Chapter 9

Processes of Culture Change in Prehistory: a Case Study from the European Neolithic

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It has been claimed that ethnogenesis is far more important than phylogenesis in generating the material culture patterns recorded by archaeologists. We have tested this assumption by applying phylogenetic techniques from biology to assemblages of pottery from Neolithic sites in the Merzbach valley, Germany. Our results indicate that both ethnogenesis and phylogenesis were involved in the generation of the pottery assemblages. This suggests that archaeologists should not simply assume that ethnogenesis is the process responsible for the assemblages they study. Rather, they need to resolve the issue empirically on a case by case basis.

It is obvious — indeed it is so obvious that it bears repeating — that identifying the processes of culture change, and determining their relative contribution to the patterns in the archaeological record, are crucial for an understanding of prehistory, and also for linking archaeological data to genetic and linguistic patterns. Recent discussions regarding culture change have focused on two processes that J.H. Moore (1994a,b) has termed 'phylogenesis' and 'ethnogenesis'. In phylogenesis a new cultural assemblage is the result of descent with modification from an ancestral assemblage, whereas in ethnogenesis a new cultural assemblage arises through the blending of elements of two or more contemporaneous assemblages. Currently, most authors consider ethnogenesis to be far more important than phylogenesis in the generation of cultural assemblages. However, most assessments of the relative importance of phylogenesis and ethnogenesis in human cultural affairs have so far been theoretical and/or qualitative (e.g. Kirch & Green 1987; Terrell 1988; Moore 1994a,b; Rowlands 1994; Dewar 1995; Bellwood 1996; Boyd *et al.* 1997; Terrell *et al.* 1997); only a few attempts have been made to address the problem in a quantitative fashion (e.g. Welsch *et al.* 1992; Mace & Pagel 1994; Moore & Romney 1994; Guglielmino *et al.* 1995; Holden & Mace 1999). Moreover, most of the work carried out to date has focused on ethnographic data rather than archaeological evidence (e.g. Kirch & Green 1987; Durham 1992; Welsch *et al.* 1992; Mace & Pagel 1994; Moore 1994a,b; Moore & Romney 1994; Guglielmino *et al.* 1995; Holden & Mace 1999).

How can we assess the relative contribution of phylogenesis and ethnogenesis to the patterns in the archaeological record? In this chapter, we argue that this archaeological problem is related to problems that have been successfully confronted by biologists, linguists and stemmatists. We then present a case study, in which we use a technique that was developed to tackle the aforementioned biological problem to assess the roles of phylogenesis and ethnogenesis in producing the patterns of variation in a group of pottery assemblages from the Central European Neolithic. Lastly, we consider the implications of our findings for current archaeological approaches to evidence for culture change.

Related problems in other disciplines

The problem of determining the relative contribution of phylogenesis and ethnogenesis to the patterns in the archaeological record is, we suggest, related to problems that have been successfully tackled by biologists, linguists and stemmatists. These problems are, respectively, estimating the phylo-

