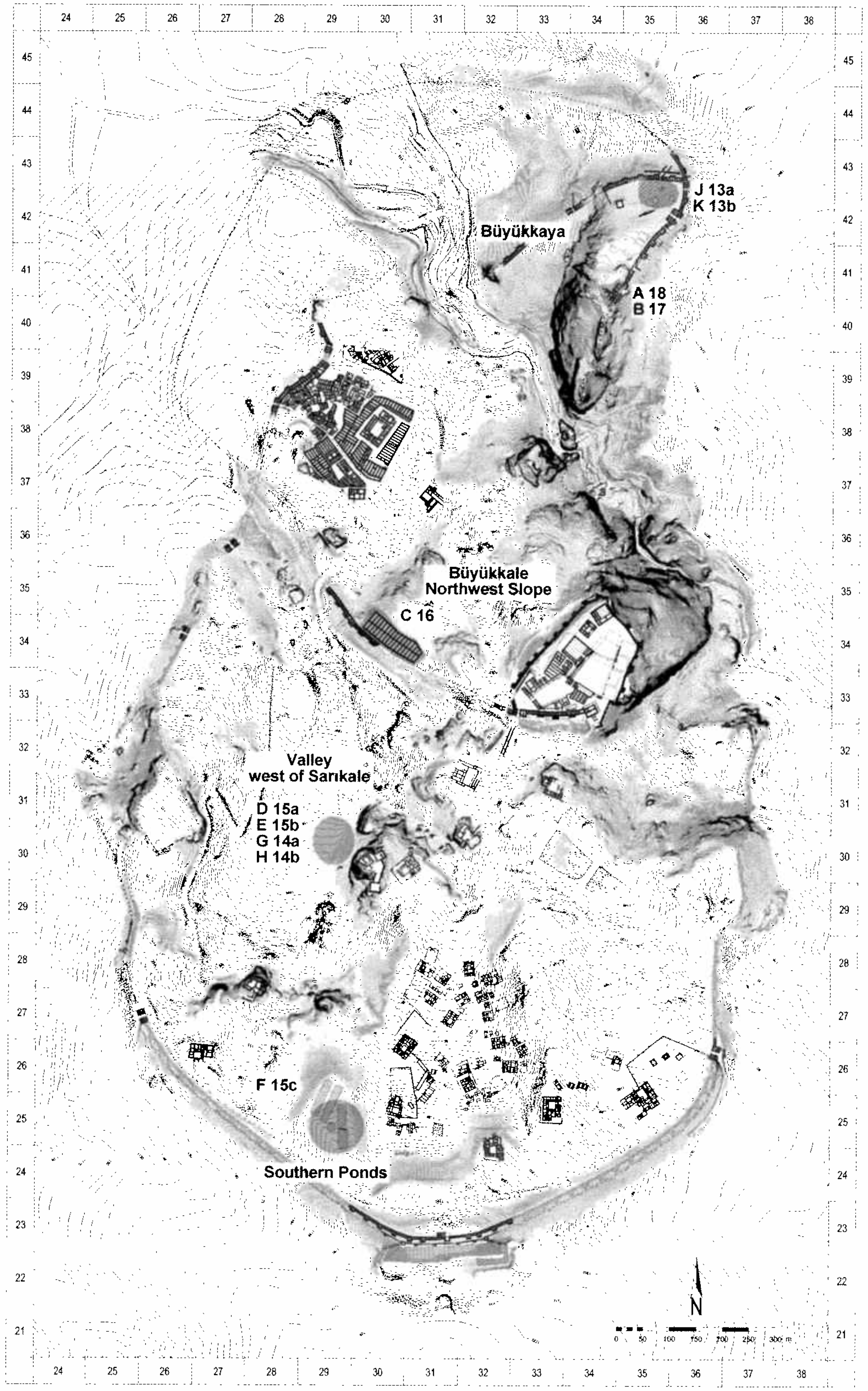


Fig. 2 Topographical plan of Boğazköy-Ḫattuša indicating the origin of the pottery complexes discussed in the text.

Designation	General Context	Location	Type of Deposit	Dating
A18	Small settlement with habitation structures	Büyükkaya Upper Plateau	Settlement remains	"Late Karum" period; 18th cent. BC ?
B17	Monumental Building	Büyükkaya Upper Plateau	Settlement remains or leveling layer?	17th cent. BC (interpolated)
C16	Silo building	Northwest Slope of Büyükkale	Pottery from burnt walls and mud ceiling	Early 16th cent. BC (^{14}C/interpolated)
D15a	Two quadrangular buildings – Barracks?	Valley west of Sarıkale	Top-floor deposits	Around 1500 BC (^{14}C)
E15b	Settlement remains	Valley west of Sarıkale	Top-floor deposits	Middle of 15th cent. BC (^{14}C)
F15c	Pottery "cache" inside the ponds – probably temple refuse	Southern Ponds	Bulk find of pottery – remains of one single dumping event	End of 15th cent. (^{14}C)
G14a	Settlement remains	Valley west of Sarıkale	Top-floor deposits	Beginning of 14th cent. BC (^{14}C)
H14b	Settlement remains	Valley west of Sarıkale	Top-floor deposits	14th cent. BC (^{14}C)
J13a	Settlement remains	Büyükkaya Lower Plateau	Top-floor deposits	First half of 13th cent. BC (^{14}C)
K13b	Settlement remains	Büyükkaya Lower Plateau	Top-floor deposits and fill of storage pits	Second half of 13th cent. BC (^{14}C)

Fig. 3 Table with a short characterization of the pottery complexes discussed in the text.

deposits associated with a small settlement on the Upper Plateau of Büyükkaya (Seeher 1998, 221, 222 Abb. 6). Conventional typology would suggest a rough contemporaneity with Layer 8a from the northwest slope of Büyükkale, i.e. the latest stratum to be placed into the Karum Period of the local sequence here.[8] Upon its abandonment, the Büyükkaya settlement was followed by the construction of a monumental building with only a few deposits assignable to it (Complex B17; cf. Seeher 1998, 221–224). These may not be true settlement remains but fill underneath the ancient floors, themselves now lost. Although this factor severely limits the analytical value of this assemblage, its possible span of origin can be closely delimited. Firstly, the typological properties of the pottery contained show it

[8] Orthmann 1963; 1969. – Orthmann correlated this assemblage with Layer 4 of the Lower City and Layer IVd from Büyükkale.

to be clearly distinct from the underlying Karum Period strata, i.e. we are not dealing with local relocation of older deposit. Secondly, a fill that served to carry a number of rooms of the monumental building on the western flank of the plateau is cut by the later postern wall beneath. As Seeher shows in his contribution to this volume (cf. also Seeher/Baykal-Seeher forthcoming), the postern wall must have been erected in the 16th century, perhaps even towards its beginning. In other words, in all probability, our assemblage B17 has to be dated to the 17th century BC.[9]

A similar situation concerns our Complex C16. This assemblage was contained in the walls and the coverings of the huge grain silo on the Northwest Slope of Büyükkale, the destruction of which is radiocarbon-dated into the 16th century.[10] Again, this is only a *terminus ante quem*, but it shows that we have to accommodate the pottery to the same time span as the typologically much older material of Complex B17 – most probably into the early 16th century BC.

Complex D15a consists of pottery from top-floor deposits of two quadrangular buildings in the valley west to Sarıkale, built here apparently on virgin soil.[11] They are radiocarbon-dated around 1500 BC. Superimposed on these remains are two consecutive building phases, the remains of which again produced good top-floor assemblages (Complexes E15b and G14a). The later Complex G14a shows a good match with the pottery "cache" dumped into the Southern Ponds high above in the Upper City, but appears somewhat younger typologically. The pond complex (G15c) cannot be fully integrated into this analysis, as we are not dealing here with ordinary settlement remains.[12] Radiocarbon dates taken from charred food remains found together with the pottery fragments date the assemblage to the end of the 15th century.

After an interval that saw heavy erosional activity acting upon the older settlement remains, a dense cluster of habitation structures was built in the Sarıkale valley. A series of radiocarbon dates indicates a duration of this settlement phase for most of the 14th century. Complex H14b belongs to the later part of this period.[13] After this time, the area was abandoned, never to be reoccupied (as far as the present record shows).

