Threads of Identity:
The Persistence and Change of Expressed Memetic Variants of the Suebi and Alamanni in Southwest Germany, the First Century BC through the Sixth Century AD

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DEDICATION

For Annika, my dear and sweet girl.

ABSTRACT

Frontiers are contact zones between cultures. The upper Rhine river valley was just such a contact zone when the Romans arrived in the first century BC. Over the next 500 years the Romans engaged in a complex cultural interaction with the non-Roman inhabitants that eventually resulted in a creolized frontier society. A model derived from Roman authors suggests that this society was replaced by the arrival of the Alamanni in the late third century AD who, in turn, were replaced by the Merovingians in the sixth century.

The replacement model of cultural interaction in the upper Rhine is tested using a methodology based in Darwinian and meme theory. Seriations were created of stylistic elements from ceramic vessel assemblages from 14 archaeological sites in southwest Germany. The seriations suggest that non-Roman inhabitants in the first century AD did adopt aspects of Roman culture but only in the realm of emotionally charged ritual. For their day-to-day existence, the artifacts they used appear to have changed little and they maintained an identity adopted centuries before. In evolutionary terms, these practices had a high fitness relative to the cost of learning new ceramic manufacturing techniques.

In the third and fourth Centuries, the Alamanni arrived and in the archaeological record, we see a proliferation of new style elements and forms. Now it appears that peoples readily adopted new means of expressing identity overturning the old forms. However, no one element had fitness great enough to invade and dominate as *Kammstrich* had in the first century. With the infiltration of people from central Europe and the continued presence of a Mediterranean culture on the Rhine the dynamism of this frontier context increased on a grand scale. Finally, with the arrival of the Merovingians in the sixth and seventh centuries, the number of style elements is almost too great to count and, while reflecting a reduction of overall fitness of the memes, the means to express identity expanded.

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CHAPTER ONE

INTRODUCTION

The accounts of native peoples in southwest Germany left by Roman and Greek historians vary in quality from author to author. Some, like Caesar and Ammianus Marcellinus, saw the people about whom they wrote, others, like Tacitus, did not. The following is a brief history of southwest Germany, based on classical accounts, from the first century BC through the sixth century AD. I will discuss some of the problems imposed on archaeological research by classical accounts, and then propose my hypothesis regarding the sequence of events during this period and methodologies to test it.

Caesar's *Bellum Gallicum* is the earliest eyewitness accounts of indigenous people living in the upper Rhine valley. During his first brief expedition east of the Rhine (55 BC), he writes of the "Suebi" who were the largest and most warlike tribe inhabiting a large area between the middle and upper Rhine and upper Danube rivers. The "Suebic" name remained in the Roman consciousness and by the late first century AD, Tacitus, writing in his *Germania*, locates them much further east in central Germany along the Elbe. According to Orosius' *Historiarum adversus paganos libri VII*, they fought in the Marcomannic wars in the

170s along the Danube, near Bohemia (Hummer 1998). The Romans, in the late first century AD, made substantial movements across the Rhine, occupying the region between the upper Rhine and the upper Danube, which Tacitius calls the *Agri Decumates* (*Germania* 29).

By AD 213, however, the Romans were experiencing pressure from a new group, the Alamanni. Dio Cassius first mentions them during Caracalla's (AD 211-217) campaign in southwest Germany. The Alamanni raided across the *limes* into Roman Raetia in AD 233 and later joined the Franks in AD 256. After a period of continual reversals for the Romans, they abandonded the *Agri Decumates* between AD 254 and 260. Conflict continued between the Roman and the Alamanni throughout the third century and into the fourth. By AD 355, the Alamanni occupied the area west of the Rhine including Strasbourg (Ammianus XVI, 2, 12). The emperor Julian (AD 355-363) defeated them in a vigorous campaign after which the Alamanni apparently retreated to the east.

Around AD 400, the name "Suebi" reappears in the texts in the area of the Rhine. In Zosimus', *Historia Nova*, the Suebi join the Alans and Vandals in an attack on Gaul (AD 406). Around AD 409, sources indicate that the Suebi moved through Gaul, finally settling in northwestern Spain. There they remained independent

until the Visigoths conquered them in AD 583. The Alamanni, meanwhile, had reached the peak of their power in the late fifth century. By AD 500, however, the Franks conquered their northern range and in AD 536, the remaining portion of *Alamannia* lost its independence.