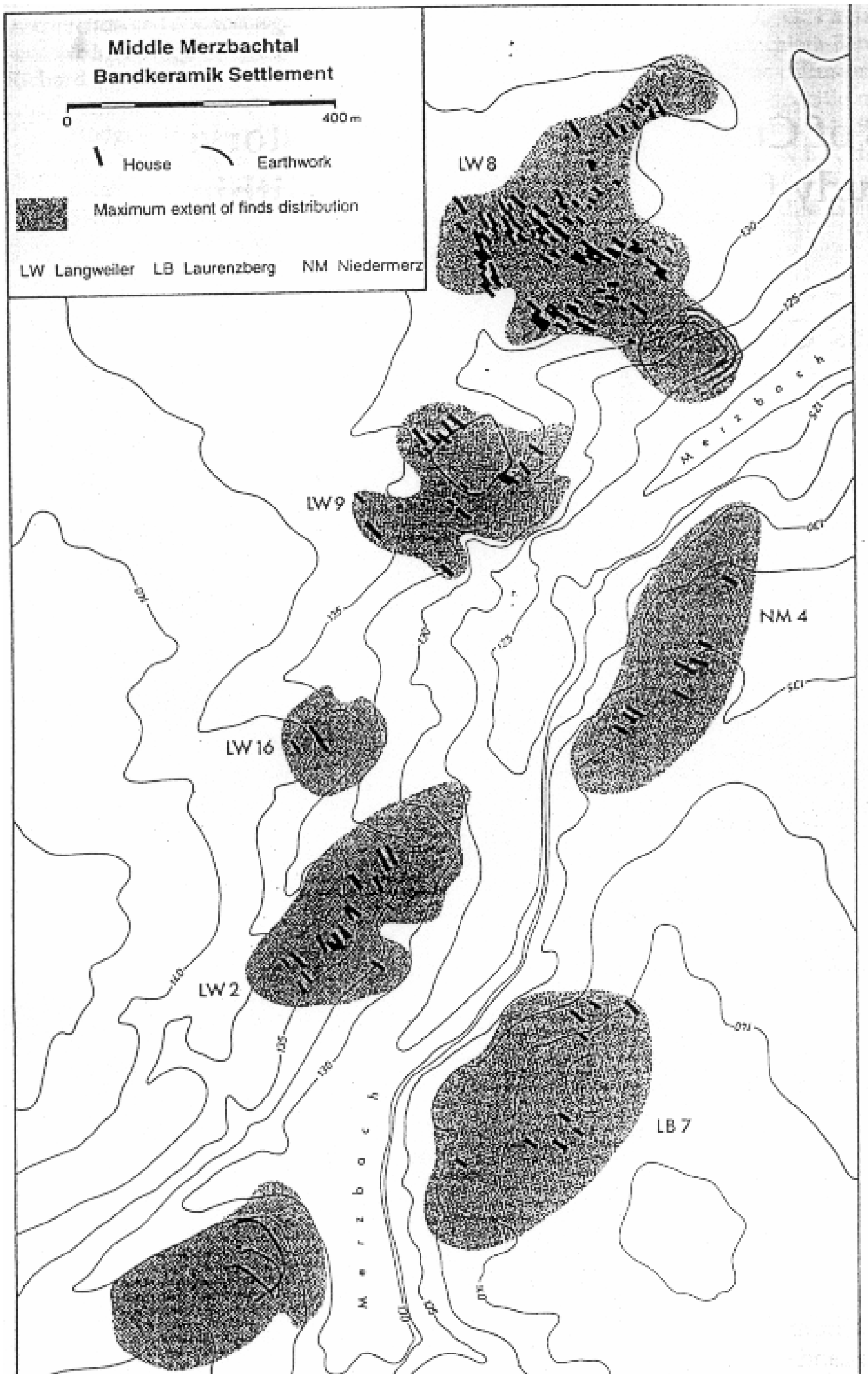

Figure 9.1. *Map of Merzbach sites.*

genetic relationships between species (Minelli 1993), delineating the genealogical relationships among languages (Ross 1997), and reconstructing ancient texts (Gjessing & Pierce 1994). What all four problems have in common is that they require the similarities exhibited by a group of taxa to be divided into those that are the result of shared ancestry (homologies) and those that are the result of mechanisms other than shared ancestry (homoplasies).

In biology, linguistics and stemmatics, this task is accomplished by generating a tree-structure which links the taxa in such a way that the number of hypotheses of change required to account for the observed distribution of similarities is minimized. Using this tree-structure it is then possible to classify the similarities as either homologous or homoplasious. Homologous similarities suggest relationships that are compatible with the tree-structure, whereas homoplasious similarities support relationships that conflict with the tree-structure. This procedure, which appears to assume what needs to be demonstrated, can be defended in relation to the principal of parsimony, the methodological injunction which states that explanations should never be made more complicated than is necessary (Sober 1988).

We suggest that the parsimony approach should be adopted in relation to the problem of determining the relative contribution of phylogenesis and ethnogenesis to the patterns in the archaeological record. If a statistically-robust tree-structure can be derived from a group of archaeological assemblages, then phylogenesis can reasonably be inferred to have played a more important role than ethnogenesis in the generation of the assemblages. Conversely, if such a tree-structure cannot be identified, then ethnogenesis can be inferred to be the most important process.

Materials and methods

The data set for the case-study was taken from Frirdich (1994). It comprised the frequencies of decorative bands on ceramic vessels from the Linearbandkeramik (LBK) settlements of the Merzbach valley, western Germany (Frirdich 1994).

The settlements, which represent the first farming communities in this part of Europe, consist of groups of longhouses and pits that are scattered along the banks of the Merzbach stream, covering an area of about 3 km^2 (Fig. 9.1; Table 9.1). The number of houses in occupation varies through time, but altogether the settlement sequence covers nearly 500 years, from *c.* 5300 to 4850 BC. A chronological sequence has been defined for the Merzbach settlements on the basis of two different sets of criteria: a detailed stratigraphic and spatial analysis of the sites (Stehli 1994) and a seriation of the pottery (Frirdich 1994). These two sequences have been correlated with one another (Frirdich 1994), a process which involved grouping the seriation intervals into the independently defined phases. Because the whole area was excavated prior to its destruction by lignite mining, and there is no evidence for large-scale taphonomic bias, the settlement picture can be considered to be undistorted.

It appears that there was an initial founding settlement in the area (Langweiler 8) which was occupied more or less continuously from beginning to end, and that subsequently new settlements were founded, which often had gaps in occupation. It is usually assumed that the new settlements were established by members of existing settlements in the micro-region, although it has been suggested that one (Langweiler 2) represents a movement of people into the area from somewhere outside (Mattheusser 1994). The Merzbach micro-region is so small that distance cannot have been an obstacle to extensive interaction between the communities, and it seems reasonable to assume that there were extensive kinship links between them.