For the first half of the 13th century, we have the vestiges of several Hittite houses erected behind the northern gate of the city wall closing off the Lower Plateau of Büyükkaya

[9] Typologically, this assemblage appears to correspond well with Layer 7 from the Northwest Slope (Orthmann 1969, 46–47), separated by a stratigraphical discontinuity from Layer 8a below. This break was taken there to mark the transition from the Karum Period to the Hittite era proper.

[10] Seeher 2000a, 356–367; Seeher 2000b, 278–287; Seeher 2001, 333–335; Seeher 2002, 77–78.

[11] Seeher 2003, 9; Seeher 2004, 62–66.

[12] The assemblage from the Southern Ponds has quite a different composition in functional types than any of the other Boğazköy assemblages. We are confronted here, as it seems, with the pottery inventory of a temple dumped into the ponds, which had already become inoperative at this early time (Seeher 2001, 341–362; Seeher 2002, 59–70).

[13] Seeher 2003, 10–13; Seeher 2004, 67–70. For a first (qualitative) evaluation of the pottery from Complex H14b, see Schoop 2003a.

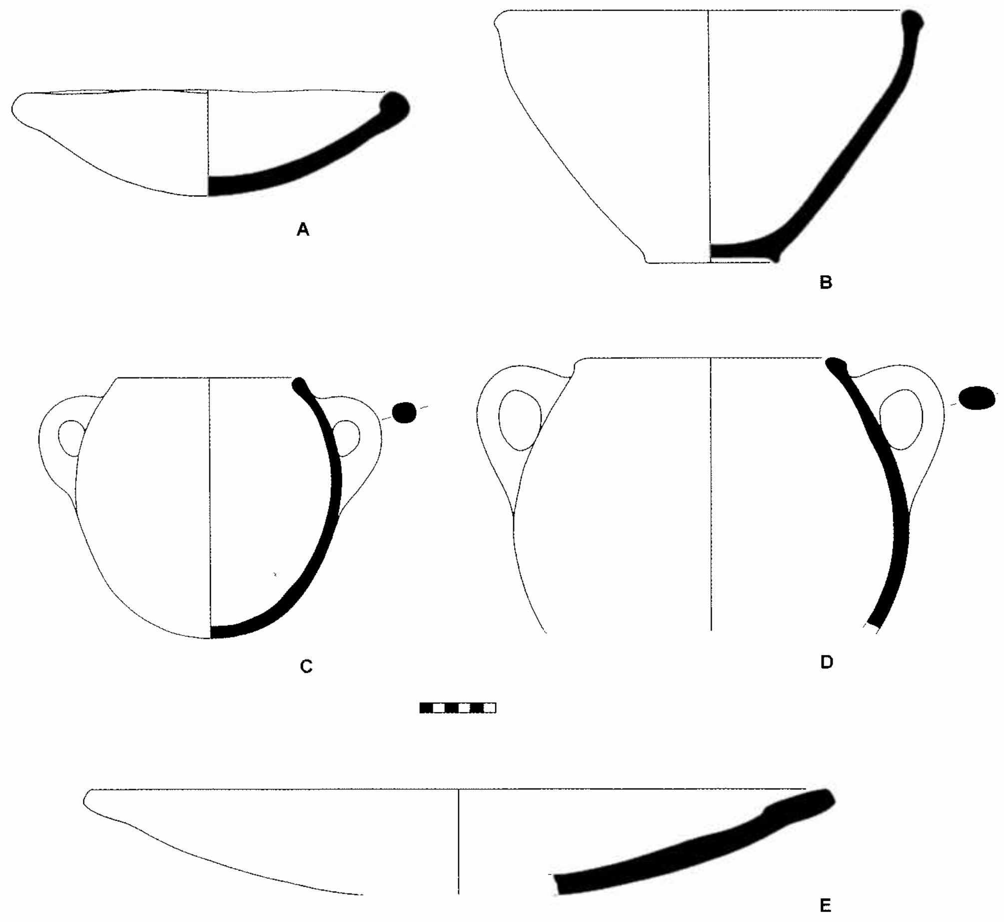


Fig. 4 Hittite vessel types discussed in the text. (A) Heavy flat bowl, (B) deep carinated bowl, (C) cooking pot with internal rim-thickening, (D) cooking pot with external rim-thickening, (E) baking plate. Scale 1:6.

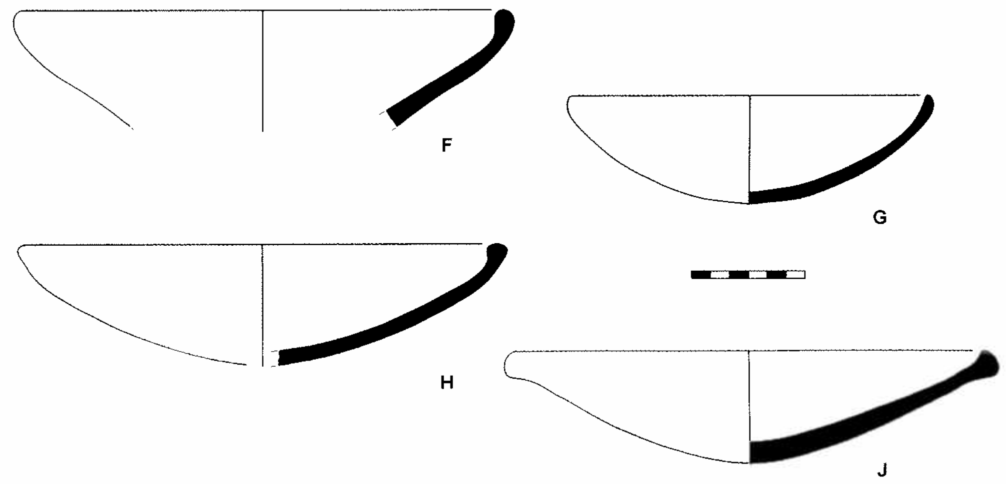


Fig. 5 Hittite vessel types discussed in the text. (F) Plain bowl with thickened rim, (G) plain bowl with pointed rim, (H) flat bowl with wedge-shaped inward-looking rim thickening, (J) flat bowl with thickened upward-pointing rim. Scale 1:4.

(Complex J13a).[14] The latest remains (Complex K13b) originate from some flimsy structures built into erosional sediment filling the depressions left by the large, now dysfunctional grain silos on Büyükkaya (cf. Seeher 1996, 346, 343 Abb. 13). This pottery shows all the signs of technical deterioration that have also been observed for the latest stage of Hittite settlement in the Upper City (Müller-Karpe 1988). Although I have posed the question elsewhere of whether this latter assemblage may not already date to the post-Empire period (Schoop 2003b, 171–173), a radiocarbon date produced by a grain sample from Büyükkaya now seems to place it well into the second third of the 13th century.

We can see that with intermittent gaps, the different complexes are distributed over the whole Hittite sequence, even if the older part of the sequence is not as well represented as one would wish. Pending new excavation results from Boğazköy itself, the detailed sequence from Kaman-Kalehöyük will produce further clarification here (Katsuno 2004; Katsuno this volume).

The typological classification of the pottery that the complexes contain is based – with some modifications – on previous work conducted at Boğazköy.[15] As far as possible, the types defined are non-functional. The groups have been differentiated to encompass as much (chronological) variation as possible while being large enough to remain quantifiable, i.e. extremely small groupings have been avoided. Quantification is twofold, being based on a simple sherd count (#) and the measurement of rim equivalents (REq), to account for both the actual number of finds represented and for differential breaking habits for vessels of different size and shape.[16]

In the type studies presented below, I will refrain from giving actual figures, as the pottery analysis is still in progress. It should also be emphasized that in the graphs as they are presented here, the different complexes are arranged in their relative order only. In other words, the X-axes show neither the absolute date of the respective assemblages nor their true chronological distance from one another. My aim here is rather to demonstrate *in general* that Hittite pottery displays a regular, consistent numerical patterning that is open to interpretation. The distinctive trends produced by this patterning are clearly visible in the preliminary data already; they may be observed on different levels of analysis.

I will begin with some type-related features, moving from simple to more complex relationships. From there, I will move on to results obtained by direct measurement of sherd features and their quantification.