STATEMENT OF PROBLEM

The relationship between the first century BC Suebi, the third and fourth century Alamanni, and the fifth and sixth centuries AD Suebi is difficult to establish from historical sources. One reason is due to the 200 years of silence between Tacitus' and Zosimus' accounts. Another reason is that the terms were not applied consistently in the sources. Researchers have long recognized that "Suebi" and "Alamanni" stood for confederations of many different, smaller groups, any one of whom might be given the name in contemporary accounts (Frahm 1930). Wenskus (1961) argued that the pan-Germanic character of groups such as the Suebi and Alamanni indicates that these designations were not new terms. Rather, they offered regional identities that eventually out competed, in many respects, local identities in southwest Germany. The names may have also offered flexible collective terms by which scattered bands could rally against their enemies but not impinge on local authority (Hummer 1998). Dio Cassius

lends support to this hypothesis, "The Suebi, to be exact, dwell beyond the Rhine (though many people elsewhere claim their name)" (LI, 6).

One gains several impressions from ancient accounts, many of which have been incorporated into archaeological analyses of culture change in southwest Germany. First, that there were large and frequent population movements from the third century AD. Based on where the word "Suebi" appears there was a migration of people from the Rhine to the middle Danube and back. The Alamanni, in view of many researchers, arose out of another group, the Semnones, on the upper Elbe River then migrated into southwest Germany. If Hummer and Wenskus were correct that identity was negotiated based on a particular situation, then perhaps it would not be useful to use these names as analytical devices to study change.

Second, there were population replacements due to the migrations, and each new group brought with it a new set of cultural practices and, therefore, each group would have a new archaeological signature or "style." The first century BC Suebi built houses and made pottery according to their style, when the Romans arrived they did likewise, and similarly the Alamanni. What is missing in most analyses is an analysis of what happened to the people who were already living

in southwest Germany when the new group arrived[1]. How did cultural identity, as it is reflected in artifact style, persist and change in southwest Germany from the first Roman contacts to the end of the migration period six hundred years later? Did the native Germans adopt Roman practices? If so, at what rate? Did they adopt a Roman identity wholesale? There is evidence to suggest the contrary. However, a result of the "migration" viewpoint is that archaeological analysis tends to focus on one group or the other and there are few studies of long-term culture change or the interaction between groups.

HYPOTHESIS AND ALTERNATIVE HYPOTHESIS

My hypothesis is that the "migration/population replacement" perspective outlined above is overstated due, in large part, to impressions gained from classical accounts. In particular, that the groups described by classical authors are separate entities, and when new groups appear in the sources this represents a replacement of either the previous population itself or the previous population's identity. I propose to test my assumption that cultural change occurred slowly through centuries of contact and that aspects of identity

[1] Tacitus views this a a marginal area occupied by Gauls, "I should not count among the people of Germany, though they have established themselves beyond the Rhine and Danube, the tribes who cultivate the "ten-lands." All the wastrels of Gaul, plucking courage from misery, took possession of that debateable land: latterly, since the frontier line has been driven and the garrisons pushed forward, these lands have been counted an outlying corner of the Empire and part of a Roman province" (*Germania* 29).

persisted through time. The alternative hypothesis is that migrations caused widespread disruption of cultural change and rapid change in identity. The underlying assumption for both hypotheses is that "style" can serve as a marker of identity both for members of a group, at any number of different levels, and those outside the group. Similarities and differences in artifact styles demonstrate aspects of social relationships among individuals and larger groups.

This analysis tests certain assumptions regarding culture contact and change from the late first century BC through the sixth century AD. In addition, this analysis is testing the utility of memetic and cultural virus theories in archaeological analysis. Cullen (1993; 1996a,b) presented a new approach for evolutionary archaeology; one that has great potential to study the evolution of ideas and artifacts themselves in addition to the people who made them. The data for this analysis is derived from 14 archaeological sites in the upper Rhine valley in Southwest Germany (Table 1.1) (Figure 1.1).

Table 1.1. Site locations and dates.

Site	Kreis	Dates (AD)	Site Type
Biengen	Breisgau-Hochschwarzwald	4th-5th century	settlement and burials
Bötzingen	Breisgau-Hochschwarzwald	5th-6th century	burials
Breisach	Breisgau-Hochschwarzwald	4th-5th century	settlement
Buchheim	Breisgau-Hochschwarzwald	4th-5th century; late 7th to early 8th centuries	settlement
Dangstetten	Waldshut	1st century	Roman fort
Diersheim	Ortenau	1st century BC – 3rd century AD	burials
Forchheim	Emmendingen	4th-5th century	settlement
Jechtingen	Emmendingen	4th-5th century	settlement and burials
Mengen	Breisgau-Hochschwarzwald	4th-5th century; late 6th-11th centuries	settlement and burials
Sponeck	Emmendingen		burials
Vörstetten	Emmendingen	4th-5th century	settlement
Weil am Rhein	Lörrach	1st-2nd centuries	burials
Weisweil	Emmendingen	4th-5th centuries	settlement