The vessels are broadly ovoid in shape and take the form of deep bowls. The body of each vessel is decorated with a series of bands made up of incised lines, strokes or indentations (Fig. 9.2). The decoration is highly distinctive and stylized, comprising a variety of distinct but clearly related motifs

Table 9.1. *Features at sites from which Merzbach pottery assemblages are derived, according to Frirdich's maps.*

Phase	Site	Feature
6	Laurenzberg 7	Houses and pits
6	Langweiler 2	No feature shown
6	Langweiler 8	Houses and pits
6	Langweiler 9	Houses and pit
6	Langweiler 16	House and pits
7	Laurenzberg 7	House and pits
7	Langweiler 2	Houses and pits
7	Langweiler 8	Houses and pits
7	Langweiler 9	No feature shown
7	Langweiler 16	House
8	Laurenzberg 7	House and pits
8	Langweiler 2	No feature shown
8	Langweiler 8	Pits
8	Langweiler 9	Houses and pits
8	Langweiler 16	Pits
9	Laurenzberg 7	House and pits
9	Langweiler 2	Houses and pit
9	Langweiler 8	Houses and pits
9	Langweiler 9	House and pits
10	Laurenzberg 7	House and pits
10	Langweiler 2	Houses
10	Langweiler 8	Houses and pits
10	Langweiler 9	Houses and pits
10	Langweiler 16	Pits
11	Laurenzberg 7	House and pits
11	Langweiler 2	Houses and pits
11	Langweiler 8	Houses and pits
11	Langweiler 9	Houses and pits
11	Niedermerz 4	Houses and pits
12	Laurenzberg 7	House and pits
12	Langweiler 2	Houses and pits
12	Langweiler 8	Houses and pits
12	Langweiler 9	Houses and pits
12	Langweiler 16	Pits
12	Niedermerz 4	Houses
13	Laurenzberg 7	House and pits
13	Langweiler 2	Houses and pits
13	Langweiler 8	Houses and pits
13	Langweiler 9	Enclosure and pits
13	Langweiler 16	No structure shown
13	Niedermerz 4	Houses and pits
14	Laurenzberg 7	No structure shown
14	Langweiler 2	Houses and pit
14	Langweiler 8	Enclosure, houses and pits
14	Langweiler 9	Pits
14	Niedermerz 4	Houses
15	Laurenzberg 7	No structure shown
15	Langweiler 2	No structure shown
15	Langweiler 8	No structure shown
15	Langweiler 9	Pits
15	Niedermerz 4	No structure shown

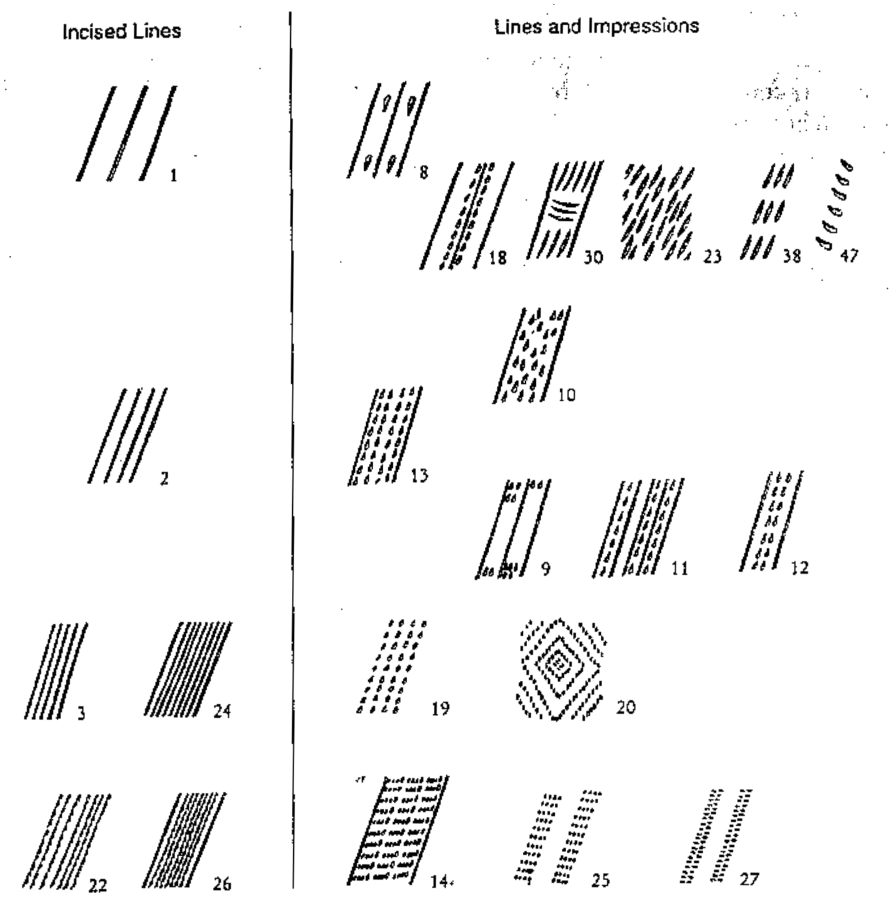

Figure 9.2. *Decorative characters from the Merzbach pottery.*

which have been defined by the excavation team. A total of 35 different band types were recorded for the vessels, the most frequent of which are shown in Fig. 9.2. The vertical dimension of the typology in Fig. 9.2 embodies multiplicity of lines, which increases towards the bottom. The horizontal dimension signifies a tendency towards fragmentation of the continuous linear patterns into rows of spatulate, punctuate marks; in extreme forms these entirely supplant the linear incisions.