[14] Seeher 1995, 604–612; Seeher 1996, 335–338.

[15] See especially Fischer 1963; Müller-Karpe 1988; Parzinger/Sanz 1992.

[16] For a discussion of the quantification of sherd assemblages and on the measurement of rim equivalents, see Orton et al. 1993, 166–181; cf. also Schiffer 1996, 282–285.

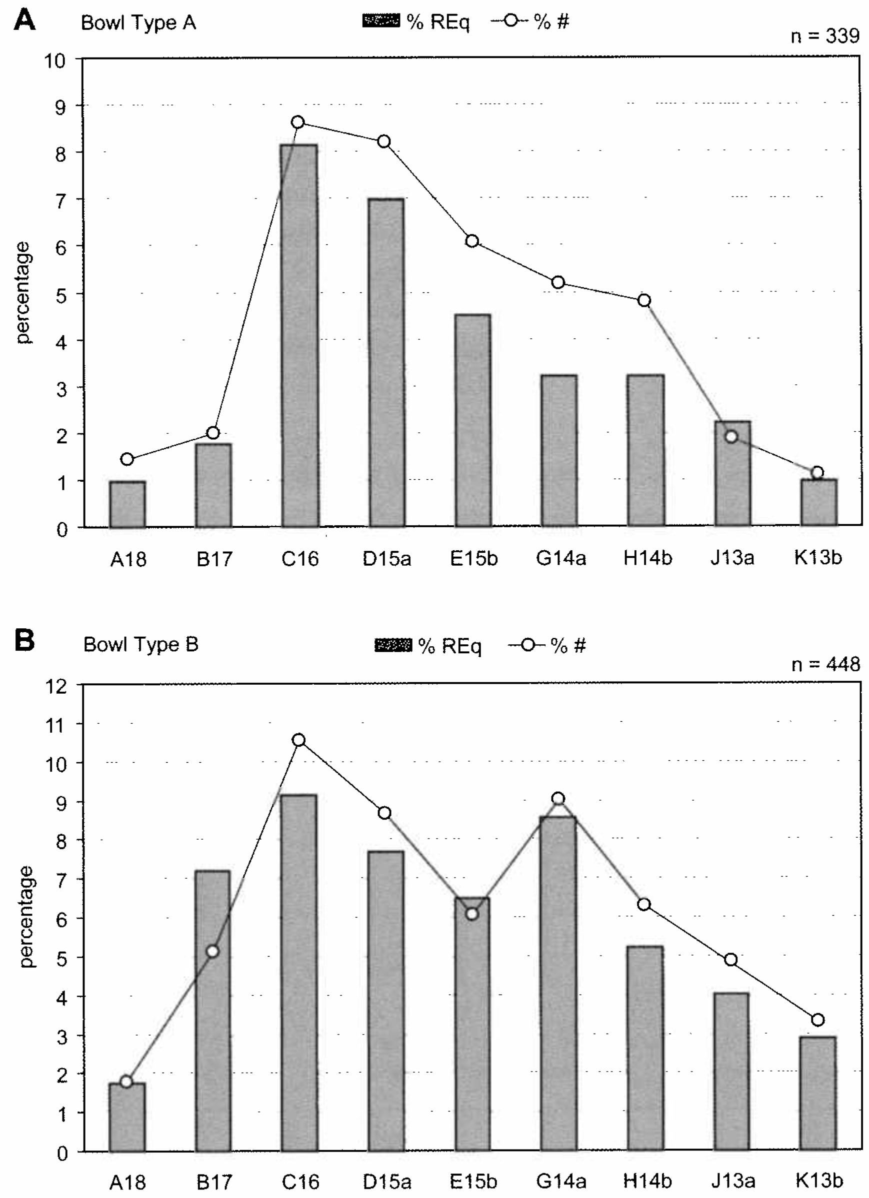


Fig. 6 Single-type frequency curves of Hittite vessel types. (A) Bowls of type A, (B) bowls of type B.

Simple frequency curves

Our starting point is constituted by two pottery types that approximate a normal distribution over time. The first of these (fig. 4A) is a large flat bowl that represents a common Hittite vessel type. These heavy vessels generally show diameters around 33 cm and elevated wall thicknesses around 11–12 mm. Typically, they display a massive thickened rim pointing inward. This type, being weakly represented at the beginning of the Hittite sequences, rises sharply in the 16th century to a value of approx. 8% (fig. 6a). During the 15th century, it seems to loose much of its popularity and nearly disappears altogether at the end of the Hittite era. Thus, to emphasize this point again, we seem to have a vessel type here that can hardly be called a type-fossil shape as it is represented in Hittite assemblages of all time periods. On the other hand, however, it shows a very distinctive quantitative behavior over time that can be quickly revealed by quantitative analysis.

Our second type (fig. 4B) consists of deep bowls with a pronounced carination below the rim, equally a familiar Hittite vessel shape. Their distribution reveals a somewhat similar picture, with a quantitative peak in the 16th century, although the subsequent decrease is much more drawn-out (fig. 6b). The exceptionally high value for Complex G14a cannot obscure the general tendency contained in this data. On the other hand, though, it is a clear indication that we have to expect outliers in quantitative pottery analysis – as in any set of natural data.

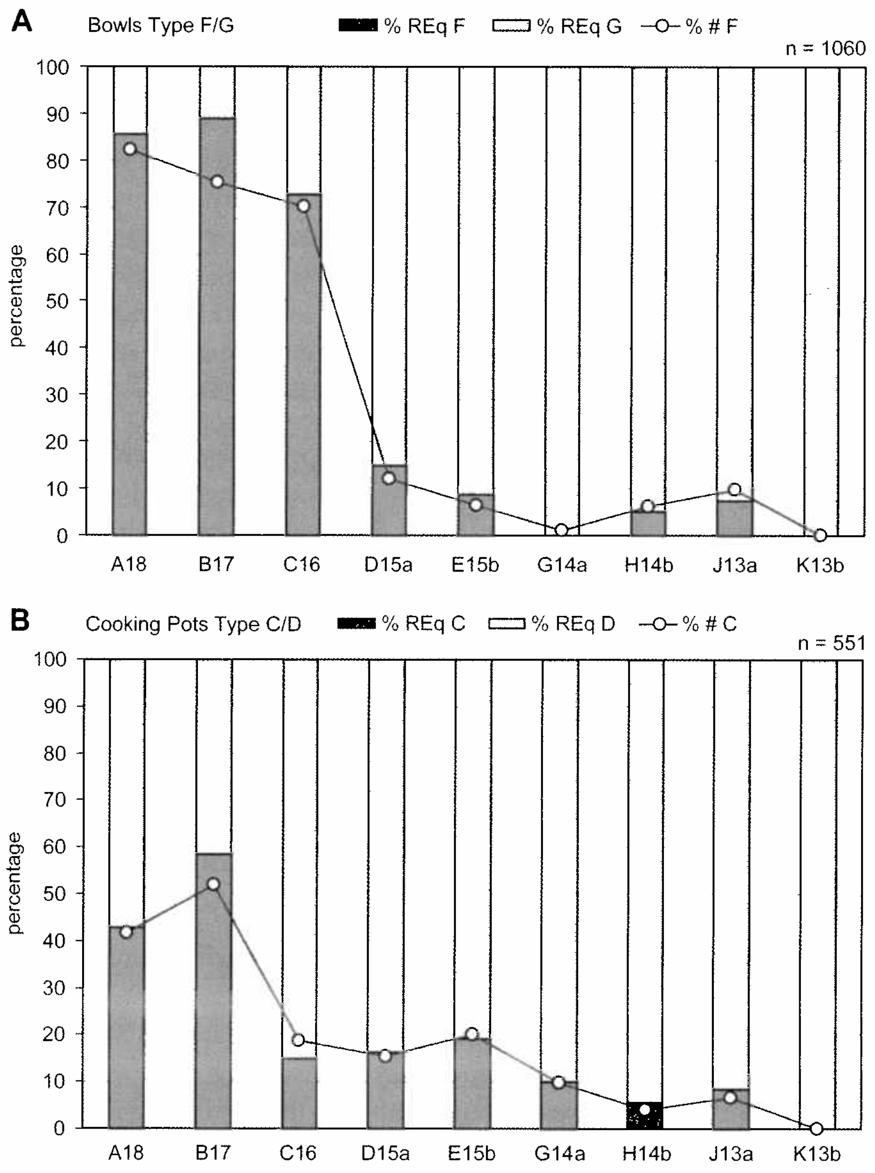


Fig. 7 Two-type frequency curves of Hittite vessel types. (A) Plain flat bowls of the varieties F and G, (B) cooking pots of the varieties C and D.