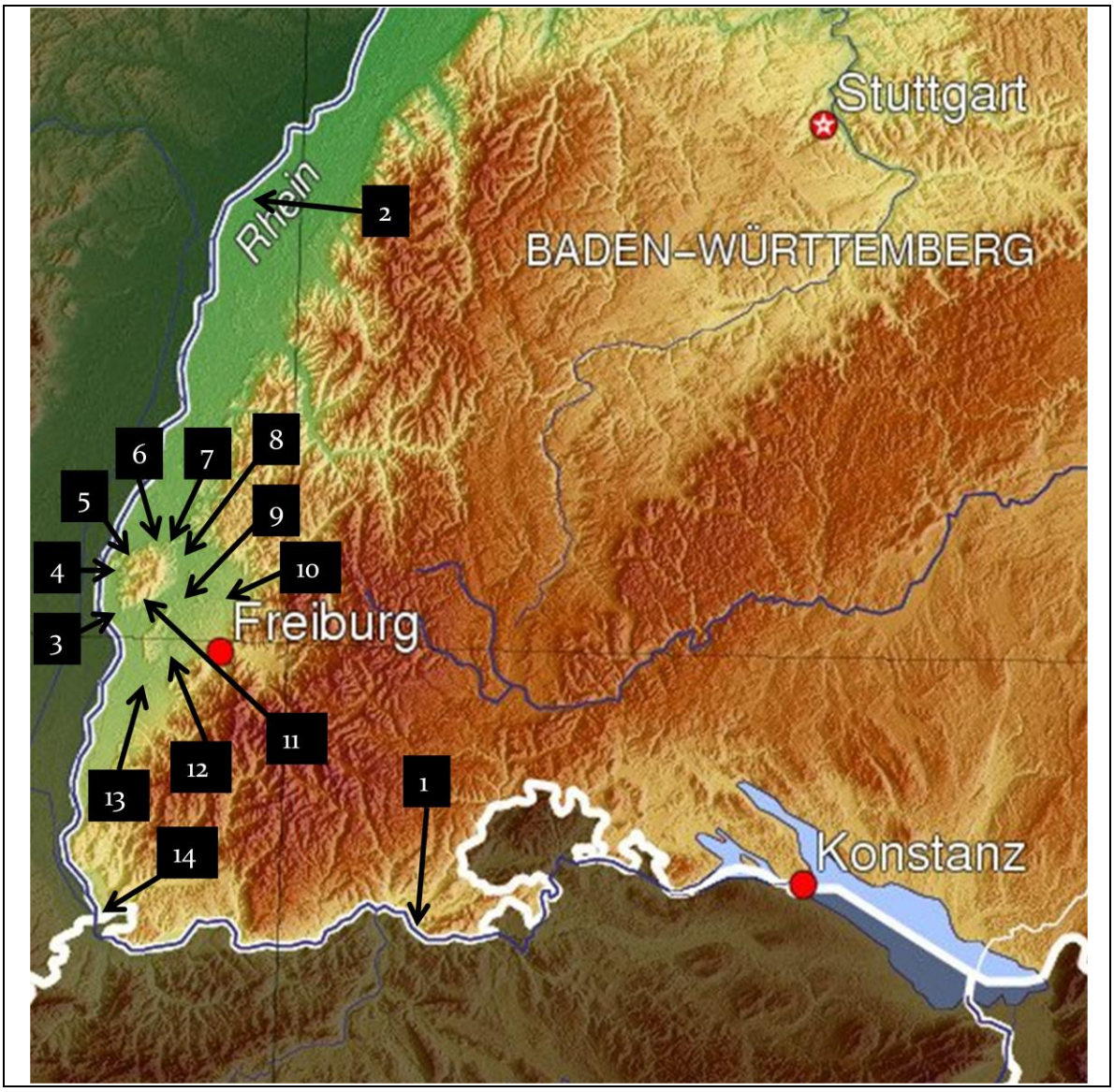

Figure 1.1. Site locations (base map from Mapsorama.com).