Frirdich's (1994) catalogue tabulates the data for six settlements within the Merzbach micro-region, in terms of the number of vessels possessing a particular band type, by pit, site and seriation interval. The counts from the pits within the sites were amalgamated to produce a count for each seriation interval for each site. The seriation intervals were then amalgamated to produce a phase-by-phase count for each settlement. Thereafter, a table was compiled which indicated the number of times a given band type occurs at a given site in a given phase. For the purposes of phylogenetic analysis, each band type was considered to be a character, and each pottery assemblage from a single phase at one site was considered to be a taxon (Table 9.2). Thus, the phylogenetic analyses used the frequencies of decorative characters to reconstruct the relationships between pottery assemblages.

The analyses were carried out using the biological phylogenetic technique of maximum parsimony bootstrapping, which is a procedure for estimating the statistical likelihood of a given phylogenetic relationship being real (Felsenstein 1985; Swofford 1991; Sanderson 1995). In this form of analysis, a matrix is constructed in which the row headings comprise the taxon names, the column headings consist of the character names, and the cells indicate the states of the characters exhibited by the taxa. Next, a large number of new matrices (normally 50 to 1000) are created by randomly sampling with replacement from the original matrix. The new matrices are then subject to branch-and-bound parsimony analysis, which employs an exact algorithm to identify all optimal cladograms for a given character state data matrix. The optimality of a cladogram is assessed in relation to the sum of the lengths of its branches. The length of a branch connecting a pair of taxa on a cladogram is computed as the sum of the character state differences between the taxa under a given model of character state evolution (e.g. ordered, unordered, irreversible). The shortest cladogram is considered to be optimal, because it minimizes the number of hypotheses of change that are required to explain the distribution of character states among the taxa. In other words, the shortest cladogram is considered to be optimal because it is the most parsimonious cladogram. Lastly, a list of the clades that comprise the optimal cladograms is compiled, and the percentage of the bootstrap cladograms in which each clade appears is calculated. Currently there is no consenus as to the percentage of bootstrap cladograms in which a clade should occur for it to be

Table 9.2. *Taxa used in phylogenetic analyses.*

Taxon	Composition	Taxon	Composition
LB7_6	Assemblage from phase 6 at Laurenzberg 7	LW8_11	Assemblage from phase 11 at Langweiler 8
LW2_6	Assemblage from phase 6 at Langweiler 2	LW9_11	Assemblage from phase 11 at Langweiler 9
LW8_6	Assemblage from phase 6 at Langweiler 8	NM4_11	Assemblage from phase 11 at Niedermerz 4
LW9_6	Assemblage from phase 6 at Langweiler 9	LB7_12	Assemblage from phase 12 at Laurenzberg 7
LW16_6	Assemblage from phase 6 at Langweiler 16	LW12_12	Assemblage from phase 12 at Langweiler 2
LB7_7	Assemblage from phase 7 at Laurenzberg 7	LW8_12	Assemblage from phase 12 at Langweiler 8
LW2_7	Assemblage from phase 7 at Langweiler 2	LW9_12	Assemblage from phase 12 at Langweiler 9
LW8_7	Assemblage from phase 7 at Langweiler 8	LW16_12	Assemblage from phase 12 at Langweiler 16
LW9_7	Assemblage from phase 7 at Langweiler 9	NM4_12	Assemblage from phase 12 at Niedermerz 4
LW16_7	Assemblage from phase 7 at Langweiler 16	LB7_13	Assemblage from phase 13 at Laurenzberg 7
LB7_8	Assemblage from phase 8 at Laurenzberg 7	LW2_13	Assemblage from phase 13 at Langweiler 2
LW2_8	Assemblage from phase 8 at Langweiler 2	LW8_13	Assemblage from phase 13 at Langweiler 8
LW8_8	Assemblage from phase 8 at Langweiler 8	LW9_13	Assemblage from phase 13 at Langweiler 9
LW9_8	Assemblage from phase 8 at Langweiler 9	LW16_13	Assemblage from phase 13 at Langweiler 16
LW16_8	Assemblage from phase 8 at Langweiler 16	NM4_13	Assemblage from phase 13 at Niedermerz 4
LB7_9	Assemblage from phase 9 at Laurenzberg 7	LB7_14	Assemblage from phase 14 at Laurenzberg 7
LW2_9	Assemblage from phase 9 at Langweiler 2	LW2_14	Assemblage from phase 14 at Langweiler 2
LW8_9	Assemblage from phase 9 at Langweiler 8	LW8_14	Assemblage from phase 14 at Langweiler 8
LW9_9	Assemblage from phase 9 at Langweiler 9	LW9_14	Assemblage from phase 14 at Langweiler 9
LB7_10	Assemblage from phase 10 at Laurenzberg 7	NM4_14	Assemblage from phase 14 at Niedermerz 4
LW2_10	Assemblage from phase 10 at Langweiler 2	LB7_15	Assemblage from phase 15 at Laurenzberg 7
LW8_10	Assemblage from phase 10 at Langweiler 8	LW2_15	Assemblage from phase 15 at Langweiler 2
LW9_10	Assemblage from phase 10 at Langweiler 9	LW8_15	Assemblage from phase 15 at Langweiler 8
LW16_10	Assemblage from phase 10 at Langweiler 16	LW9_15	Assemblage from phase 15 at Langweiler 9
LB7_11	Assemblage from phase 11 at Laurenzberg 7	NM4_15	Assemblage from phase 15 at Niedermerz 4
LW2_11	Assemblage from phase 11 at Langweiler 2		