Combined frequencies

Two-partite comparisons are especially useful when looking at varieties of single types. Our next example compares the occurrences of two varieties of plain flat bowls, with diameters around 19–20 cm and wall thicknesses of 5–6 mm, which is much smaller than the type cited above. Such bowls occur with thickened rims (fig. 5 F) or with pointed rims (fig. 5 G). As it can be easily seen, the type F dominates at the beginning of the sequence, with values above the 70% mark (fig. 7a). The graph already indicates a steady decrease of the type during this time. During the 16th century, there appears to have been a sudden reversal of the pattern, with type G rising to predominance. Only at the end of the Hittite sequence does the older type F seem to have disappeared completely.

Cooking pots appear in Hittite contexts in two basic varieties (fig. 4). Type C, with internal rim-thickening, is in fact a wheel-thrown variety of the formerly hand-made EBA-cooking pots. Type D, with external thickening or folded rims, represents a new development of this shape. These two types show a somewhat different picture (fig. 7b). As before, the older type C becomes increasingly replaced by the younger type D, with external rim thickening. There seem to be three stages of this development, however: The first stage is characterized by a high percentage of the old type, representing 40–50%. In the second stage, comprising the 16th and 15th centuries, it falls to a value just below 20%. In the last stage – roughly corresponding to the Empire period – it drops under the 10% mark, until it disappears completely towards the end of the 13th century.

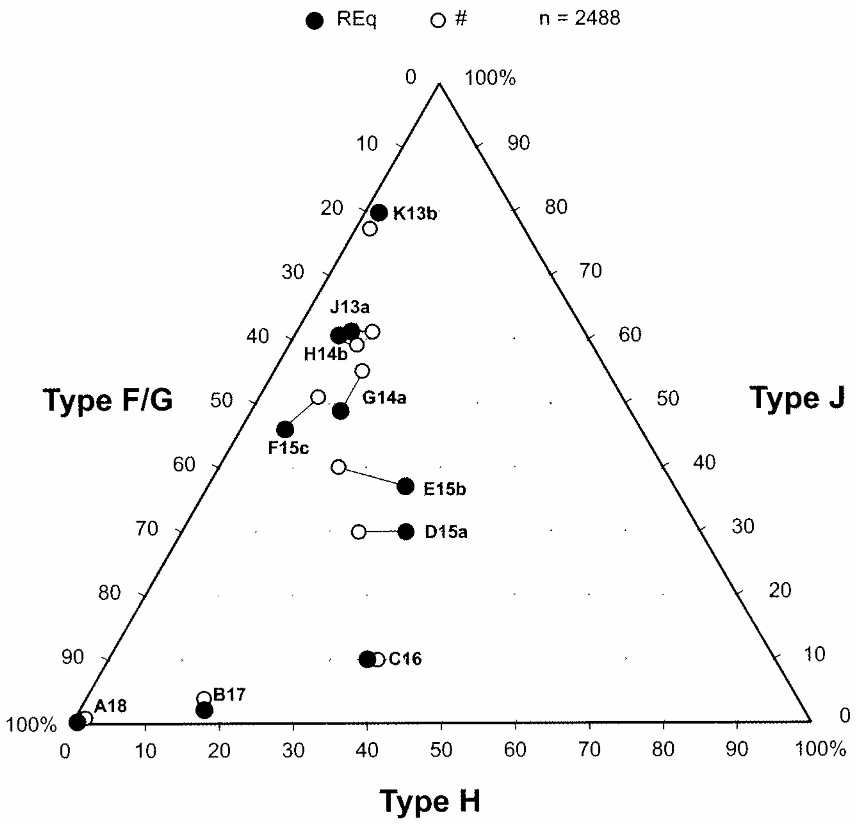


Fig. 8 Triangular graph comparing the frequencies of flat bowls belonging to the types F/G, H and J.

If we introduce a third type into our analysis, things become more complicated. Our example describes the pattern of three flat bowl types (fig. 5). Type F/G is the plain bowl type mentioned above. Type J displays a thickened upward-pointing rim; type H has a more wedge-shaped inward-looking rim thickening. For purposes of comparison, we can use a triangular graph with each side representing the percentage of a single type (fig. 8). What becomes immediately clear when looking at the resulting picture is a time-dependent patterning moving up the graph. While at the starting point (within Complex A18) only plain bowls of type F/G are represented, the following period sees – as the main feature – their gradual replacement by type J, terminating at a proportion of roughly 20% to 80%. Type H, however, shows a development on a different time scale. Its rise and demise is essentially a feature of the first part of the sequence, with a slow lingering out at its later part. The relative percentages of the three types therefore seem to be a very good chronological indicator.

Measurement of vessel parameters

In contrast to such classification-based observations are direct measurements of vessel parameters. Although they are less subjective than the former, it is much harder to detect features that are of structural significance. It is important to stress that the figures presented here are mean values calculated for each assemblage. They *never* apply for every piece within them. Let us proceed with exemplary data obtained from cooking pots and baking plates, which, despite a rather unspectacular appearance, display a surprisingly rich body of variation. Starting with cooking pots of the variety with external rim strengthening (type D), we may first look at the changes in diameter of the openings (fig. 9). With the onset of the 14th century, we see here a steady and rather fast increase of this value, beginning at

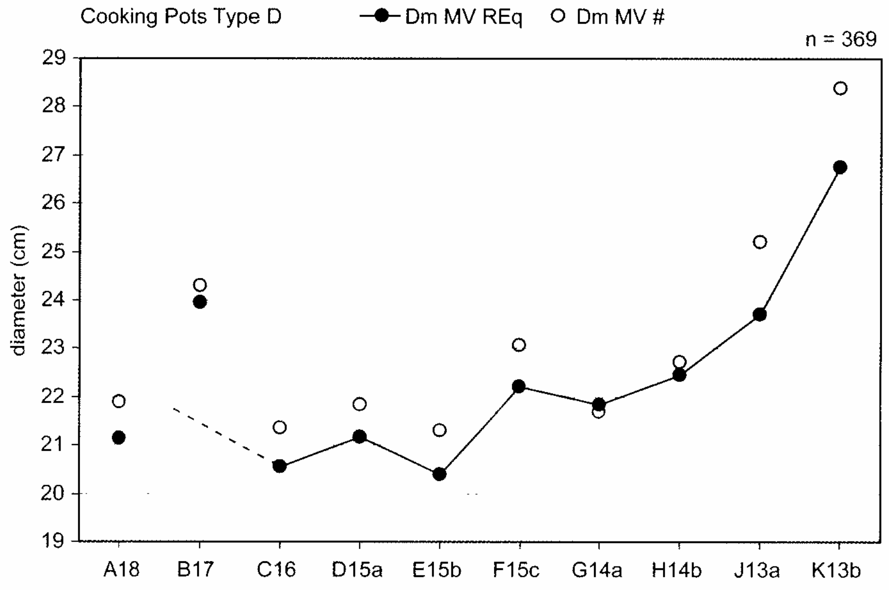


Fig. 9 Variation in the diameters of cooking pots (type D) according to the mean values of the assemblages.

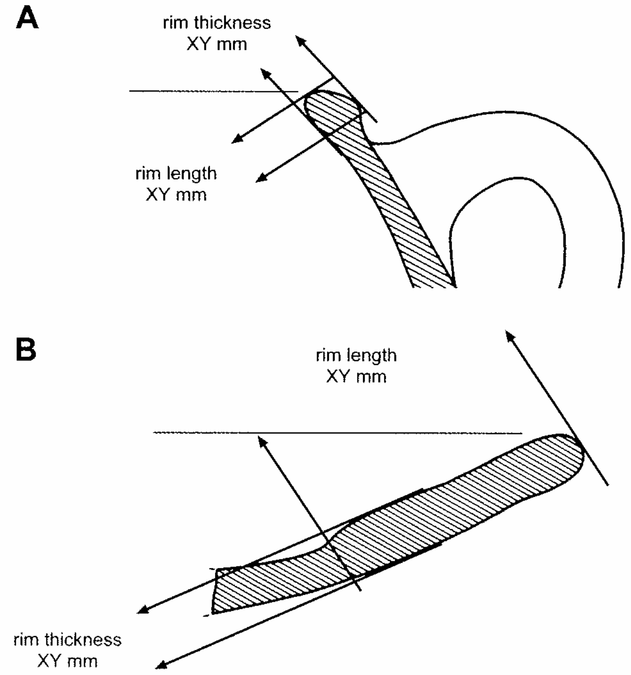


Fig. 10 Measurements taken from the rims of cooking pots D (A), and baking plates E (B).