1. Dangstetten	4. Sponeck	7. Forchheim	10. Vörstetten	13. Biengen
2. Diersheim	5. Jechtingen	8. Riegel	11. Bötzingen	14. Weil
3. Breisach	6. Weisweil	9. Buchheim	12. Mengen	

THE PROBLEM OF DEFINITIONS

Archaeologists have long debated the words they use in their research, their, meaning, and the assumptions they have regarding those words (Lyman et al. 1997; Trigger 1989). This debate is important for archaeology as a discipline since an analyst's conclusions regarding a particular problem are based on the terms he or she uses to formulate that problem (Dunnell 1971). Because of this, terms and definitions must be stated in explicit language. Modern archaeologists who study contact between Romans, a definition that can vary depending on time and context, and non-Romans have long used language borrowed from classical authors and early antiquarian researchers. Words such as "Roman", "Alamanni", "Iron Age", and "Fibula" possess meanings that are understood implicitly to greater or lesser extents.

What makes a "Roman" a "Roman"? The word probably lost all meaning as an ethnic designator the instant non-Latin speaking peoples in Italy were given citizenship. After Caracalla made citizens of all free, male adults within the empire (AD 213), the word is further reduced to a geographical, and perhaps political, meaning. "Romans" are individuals who could come from anywhere and, unless we have some literary or epigraphic indication, we cannot really

understand how they conceived of themselves. If one is born in Roman Syria, pays their taxes to a Roman government, but only speaks Greek or Aramaic and never goes to a bath, do they understand themselves as Roman, or Greek, or Syrian, or what? Certainly, the army of the soon-to-be-emperor Julian had more in common in terms of language and culture with their enemies the Alamanni than they had with their own general. Moreover, since the early second century AD, most emperors were not even of Italian origin and many had never been to Rome itself.

The historian Tacitus discusses the Roman provincial policy where non-Roman peoples, in this case the Britons, were encouraged to adopt new cultural practices.

> In order that a population scattered and uncivilized, and proportionately ready for war, might be habituated by comfort to peace and quiet, he (General Agricola) would exhort individuals, assist communities, to erect temples, market-places, houses…moreover he began to train the sons of chieftains in a liberal education…as a result, the nation which used to reject the Latin language began to aspire to rhetoric: further, the wearing of our dress became a distinction, and the toga came into fashion, and little by little the Britons went astray into alluring vices: to the promenade, the bath, the well-appointed dinner table (Agricola 21)

General Agricola encourages a set of behaviors, wearing togas, going to the bath, speaking Latin, that are intended to produce a change in identity from that of

Briton, of whatever tribe, to that of something new. In Tacitus' view, this new identity is Roman. Such a definition of "Roman" is problematic for archaeological research since it is based on an implicit, essentialist[2] understanding of the behaviors that constituted Roman culture. Any culture is constantly changing, through time and across space as it encounters other cultures. Tacitus' understanding of "Roman" is confined to his particular geographic location and his experience in the late first century A. D. after it had been altered by contact with peoples throughout the Mediterranean. Would Tacitus view the aforementioned Syrian taxpayer as Roman? Would he view a Christian, Romano-Byzantine Emperor as Roman or would he recognize the Roman culture of the regal period 600 years earlier?

A belief that people viewed themselves as Roman simply because they used terra sigillata dinnerware is also problematic as "Roman", in this case, is a definition that is not preserved in the archaeological record. How do we know, archaeologically, what someone thought as that person wore a new toga to the newly built forum in the newly built He feels like an important Briton? He feels like a provincial Roman? People certainly attach meaning to objects and use them to represent themselves to society at large (Wells 1998), but it is debatable

[2] See Chapter 2, Theories of Cultural Evolution for a discussion of essentialism.

whether archaeologists can identify what those meanings are. By adhering to these kinds of definitions derived from texts, archaeologists privilege historical data over their own derived from artifact analysis. An independent archaeology will produce research tailored to its intended goals, that is, explaining variation and change in the archaeological record.

A definition is a statement of the meaning or significance of a word and can be derived either extensionally or intensionally. An extensional definition is primarily a list of all objects to which the term is applicable or all characteristics exhibited by a member of a group. For example, an extensional definition of "dog" would be a list of all known dogs or a list comprising of: tail, ears, fur, etc. (Dunnell 1971). Lyman and O'Brien state that, "the definitive criteria are literally an extension of observed character states of specimens in a group" (2003:226). Since extensional definitions are derived from previously created assemblages, or rather, they define that which is already known, they are rarely expressed in an explicit manner and inclusion of new members becomes difficult. For example, an extensional definition of "Alamanni" would be a list of all Alamannic individuals who ever lived, and the criteria for inclusion would be defined by those already listed. For archaeologists, who cannot ask a Roman or Alaman how they define themselves, we run the risk of tautology when using

extensionally defined groups. A thing is that thing because it is under an extensional definition (Dunnell 1971). In addition, since artifacts can be sorted into piles and a definition can be produced from those piles it tends to reinforce the notion that those piles are somehow inherent or real, rather than analytically constructed tools (Lyman and O'Brien 2003).