considered statistically significant. Some workers favour Felsenstein's (1985) original ≥95 per cent criterion, while others have suggested that clades can occur in 70 per cent of bootstrap cladograms and still be real (e.g. Hillis & Bull 1993).

Two sets of analyses were carried out. The first set focused on the four settlements that have evidence for occupation throughout the 10-phase period (Laurenzberg 7, Langweiler 2, Langweiler 8 and Langweiler 9). We conjectured that, if the phylogenesis hypothesis is correct, phase-by-phase bootstrap analyses of the frequency data for the four settlements should separate the settlements into the same groups in consecutive phases. On the other hand, if the ethnogenesis hypothesis is correct, such analyses should separate the settlements into different groups in consecutive phases. Ten taxon-by-character matrices were generated, each of which comprised just the data for Laurenzberg 7, Langweiler 2, Langweiler 8 and Langweiler 9 from one of the phases. Next, each matrix was coded using the procedure described by Baum (1988). The values for each character were ranked in ascending order and a new character-by-taxon matrix produced in which each cell displayed the rank of a given taxon for a given character. Lastly, each matrix was bootstrapped using the cladistics program Phylogenetic Analysis Using Parsimony (PAUP) 3.0s (Swofford 1991). Because the characters were metrical and their states could therefore be assumed to have evolved serially, the characters were treated as freely-reversing, linearly-ordered variables (Slowinski 1993). The matrices were resampled 10,000 times.

The second set of analyses focused on the three instances in the 10-phase period in which a new pottery assemblage appears. We reasoned that, if the

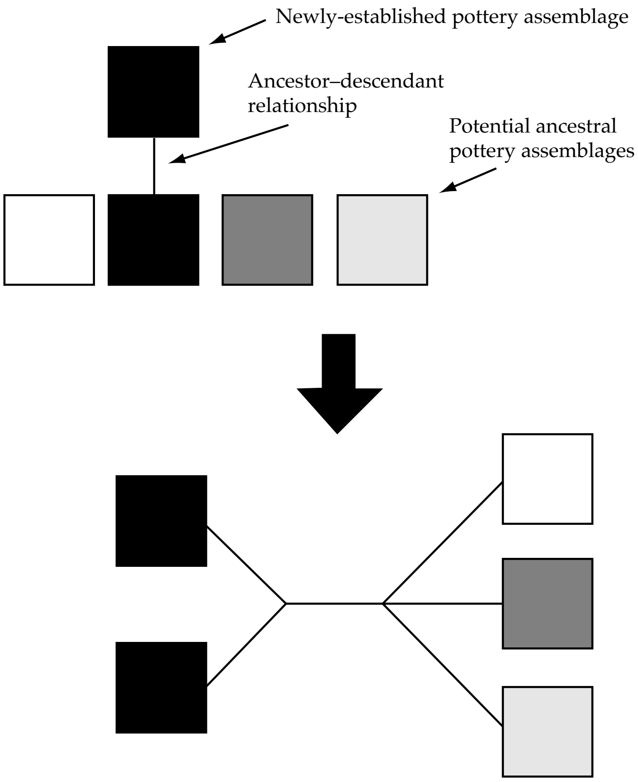

Figure 9.3. *Prediction of the phylogenesis hypothesis in the newly-founded settlements analyses. If the hypothesis is correct, the bootstrap analysis should group the newly-established pottery assemblage with just one of the potential ancestral assemblages.*

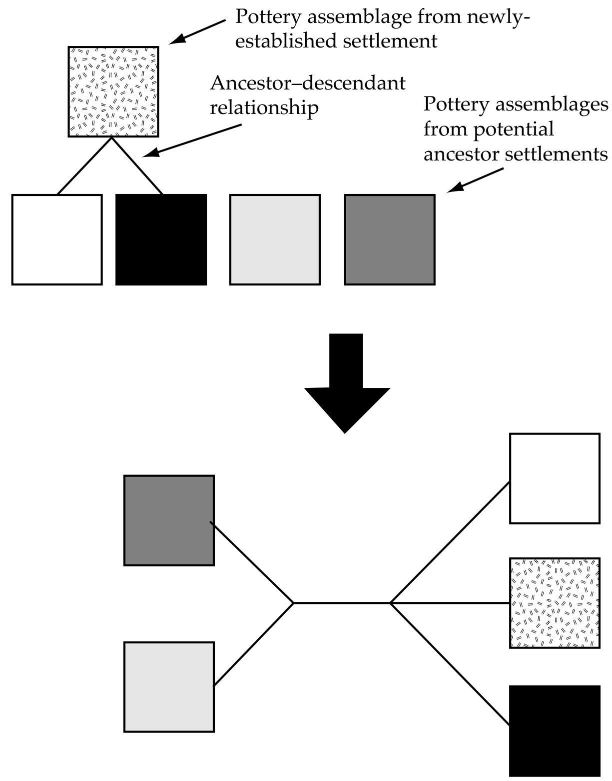

Figure 9.4. *Prediction of the ethnogenesis hypothesis in the newly-founded settlements analyses. If the hypothesis is correct, the bootstrap analysis should group the newly-established pottery assemblage with never less than two of the potential ancestral assemblages.*