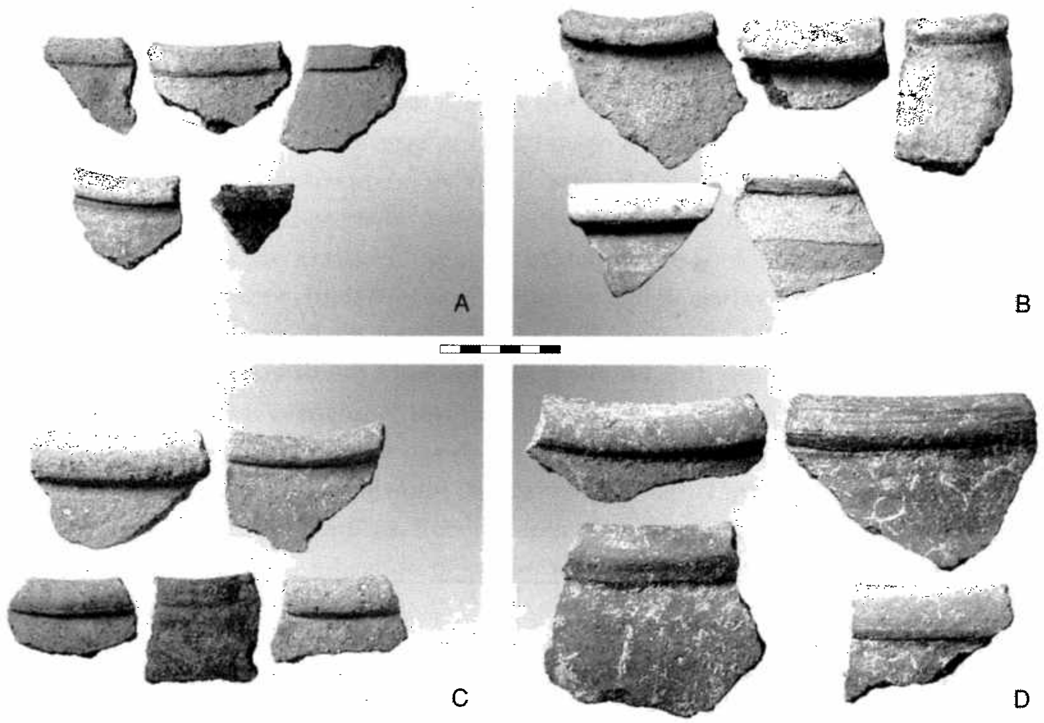


Fig. 11 Rims of cooking pots D from complexes A18 (A), C16 (B), D15a (C), and K13b (D).

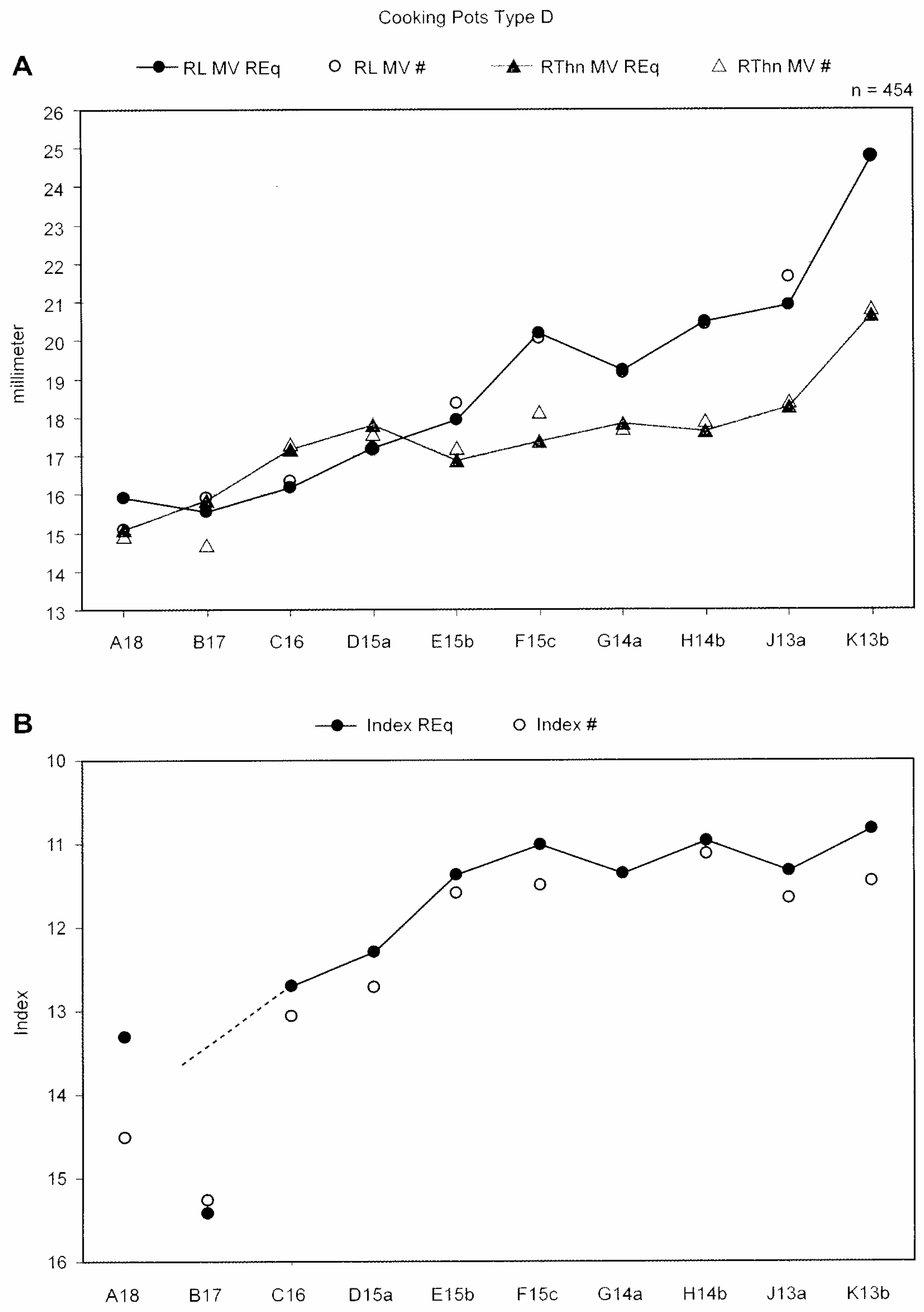


Fig. 12 Cooking pots D. (A) Variation in rim length (RL) and rim thickness (RTh) according to the mean values of the assemblages. (B) Index figure showing relative rim length (MV diam. / MV RL). Decreasing index figures indicate increasing relative rim length.