Extensional definitions are useful in single cultural situations in which it is not necessary to know why an object is something because participants agree on what objects should be included under that definition (Dunnell 1971). Participants can convey meaning to one another with a minimum of knowledge. Tacitus' definition of a German worked within his context because both he and his audience implicitly understood what a German was. No further information needed to be provided which was not already in common possession. Such definitions fail in those situations in which a non-participant does not receive the necessary information to include an object within a defined group (Dunnell 1971). An archaeologist reading Ammianus Marcellinus does not understand the implicit meaning behind "Alamanni" since the author does not provide necessary and sufficient conditions for inclusion within the group. Assigning a site to the Alamanni, as an extensionally defined group, requires an understanding of "Alamannicness" as it was understood by the Romans.

An intensional definition, on the other hand, specifies a set of necessary and sufficient conditions, which objects must display in order to be considered a member of a group (Lyman and O'Brien 2003). The membership conditions are derived from theory and are specific to research questions, and the members of a group may possess other attributes that are non-definitional for the purposes of investigating the question at hand. Intensional definitions are invariable as long as they are used to address the research questions for which they were constructed. This aspect establishes a framework to evaluate anything, which may or may not have been considered when the term was, defined (Dunnell 1971).

Given the diachronic dimension of the archaeological record, archaeologists, more often than not, are not participants in the author's culture whose works they seek to use. The kind of definitions that Tacitus, or any other person living at that time, used to designate a "Roman" or "Briton" or "Alamanni" may have been intensional. However, they were rarely explicit and we, as readers of texts, can only assume what they meant. Our interpretation of their definition thus becomes extensional. The implicitness of ancient sources becomes even more problematic when archaeologists use their own common-sense epistemology to define these groups and apply them to the archaeological record. What defines

the Suebi in the 1st century AD? Is it only that Tacitus believed they lived in region where those observed by Caesar lived?

YOU KNOW A ROMAN WHEN YOU SEE ONE

An intensional definition for "Roman", "Suebi", or "Alamanni" would be a list of those things that constitute "Romanness", "Suebicness", or "Alamannicness". Such a list might include an explicit suite of stylistic features that must be exhibited by artifacts in order to be included under that definition. While the Alamanni, for example, have received much attention through the years (Fuchs et al. 1997; Nuber et al. 1990), few archaeologists have provided an explicit definition based on archaeological data or have attempted to move beyond definitions provided by the Romans[3].

For the purposes of this research I will not use the terms "Suebi" or "Alamanni" unless in context of discussing previous research or historical sources. While these terms may serve as a sort of short hand for a particular temporal or spatial context, there is also much implicit meaning attached to them. I will, instead, use the term "non-Roman" to stand in place of these terms (Table 1.2).

[3] See Donat 1988 and 1991 for exceptions.

Table 1.2. Intensional Definitions for Roman and Non-Roman.

	Roman	Non-Roman
Temporal Period	50 BC – AD 400	50 BC – AD 400
Spatial Boundaries	Breisgau	Breisgau
Ceramic Production	Wheel-turned	Hand-formed
Body Treatment	Cremation	Inhumation
Grave Goods	Absent	Present
Building Construction	Predominately stone	Predominately wooden

What, then, is a "Roman"? Any individual can perceive their own identity at any number of scales, personal, community, regional, or national (Wells 2001). Identity is also embedded in the individual's immediate context and is negotiated through contact with other individuals. Any person may adhere to an identity at a local level that may seem incongruous with an identity assumed at a regional level[4]. This contextuality of identity makes archaeological research difficult when it comes to assigning an artifact assemblage to any particular ethnicity. At best, we may state that Rome existed as a political entity for a defined period, it controlled territory, it had an army, and it produced goods. The buildings, walls, and forts it created are distinctive on the frontier compared with non-Roman architectural styles.

[4] St. Paul famously invokied his Roman identity when it served his purposes (Acts 25:10-12).

PROPOSED ANALYSIS

The concept of descent with modification, or selection, provides a framework by which researchers can understand trans-generational continuity and change in social phenomena[5]. Social phenomena, in general, satisfy the three necessary and sufficient conditions for selection: 1) there exists a continuous stream of novelty and variation in a phenomenon's characteristics; 2) there exists a continuously operating mechanism for transmission of these characteristics to other individuals allowing cultural phenomena to persist beyond the life of any one individual; and 3) at any given time, various circumstances can inhibit transmission of different alternative characteristics relative other characteristics (Dunnell 1980). A phenomenon's history and the range of interactions between individuals limit the number of possible alternatives. Through observing each other's alternative practices and through innovation, people always have an available repertoire of practices in their daily interactions.