phylogenesis hypothesis is correct, a bootstrap analysis of the band frequencies for one of the newly-founded pottery assemblages and its potential ancestors should group the newly-established assemblage with just one of the potential ancestral assemblages (Fig. 9.3). Conversely, if the ethnogenesis hypothesis is correct, such an analysis should group the newly-established assemblage with never less than two of the potential ancestral assemblages (Fig. 9.4). Three character-by-taxon matrices were generated, each of which comprised the band frequencies recorded for one of the newly-founded assemblages, plus the band frequencies for the preceding phase of the potential ancestral settlements. The taxa in the first matrix were LW16_10, LB7_9, LW2_9, LW8_9 and LW9_9. The taxa in the second matrix were LW16_12, LW2_11, LW8_11, LW9_11 and LW16_11 and NM4_11. The taxa in the third matrix were NM4_11, LB7_10, LW2_10, LW8_10 and LW9_10. As in the first analysis, each matrix was coded using Baum's (1988) procedure and then bootstrapped using PAUP 3.0s (Swofford 1991). Again, the characters were treated as freely-reversing, linearly-ordered variables, and the matrices were resampled 10,000 times.

Results and discussion

The first set of analyses focused on the assemblages from the four settlements that have evidence for occupation throughout the 10-phase period. It was conjectured that, if the phylogenesis hypothesis is correct, phase-by-phase bootstrap analyses of the assemblages should divide them into the same groups in consecutive phases. On the other hand, if the ethnogenesis hypothesis is accurate, the analyses should separate the settlements into different groups in consecutive phases.

The results of the first set of analyses are summarized in Table 9.3. The four settlements are divided into the same groups in six of the instances in which consecutive phases can be compared (phases

6 & 7, 7 & 8, 8 & 9, 9 & 10, 12 & 13, 14 & 15). In the remaining three instances, the settlements are divided into different groups in consecutive phases (phases 10 & 11, 11 & 12, 13 & 14). These results are not wholly compatible with either hypothesis. Rather, they indicate that phylogenesis and ethnogenesis were both involved in the generation of the Langweiler pottery assemblages.

The second set of analyses focused on the three instances in the 10-phase period in which a new pottery assemblage appears. We reasoned that, if the phylogenesis hypothesis is correct, a bootstrap analysis of the band frequencies for one of the newly-founded pottery assemblages and its potential ancestors should group the newly-established assemblage with just one of the potential ancestral assemblages. Conversely, if the ethnogenesis hypothesis is correct, such an analysis should group the newly-established assemblage with never less than two of the potential ancestral assemblages.

Well-supported divisions were returned in all the analyses (Table 9.4). Two such divisions were identified in the analysis that focused on the origins of the assemblage that appears at Langweiler 16 in phase 10. The first grouped the newly-established assemblage with LW2_9 and LW9_9 to the exclusion of LB7_9 and LW8_9. The second division grouped the newly-established assemblage with LW2_9 to the exclusion of LB7_9, LW8_9 and LW9_9. This result is in line with the prediction of the phylogenesis hypothesis that the newly-founded assemblage should be grouped with just one of the potential ancestral assemblages, since the second division groups the newly-founded assemblage with LW2_9 to the exclusion of the other potential ancestral assemblages. Significantly, this result also supports the excavators' contention that the pits at Langweiler 16 in phase 10 are outliers of the Langweiler 2, which is just across a small valley (Stehli 1994).

Two well-supported divisions were also returned in the analysis that focused on the origin of the assemblage from phase 12 at Langweiler 16. One of these grouped the newly-established assemblage with LB7_11 and NM4_11 to the exclusion of the LW2_11, LW8_11 and LW9_11. The other grouped the newly-established assemblage with NM4_11 to the exclusion of LB7_11, LW2_11, LW8_11 and LW9_11. This result is also in line with the phylogenesis hypothesis, since there is strong support for a division among the assemblages that groups the newly founded assemblage (LW16_12) with just one of the potential ancestral assemblages (NM4_10).