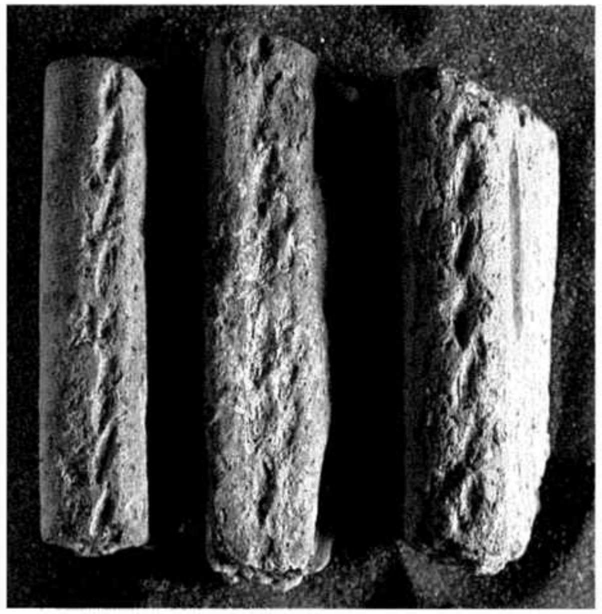


Fig. 13 Fragments of baking plates E displaying string impressions around the rim.

around 21 cm and terminating at around 27 cm. Due to an irregularity at the beginning of the sequence (either in Complex A18 or in Complex B17), we do not know whether the curve is U-shaped or whether we are confronted with a more linear development. As vessel proportions do not change during this time, the curve means that vessel volume was changing. Here, we are evidently not faced with a change in fashion or a typological drift but rather with still unexplained changes in the economic, nutritional or social spheres. However, this is not all that our cooking pots have to offer. Measuring the rim strengthening for its length and its thickness (fig 10a, cf. fig. 11), we see both features significantly increase over time (fig. 12a). Obviously, we do not see the changes in vessel size mentioned before reflected in this graph. Thus, we may also calculate the relative length of the rims in relationship to vessel diameters by dividing their mean values. The figures we obtain through this operation (fig. 12b) show a gradual increase of rim length over time that seems to be strongly related to the chronological position of the assemblages.

Let us look now at the large baking plates that are such a prominent component of the Hittite pottery inventory (fig. 4 E). They represent the only pottery class that continues to be hand-manufactured in the Late Bronze Age. Although it would seem a logical assumption to regard these vessels as descendants of the flat-based baking trays of the Early Bronze Age, they are suspiciously absent from assemblages of the Karum period. Looking at their diameters (fig. 14a), we see a pattern opposed to that of the cooking pots: Their size continuously increases over time, until they reach impressive dimensions with a maximum mean of approx. 58 cm at the turn from the 15th to the 14th century.[17] Afterwards, there is a distinctive drop in mean vessel size to a low value (approx. 40 cm), which stays stable throughout the Empire period. It is useful at this point to make a brief diversion into the field of pottery technology. One feature that has always drawn attention to our plates has been the occurrence of string impressions around their rims (fig. 13). These have sometimes even been regarded as decorative features. Recent replication experiments by the Kuşaklı team have clearly shown that the application of strings was essential during the forming process to prevent the soft clay from falling apart (Mielke 2006, 130–133 with Abb. 132). Thus, we may assume the occurrence of string impressions to be related to the rising or falling

[17] The maximum for this value is always much higher than the mean; the largest examples from the Ponds assemblage approach diameters of one meter.

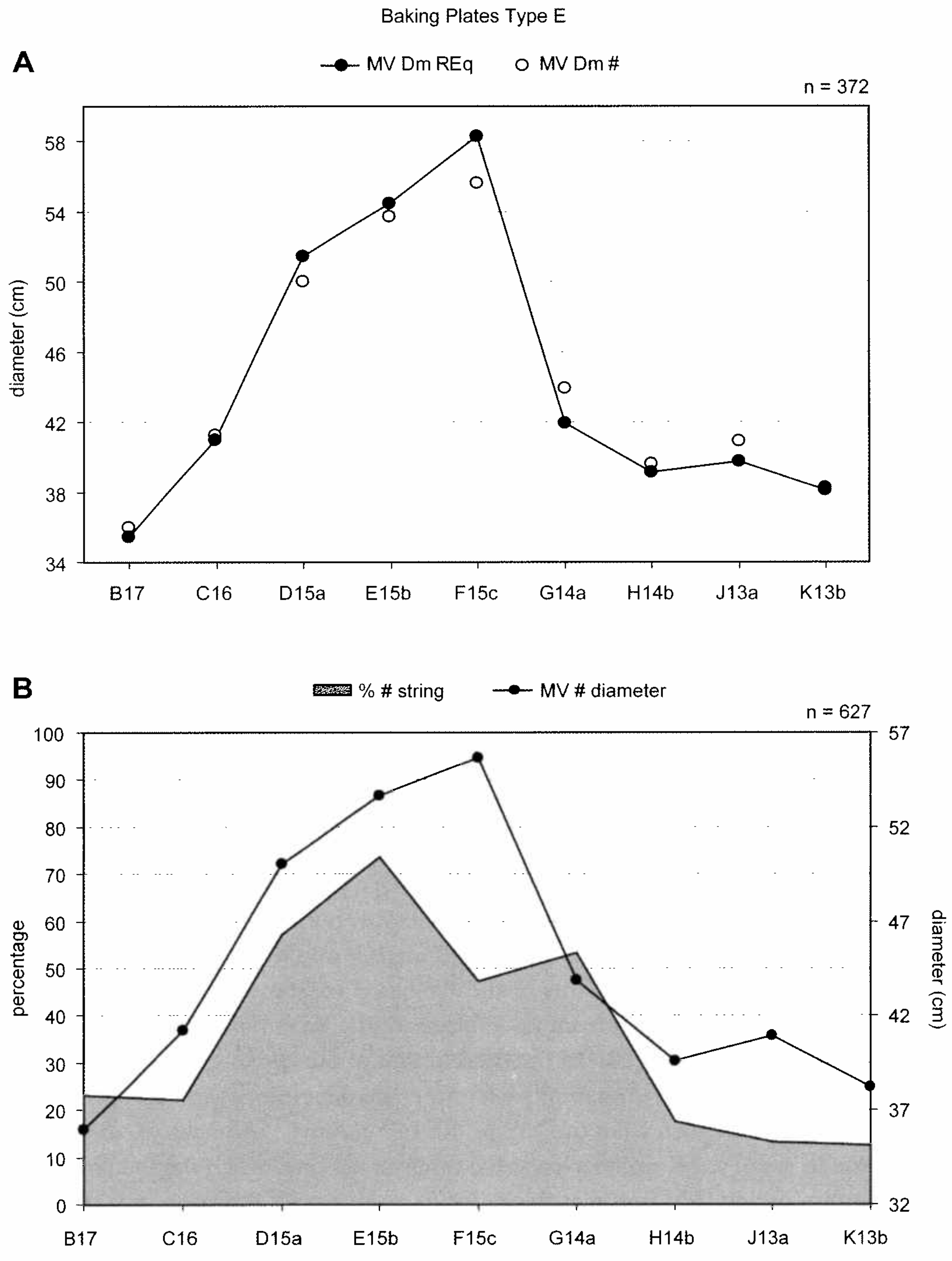


Fig. 14 Baking plates E. (A) Variation in diameter,
(B) comparison of diameter variation with the frequency of string impressions.

diameters of the vessels. The data support this assumption (fig. 14b): String impressions strongly increase in number towards the middle of the sequence and decrease in frequency afterwards. Superimposing both curves, showing vessel diameters and frequency of string impressions, we see that there is no exact match here: where vessel diameters reach their