Recent developments in selectionist theory allow us to conceive of identity as a collection of ideas or memes, some of which are selected in a manner analogous

[5] What Darwin proposed was an explanation for why traits, in any system possessing transmittable variability, will tend to be preserved. Biology, at the time, happened to be more amenable to Darwin's proposal than other fields of study (Dennett 1995).

to genes (Blackmore 1999; Cullen 1996a,b; Dennett 1995). The question remains of how to measure change in identity through the archaeological record. Stylistic affinity in artifacts has long been used in archaeology to establish cultural relatedness in an artifact assemblage (Evans 1850; Flinders-Petrie 1899; Kidder 1917; Kroeber 1916; Rouse 1939). The frequency seriation technique is a way to test hypothesized homologous similarities (Lipo et al. 1997; Neiman 1995; Teltser 1995). Homologous types will display particular frequency distributions over time and through space; types that do not exhibit these distributions are not homologs. The focus of frequency seriations is changes in the relative frequency of specimens representing multiple stylistic variants (Lyman and O'Brien 2000). We can examine change in identity from a methodological perspective that views time as a continuum and can account for the persistence of aspects of cultural identity through time.

Cultural identity can be conceived of as a set of memes shared by members of a population. Some of these memes are expressed in artifacts, but most are not. Variability in expression is introduced through manufacturing error and experimentation. Those expressed variants that best convey cultural meaning to members and non-members of the group tend to possess greater fecundity than those that do not. There is no doubt that cultural identity changed in southwest

Germany during the period under question, especially during the period of Roman contact when trade and population movement was relatively easy. Native peoples in this region were in a position of potential contact with those throughout the Mediterranean basin. What is lacking in many analyses is the ability to measure change and retention of elements of identity.

A major task is to develop a frequency seriation to analyze hypothetical phylogenetic relationships between classes of artifacts produced before direct Roman contact that is political incorporation of southwest Germany into the empire, during Roman contact, and after. For this analysis, I will concentrate primarily on ceramic artifacts since they present a common source of stylistic data from publications and field collections.

CHAPTER TWO

THEORIES OF CULTURAL EVOLUTION

Debates over the application of Darwinian and non-Darwinian evolutionary principles to archaeological research have punctuated growing interest in this perspective (Boone and Smith 1998; Broughton and O'Connell 1999; Hart and Terrell 2002; Lyman and O'Brien 1998; Spencer 1997; Teltser 1995c). Three current paradigms that dominate the discussion are evolutionary processualism, evolutionary ecology, and evolutionary or "selectionist" archaeology. Each paradigm makes assumptions regarding how variation is created in the realm of the archaeological record, how variation is maintained and transmitted, and the role of intent or innovation in creating variation.

THE ROOTS OF EVOLUTIONARY ARCHAEOLOGY

Academic study of archaeology and anthropology developed in the nineteenth century during a period when evolutionism preoccupied both the physical and social sciences. Evolution, was, and is, a concept that referred to a sequence of formal change through time and the mechanisms that produced the sequence (Spencer 1997). The former aspect, that forms change, was first articulated in the

late eighteenth century by Jean-Baptiste Lamarck (1809) and Erasmus Darwin[6]. It remained until the middle of the nineteenth century, however, that the foundations of evolutionary anthropology were conceived first through the insights of Charles Darwin and Herbert Spencer and later modified by Lewis Henry Morgan and Edward Burnett Tylor.

Darwin proposed an explanation for evolution that drew upon Lamarck's concepts of formal change through time and environmental impact upon form. He combined it with a new mechanism for change that did not include Lamarck's belief of the transmission of acquired characteristics. This explanation was composed of five theories[7], each of which has enjoyed varying amounts of success in the period since 1859. Of these five, Darwin's natural selection had the greatest impact on evolutionary theory, especially in Britain and the United

[6] Prior to Lamarck and E. Darwin, forms in the natural world, called species, were considered to be immutable following Linneaus' work *Systema Naturae* in 1735. Life forms were created by God as they were and could not change. Lamarck believed that although species could not become extinct, their forms could change in response to climatic pressures and, over time, these pressures result in the transformation of life forms (Mayr 1991). Evolutionary changes are due to the effort with which species uses a particular body part, thus need promotes the formation of new organs or alteration of old ones.

[7] The five theories are (Darwin 1859; Mayr 1991), 1) the world, and its inhabitants, are not constant nor recently created nor perpetually cycling but rather are changing; 2) every group of organisms is descended from a common ancestor; 3) species multiply, either by splitting into daughter species or by allopatric speciation; 4) evolutionary change takes place through the gradual change of populations and not by the sudden production of new individuals that replace a new type; 5) natural selection.