The third analysis, which focused on the origin of NM4_11, identified two well-supported divisions

Table 9.3. *Results of phase-by-phase analysis of assemblages from settlements that are occupied throughout the 10-phase period.*

Phase	Group 1	Group 2	Support for division
6	LB7_6 & LW8_6	LW2_6 & LW9_6	65%
7	LB7_7 & LW8_7	LW2_7 & LW9_7	98%
8	LB7_8 & LW8_8	LW2_8 & LW9_8	100%
9	LB7_9 & LW8_9	LW2_9 & LW9_9	100%
10	LB7_10 & LW8_10	LW2_10 & LW9_10	67%
11	LW8_11 & LW9_11	LB7_11 & LW2_11	70%
12	LB7_12 & LW8_12	LW2_12 & LW9_12	100%
13	LB7_13 & LW8_13	LW2_13 & LW9_13	94%
14	LW8_14 & LW9_14	LB7_14 & LW2_14	66%
15	LW8_15 & LW9_15	LB7_15 & LW2_15	96%

Table 9.4. *Results of analyses that focused on the instances in which a new assemblage is established during the 10-phase period. Analysis 1 concentrated on the origin of the assemblage from phase 10 at Langweiler 10. Analysis 2 examined the origin of the assemblage from phase 12 at Langweiler 16. Analysis 3 focused on the origin of the phase 11 assemblage at Niedermerz 4.*

Analysis	Group 1	Group 2	Support for division
1	LB7_9 & LW8_9	LW16_10, LW2_9 & LW9_9	99%
	LW16_10 & LW2_9	LB7_9, LW8_9 & LW9_9	100%
2	LW16_12, LB7_11 & NM4_11	LW2_11, LW8_11 & LW9_11	91%
	LW16_12 & NM4_11	LB7_11, LW2_11, LW8_11 & LW9_11	100%
3	NM4_11, LW9_10 & LW16_10	LB7_10, LW2_10 & LW8_10	95%
	LW9_10 & LW16_10	LB7_10, LW2_10, LW8_10 & NM4_11	97%

among the assemblages. The first of these grouped the newly-founded assemblage with LW9_10 and LW16_10 to the exclusion of LB7_10, LW2_10 and LW8_10. The second division grouped the LW9_10 and LW16_10 to the exclusion of NM4_11, LB7_10, LW2_10 and LW8_10. This result is difficult to interpret. The newly-established assemblage is never grouped with fewer than two of the potential ancestral assemblages, which is in line with the ethnogenesis hypothesis. However, the two assemblages with which the newly-established assemblage is linked, LW9_10 and LW16_10, are themselves grouped together to the exclusion of the newly-established assemblages and the other potential ancestral assemblages. This division is not compatible with the ethnogenesis hypothesis, since it predicts that the relationship between the newly-established assemblages and its ancestors will be multichotomous (Fig. 9.4). It does not predict that, within a clade comprising the newly-founded assemblage and several potential ancestral assemblages, the ancestral assemblages will be grouped to the exclusion of the newly-founded assemblage. The most likely explanation for this unexpected result is that the pits at Langweiler 16 in phase 10 are outliers of the phase 10 settlement at Langweiler 9, and therefore could not have been the ancestor from which the Niedermerz 4 assemblage was derived, even partially. The corollary of this is that there is a well-supported division among the taxa between Niedermerz 4 and Langweiler 9 on the one hand, and Laurenzberg 7, Langweiler 2 and Langweiler 8 on the other. This division is in line with the phylogenesis hypothesis.

In sum, the second set of analyses support the phylogenesis hypothesis rather than the ethnogenesis hypothesis. Two of the analyses offer strong support for the idea that newly-founded assemblages derive from a single ancestral assemblage through descent with modification. The results of the third analysis are more ambiguous. However, the most parsimonious interpretation of these results also supports the notion that the newly-founded assemblages have a single parent among the assemblages in the preceding phase.

The two sets of analyses of the Merzbach data are not compatible with the assertion that cultural assemblages arise predominantly through ethnogenesis. The first set of analyses indicate that ethnogenesis can only account for a minority of the assemblages that are found at the sites which are occupied throughout the 10-phase period, whilst none of the second set of analyses supports the ethnogenetic hypothesis. Thus, if anything, the two sets of analyses suggest that phylogenesis is more important than ethnogenesis in the generation of the patterns observed among the Merzbach pottery assemblages.

One implication of these results is that archaeologists should not simply assume that the assemblages they study are the result of ethnogenesis. Rather, the relative contribution of ethnogenesis and phylogenesis to the generation of the assemblages needs to be determined empirically on a case-by-case basis (see also Bellwood 1996). A second implication of the results is that the processes of colonization and group fission which are usually assumed to lie behind the LBK Early Neolithic expansion into Europe appear to have the cultural consequences we might expect, and were perhaps associated with corresponding linguistic and genetic patterns. It is particularly striking that the cultural consequences of group fission so clearly involve cultural differentiation and branching even at the localized scale of the sites analyzed in this study, given the extensive inter-site interaction and close relationships that can be assumed to have existed. This seems to point to the operation of transmission-isolating mechanisms of the kind discussed by Durham (1992). It also fits with the suggestion made by Frirdich (1994) that the newly-founded Merzbach communities were concerned to establish distinct identities.