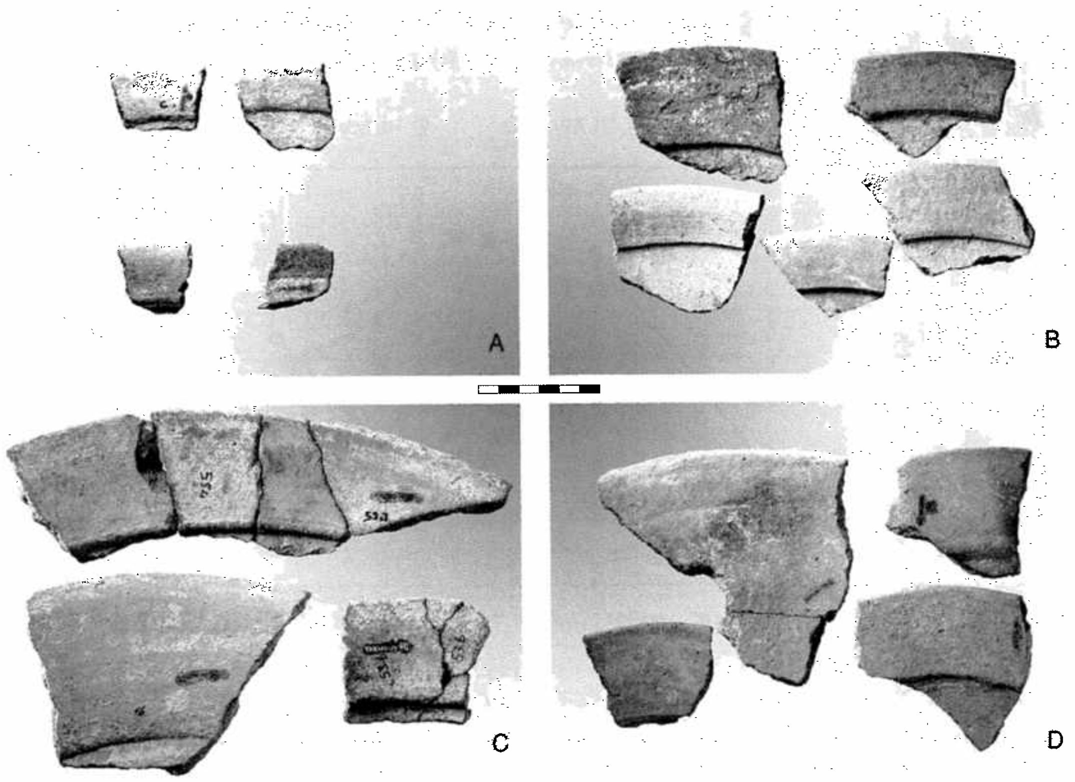


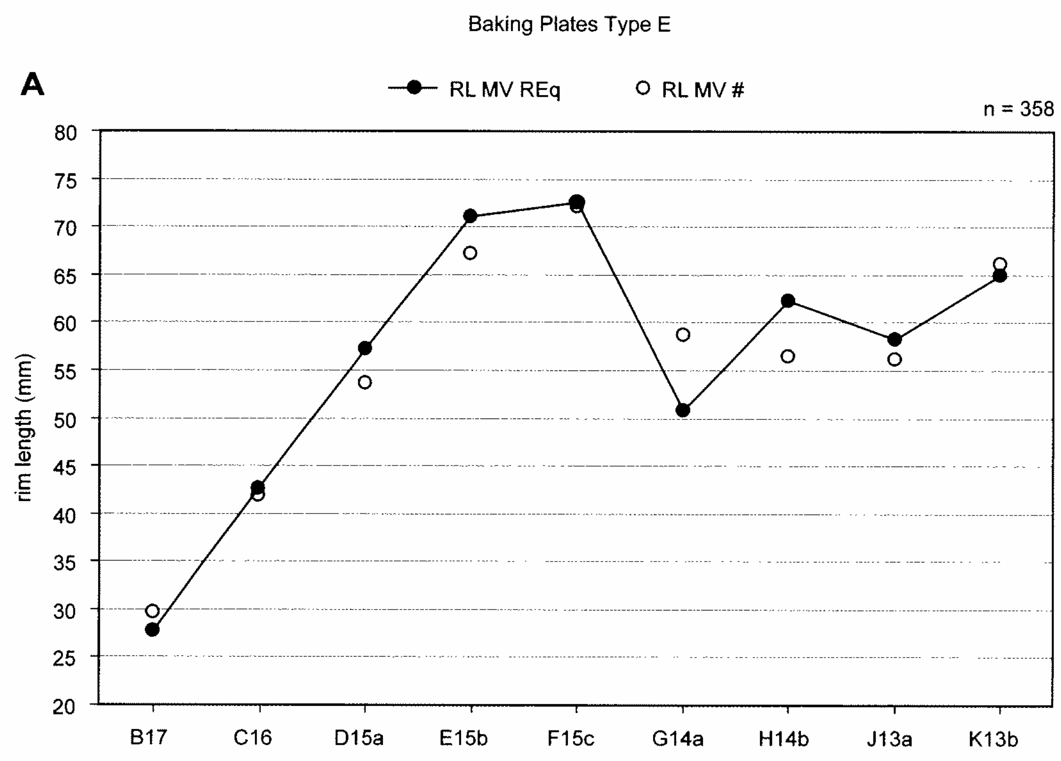
Fig. 15 Rims of baking plates E from complexes B17 (A), C16 (B), F15c (C), and K13b (D).

peak, the distribution curve for the string impressions displays an asymmetrical truncation. It is perfectly possible, however, that the value for the relevant assemblage from the Southern Ponds is skewed, as the sample is relatively small.

With the plates, we can perform a set of measurements similar to that of the cooking pots: we can measure the length and the thickness of their rims (fig. 10b, cf. fig. 15). We see from these data that rim length increases markedly over time and falls again after they have reached their maximum diameters in the Southern Pond assemblage (fig. 16a).[18] The same pattern is observable with rim thicknesses (fig. 16b). Unlike the diameters, however, both features never again reach the low values that they had at the beginning of the sequence. Once more, we may calculate an index figure showing the relationship of rim length to diameter (fig. 17). As with the cooking pots, we observe that relative rim length increases over time in a regular and gradual manner.

Although more examples derived from other vessel types could be added to those discussed, our short survey can be concluded here.

[18] The apparent "rise" of rim length in the latest Complex K13b is probably due to the fact that we have here, for the first time, a fair number of plates with no thickening of the rim at all, a factor not accounted for here.



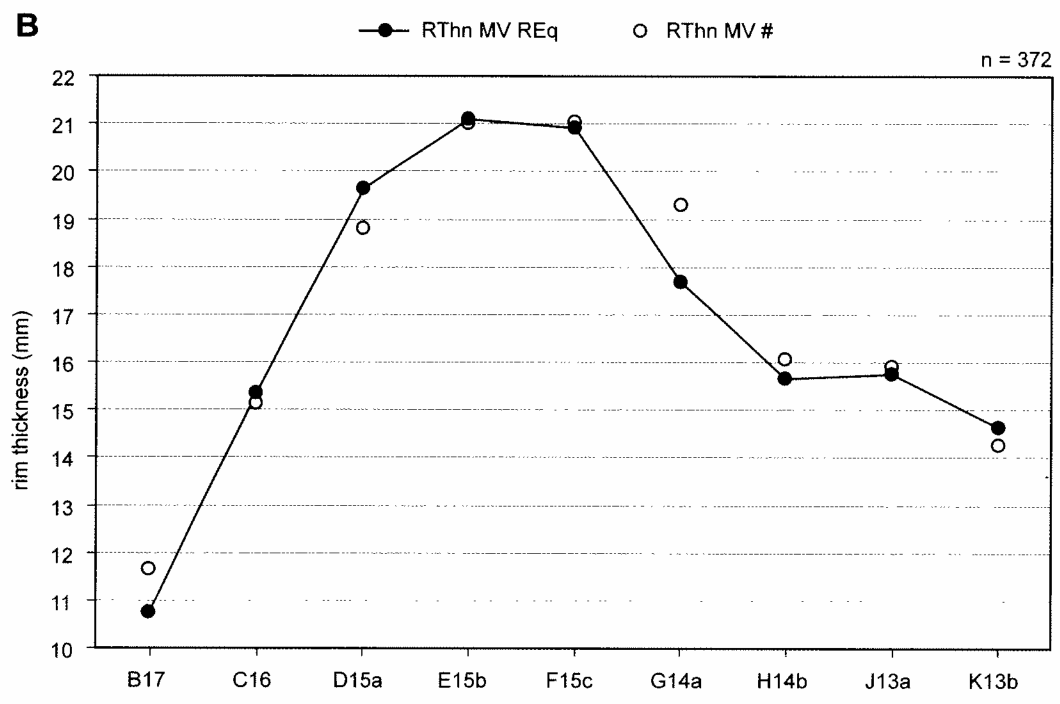


Fig. 16 Baking plates E. Variation in rim length (A), and rim thickness (B) according to the mean values of the assemblages.