States, although the cultural-evolutionary perspective itself developed during the Enlightenment (McGee and Warms 1996; Trigger 1989).

Darwin began with the idea that more individuals of a species are born than survive into adulthood[8] and then postulated about the factors that affect which individuals survive and which do not. Small variations occur in the form or behavior of members of a population, and these variations affect the success of an individual who competes for food and/or sexual reproduction. Adaptive variations were those that helped an individual survive within an environment, thus the relationship between an individual's physiology, behavior, and environment determined who would survive, reproduce, and pass on their adaptive traits to the next generation (Darwin 1859). Interaction with the evnironment implied that environmental change could affect the traits selected in a species and through time alter the form individuals of that species.

Perhaps the most revolutionary aspect of Darwin's work was the challenge it posed to deeply held Western ontologies. Specifically that the individual, and individual variation, within a population was affected by evolution ran contrary to commonly held essentialist beliefs of saltation, or evolution by sudden

[8] A concept first proposed by Thomas Malthus (1798).

transformation (Mayr 1988). Darwin also challenged the belief in "final causes", that there was a direction or goal to evolutionary change (Mayr 1991). Elements of both essentialism and finalism are still found in modern scientific inquiry, and indeed are primary assumptions of physics and chemistry. Anthropology and archaeology also retain essentialist and finalist characteristics evident in Binford's (1962, 1965) search for laws of human behavior and Flannery's (1968) systems theory. But it is variation and change in classes of things, for example artifact and settlement types, that are best represented in the archaeological record.

ESSENTIALISM

Essentialist ontology presumes the existence of discoverable, discrete kinds of things (Lyman, et al. 1997). Things are of the same kind because of shared characteristics, "essences", and these essential properties determine whether a thing is Kind A or Kind B. The essential properties define an archetype to which actual objects are imperfect approximations (Lewontin 1974; Lyman, et al. 1997)[9].

[9] Essentialism in Western philosophy dates to the Pythagoreans who stated that a triangle, regardless of the combination of angles, will always be a triangle (Mayr 1991). Plato used the analogy of shadows on a cave wall, the phenomena we see in the world are like the shadows cast by a fire and we can never see the real essences.

Chemical elements, for example, are essentialist units where individual atoms within each class are so similar to each other that they are not imperfect approximations but rather clones. Essentialism has also been successful in mathematics, physics, and logic primarily due to the nature of phenomena that each discipline studies. Prior to Darwin, it was the predominant epistemology for those who studied biology and evolutionary biology. Most scientists saw species as "natural kinds", defined by constant characteristics and distinguished from one another by distinct gaps (Mayr 1991)[10]. Variation in form was the manifestation of imperfect reflections from the underlying essences.

The strength of essentialism's influence results, in part, from our own limited consciousness and because we rely on common sense to compress variation into groups for management's sake, for example, "Douglas firs" and "alders" become "trees", diamonds and rubies are "gems" (Lyman, et al. 1997). Even the variation that exists within a group defined as narrowly as "Douglas Fir" is compressed to accommodate our limited capacities. Related to this is the structure of our language. Languages use nouns to group highly variable phenomena "even though the kinds [of phenomena] do not stand in direct relation to one another…the simple noun defines the class of object" (Mayr 1991:41).

[10] Charles Lyell, for example, believed that "there are fixed limits beyond which the descendants from common parents can never deviate from a certain type" (1835:162).

FINALISM

Like essentialism, a belief in final causes, or teleology, has deep roots in western philosophy. It was widely believed among Greek philosophers that the world must have a purpose because Nature did nothing in vain (Mayr 1991). Any change in the world, then, is due to "final causes" that move the particular object or phenomenon toward an ultimate goal. Many philosophers, for example Aristotle, used the development of an organism from egg to adult as an example of this process and everything in nature, particularly directional processes, moved in an analogous manner.

Many naturalists during the seventeenth century became dissatisfied with the strictly mechanistic view of the physicalists, who argued that though God created the world and the processes that govern it, there has been no further divine intervention in nature; the Watchmaker made the watch, set it running, then moved on. The naturalists opted for a greater role for God in initially designing the world and His effecting changes since creation (Mayr 1991). This new school, natural theology, emphasized the elaborateness of the world's original design and, combined with observations of ongoing changes in the world and statements in Genesis, proposed a new concept of nature. They saw

creation as an ongoing process, directed by final causes, culminating in the production of man (Mayr 1991). Teleological thinking was reinforced by geological discoveries of successions of fossil faunas culminating in strata containing mammals and finally humans.