Conclusions

This chapter describes two sets of analyses that were designed to evaluate the relative contribution of phylogenesis and ethnogenesis to the formation of a group of pottery assemblages from the European Neolithic. The results of these analyses suggest that phylogenesis played an important role in generating the patterns in the pottery assemblages that have been found at the Merzbach Neolithic sites. Thus, contrary to what some have claimed, ethnogenesis is not the only process responsible for producing the material culture patterns recorded by archaeologists. Phylogenesis should not be dismissed as a factor in the cultural affairs of past human societies.

References

Baum, B.R., 1988. A simple procedure for establishing discrete characters from measurement data, applicable to cladistics. *Taxon* 37, 63–70.

Bellwood, P., 1996. Phylogeny vs reticulation in prehistory. *Antiquity* 70, 881–90.

Boyd, R., M. Borgerhoff Mulder, W.H. Durham & P.J.

Richerson, 1997. Are cultural phylogenies possible? in *Human by Nature*, eds. P. Weingart, S.D. Mitchell, P.J. Richerson & S. Maasen. Mahwah (NJ): Lawrence Erlbaum.

Dewar, R.E., 1995. Of nets and trees: untangling the reticulate and dendritic in Madagascar's prehistory. *World Archaeology* 26, 301–18.

Durham, W.H., 1992. Applications of evolutionary culture theory. *Annual Review of Anthropology* 21, 331–55.

Felsenstein, J., 1985. Confidence limits on phylogenetics: an approach using the bootstrap. *Evolution* 39, 783–91.

Frirdich, C., 1994. Kulturgeschichtliche Betrachtungen zur Bandkeramik im Merzbachtal, in Lüning & Stehli (eds.), 207–394.

Gjessing, H.K. & R.H. Pierce, 1994. A stochastic model for the presence/absence of readings in Niorstigningar saga. *World Archaeology* 26, 268–93.

Guglielmino, C.R., C. Viganotti, B. Hewlett & L.L. Cavalli-Sforza, 1995. Cultural variation in Africa: role of mechanisms of transmission and adaptation. *Proceedings of the National Academy of Sciences of the USA* 92, 7585–9.

Hillis, D.M. & J.J. Bull, 1993. An empirical test of bootstrapping as a method for assessing confidence in phylogenetic analysis. *Systematic Biology* 42, 182–92.

Holden, C. & R. Mace, 1999. Sexual dimorphism in stature and women's work: a phylogenetic cross-cultural analysis. *American Journal of Physical Anthropology* 110, 27–45.

Kirch, P.V. & R.C. Green, 1987. History, phylogeny and evolution in Polynesia. *Current Anthropology* 28, 431–56.

Lüning, J. & P. Stehli (eds.), 1994. *Die Bandkeramik im Merzbachtal auf der Aldenhovener Platte*. Bonn: Habelt.

Mace, R. & M. Pagel, 1994. The comparative method in anthropology. *Current Anthropology* 35, 549–64.

Mattheusser, E., 1994. Eine Entwicklungsgeschichte der Bandkeramik zwischen Rhein und Maas. Unpublished Ph.D. dissertation, Seminar for Pre- and Protohistory, University of Frankfurt, Frankfurt am Main.

Minelli, A., 1993. *Biological Systematics: the State of the Art*. London: Chapman & Hall.

Moore, C.C. & A.K. Romney, 1994. Material culture, geographic propiniquity, and linguistic affiliation on the North Coast of New Guinea: a reanalysis of Welsch, Terrell, and Nadolski (1992). *American Anthropologist* 96, 370–96.

Moore., J.H., 1994a. Putting anthropology back together again: the ethnogenetic critique of cladistic theory. *American Anthropologist* 96, 370–96.

Moore, J.H., 1994b. Ethnogenetic theory. *National Geographic Research and Exploration* 10, 10–23.

Ross, M., 1997. Social networks and kinds of speech-community event, in *Archaeology and Language*, vol. 1, eds. R. Blench & M. Spriggs. London: Routledge, 209–61.

Rowlands, M., 1994. Childe and the archaeology of freedom, in *The Archaeology of V. Gordon Childe*, ed. D. Harris. London: UCL Press, 35–54.

Sanderson, M.J., 1995. Objections to bootstrapping phylogenies: a critique. *Systematic Biology* 44, 299–320.

Slowinski, J., 1993. 'Unordered' versus 'ordered' characters. *Systematic Biology* 42, 155–65.

Sober, E., 1988. *Reconstructing the Past: Parsimony, Evolution and Inference*. Cambridge (MA): The MIT Press.

Stehli, P., 1994. Chronologie der Bandkeramik im Merzbachtal, in Lüning & Stehli (eds.), 79–192.

Swofford, D.L., 1991. *Phylogenetic Analysis Using Parsimony, Version 3.0s*. Champaign (IL): Illinois Natural History Survey.

Terrell, J.E., 1988. History as a family tree, history as a tangled bank. *Antiquity* 62, 642–57.

Terrell, J.E., T.L. Hunt & C. Gosden, 1997. The dimensions of social life in the Pacific: human diversity and the myth of the primitive isolate. *Current Anthropology* 38, 155–95.

Welsch, R.L., J. Terrell & J.A. Nadolski, 1992. Language and culture on the North Coast of New Guinea. *American Anthropologist* 94, 568–600.