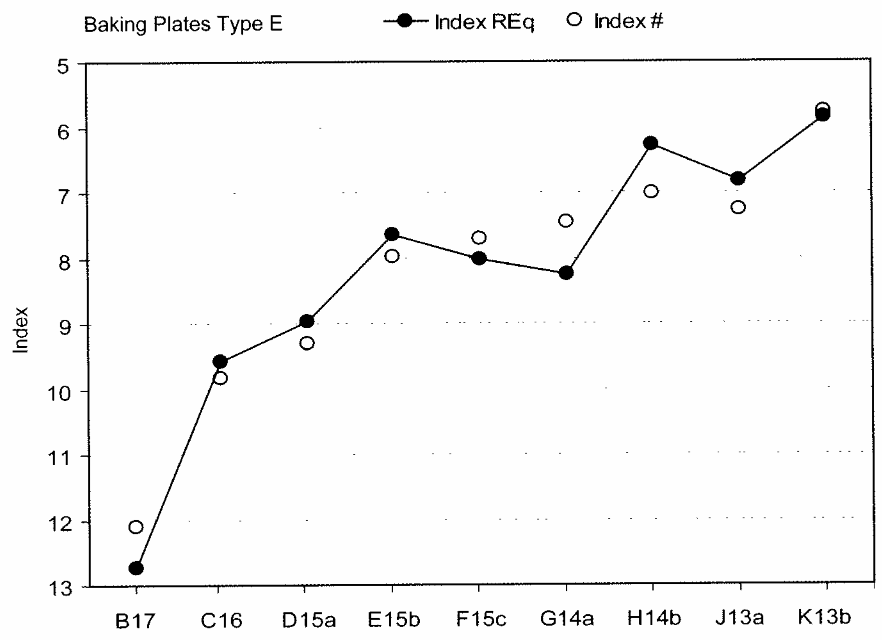


Fig. 17 Index figure showing relative rim length of baking plates E (MV diam. / MV RL). Decreasing index figures indicate increasing relative rim length.

Potential and restrictions in the interpretation of the numerical data

I believe that these examples have sufficiently shown that Hittite pottery does indeed change over time in a fashion that may be expressed in a metric way. The dataset from which they are derived was, in fact, designed to capture – above all – *chronological* variation incorporated in this class of artifact. The basic idea behind it is to create a master sequence into which future complexes may be fitted. This work is by no means complete. Especially in the earlier part of the sequence there are still major gaps that have to be filled. Other assemblages will have to be replaced when more secure contexts are excavated. One feature that makes this approach particularly attractive is the fact that such a match will not be dependent on one single value only. There is a range of mutually independent variables that control each other, *including* old-fashioned typology, as I wish to stress – it makes no sense to give up old approaches that, up to a certain point, still serve their purpose; we should rather enlarge them.

There is, however, one factor that makes the situation more complicated. In the present state, with all our complexes spread out over the Hittite time scale, I could easily present the situation in rather straightforward line graphs. As mentioned above, it is rather unlikely that any two contemporary assemblages will produce exactly identical values for any of the variables. This means that ultimately, we will have to deal with plots showing dots scattered along a common trajectory. From this, it follows that we will have to analyze a fair number of 'redundant' assemblages in order to find out about the range of possible variation incorporated in the data. This *again* underlines the importance of external dating as the pivotal issue in our undertaking.

Let us, for the time being, assume that such a master sequence has been successfully created, be it at Ḫattuša or anywhere else. What would be the major potential of such a data set and its comparison with others? Its principal – and maybe only – value would be to measure variation, especially deviation of a new dataset from the original one. As far as I can see, this would mainly concern three sets of questions:

1. Variation in time,
2. Variation in space, and
3. Variation in function.

Variation in time may be treated as relatively straightforward here. It offers the possibility to match a newly found assemblage to a dated one in the master sequence, or interpolating it between two different ones. We translate material culture variation into time and can compare the result with others, e.g. radiocarbon dates or dates derived from datable small finds. The final dating would have to embrace an explanation for all of these results. In the ideal case, we could then add another point to our curve.

Spatial variation is still a rather problematic question within the Hittite core area. Metric data would offer a good means to compare contemporary assemblages from different regions of the empire. This would give us a new basis on which to evaluate how far the apparent pottery uniformity over this area is an actual fact, how far deviation goes, whether the different parts of the empire all behave the same in this respect, whether there have been changes of this feature over time, and how they are to be interpreted (cf. Gates 2001).

Functional variation will be a key issue in many questions relating to the quantitative analysis of Hittite pottery. We know that Hittite society had developed a highly differentiated mode of production. At least within larger settlements, we may expect a differential composition of pottery assemblages between areas of unequal functionality. In some cases, this can be very obvious, as within the pottery deposit in the Southern Ponds at Boğazköy that is dominated by large jars and imported spindle bottles. In other cases, this difference may be far less apparent. One observation made during the analysis of the assemblages discussed above should be mentioned here: Without going into detail, although they originate from different locations within the city area and although they are all of different age, there turned out to be – rather surprisingly – hardly any variation in their composition of functional types. As it is rather unlikely that all of the associated architecture served only one sole purpose (i.e. as ordinary habitation structures), we must conclude that there have been depositional forces at work that led to a strong overall homogenization of the archaeological deposit found inside the structures. If this turns out to be a general feature (as is seemingly the case), then we must conclude that the contextual link between the finds contained in such deposits and the features in which they formed is rather weak. Returning to our exceptional (and clearly deviating) case – the pottery "cache" from the Southern Ponds – we notice that here, we seem not only to have a different functional background (the pottery most likely stemming from a temple inventory), but also a different and rather unusual depositional history, as these vessels are likely to have been discarded all at once.

Having been thrown into the ponds, they additionally bypassed the subsequent depositional history that ordinary settlement pottery is normally subject to. While the above is rather discouraging for any attempt to discern functional differences between single structures from such material, it may turn out to be positive for chronological purposes; it seems unlikely under these circumstances that we will have chronological variation that is greatly confounded by functional variation.

Perhaps even more exciting may be the comparison of settlements of different rank. I am thinking particularly here of the difference between urban and rural settlements. Research into the Hittite countryside has been quite limited so far, and to my knowledge no village or hamlet has ever been excavated. Yet, we may learn a great deal about rural economy, the distribution of goods within the empire and the degree of economic interdependence within settlement hierarchies.

Although all of these factors may influence the composition of any Hittite pottery assemblage, they act on different levels. When analyzing a given assemblage, it will show us only one thing: variation, i.e. variation without any information about which factor has mainly caused this variation. Thus, we will only obtain information for one of these factors if we are able to eliminate the possibility of variation in the others. The three major tools for this task will be: strict discrimination on the kinds of deposit subjected to pottery analysis, extensive application of external dating, and the creation of *independent* local sequences in different parts of the Hittite culture area.

The data from Boğazköy are a beginning in this direction. They provide a good starting point, as we are fortunately in the possession of chronologically widely spread assemblages that can be studied together in one consistent framework. A large series of radiocarbon dates will serve as the spine for chronological ordering. On the other hand, there are still major gaps, and not all of these complexes are as well defined as one would wish. Before us lies a long path of data collection, identification of useful parameters and procedures, of discussing the emerging patterns, and – eventually – their integration into our picture of Hittite culture and history.

Hititler'in Tarihlendirilmesinde İstatistik: Boğazköy-Ḫattuša'dan on Keramik Kompleksi

Hitit keramiği, geleneksel tipoloji yöntemiyle tarihlendirmeye pek elverişli değildir. Bunun sebepleri homojen bir yapı sergilemesi ve kap biçimlerinin çok yavaş gelişmesidir. Bu makalede, Hitit keramiğinin sayısal analizinin gerekliliği savunulmakta ve bu yöntemin uygulanmasında göz önüne alınması gereken birkaç önemli şart sıralanmaktadır. Bunların içinde en önemlisi, böyle bir analize uygun olan arkeolojik bağlamın seçimidir. Boğazköy-Ḫattuša'dan tarihleri Geç Karum döneminden Hitit döneminin sonuna kadar uzanan dönemi kapsayan on adet keramik topluluğu böyle bir malzemenin incelenmesinde istatiksel yaklaşımın geçerliliğini göstermek amacı ile örnekleme çalışmaları için seçilmiştir. Bazı kap biçimlerinin istatiksel dağılımına, çeşitli kap biçimlerinin birbirleriyle olan sayısal ilişkisine ve kapların belirli yerlerinden alınan ölçümlere ilişkin örnekler verilmiştir. Makale, Hitit keramiğinin sayısal analizinin içerdiği yorum potansiyelinin ve sınırlarının açıklamasıyla son bulmaktadır.

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