As the naturalists continued their analyses, however, they began to find phenomena that were not perfectly designed for their role in nature. They asked the questions: if the environment changes, then how could an organism perfectly fit within its niche, and how could design be perfect if it led to the widespread extinctions shown in the fossil record? By 1800, natural theology, with its emphasis on design, had been virtually abandoned everywhere in Europe, except England (Mayr 1991)[11,12].

Darwin demonstrated that biological phenomena, the result of a historical chain of events, cannot be explained by simple laws and cannot be proven in the same way as phenomena studied by the physical sciences. Because evolution is ongoing, there cannot be a final form of any phenomenon that is shown to be

[11] All of Darwin's peers, including Lyell, were confirmed natural theologians including Darwin himself, prior to his *Beagle* voyage (Mayr 1991).

[12] Many modern archaeological analyses rely on teleological explanations, although few seriously accept a "cosmic teleology" based on final causes (Jones, et al. 1995). Processes that are the result of physical laws, for example that a pottery vessel is thermally altered clay or that a flake is the result of percussive force, are properly explained by teleological processes.

affected by natural selection. However, as Simpson (1949) demonstrated, each evolutionary lineage has its own history, and evolutionary progress can only be defined in terms of that particular lineage. Many lineages demonstrate change through time, become extinct, or show no evidence for change over millions of years, "progress thus is not at all a universal aspect of evolution, as it ought to be if evolution were generated by final causes" (Mayr 1991:65).

CULTURAL EVOLUTION

Despite the impact of Darwin's theories in the biological fields, evolutionary theory in the social sciences followed from the work of Spencer, Morgan, and Tylor. Spencer, in contrast to Darwin's gradualism, placed more emphasis on directional, saltational evolution, that is, change as a series of discrete forms[13]. The essential feature of evolution was the development of complex forms from simple ones according to unvarying principles of change (Spencer 1997). Spencer linked biological and social evolution through his "social organism" concept where societies, like biological organisms, evolved from simple, undifferentiated groups to complex states. A "psychic unity" existed among humans which, for

[13] Spencer's "First Principles" was published four years after Darwin's "Origins" in 1863. He was clearly still influenced by pre-Darwinian finalism, "…a change from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity; through continuous differentiations and integrations" (Spencer 1863).

Spencer, meant that as their societies evolved each would pass through the same stages attaining, at last, some end point. Simple and complex societies were comparable because human minds developed along similar lines, so even unrelated societies would develop in parallel tracks (McGee and Warms 1996). The comparative method, psychic unity, parallel evolution, and progress were all woven together to support the unilinear view of cultural evolution.

Morgan and Tylor both expanded Spencer's unilinear social evolution, concentrating on the development of society in general and religion, respectively. Morgan, in 1877's "Ancient Society", divided cultural evolution into three stages, savagery, barbarism, and civilization, with the first two stages further divided into lower, middle, and upper phases. Each stage, and phase, was marked by specific development in family structure, subsistence, and technology[14]. Although Morgan acknowledged that his stage divisions were arbitrary, he retained an essentialist, and finalist, perspective concerning the analysis of societies, "each of these periods has a distinct culture and exhibits a mode of life more or less special and peculiar to itself…it is possible to treat each society

[14] For example, the middle phase of savagery was distinguished by the development of fishing subsistence and the use of fire and ended with the invention of the bow and arrow (Morgan 1877). Barbarism began with the adoption of pottery and ended with the phonetic alphabet. Civilization was divided into Ancient and Modern with Europeans representing the highest state of the last phase.

according to its condition of relative advancement." (Morgan 1877)[15]. Although Morgan's evolutionary system was not a direct ancestor, elements of it do appear later in Americanist culture history of the 1930's and 1940's with the Archaic-Woodland-Mississippian chronology.

Tylor developed a hypothesis of religious evolution based again on a stage typology from simple to complex. Religion began with animism, evolved into polytheism, and finally progressed into what he considered the highest form, monotheism (McGee and Warms 1996; Tylor 1871). In contrast to Spencer and Morgan, he believed that the history of a system was important for proper analysis of that system; similar to what Darwin stated 12 years earlier (Darwin 1859)[16]. Aspects of modern societies that seemed to serve no function were survivals from a previous stage of development. Therefore, one could learn from these survivals something about the past system.

Unilinear evolutionary theory in late nineteenth century social science was influenced by beliefs about Western society in addition to the essentialism and

[15]For example, the Australian Aborigines belonged to the Middle Savagery stage, Native American groups east of the Mississippi River were Lower Barbarians, and Iron Age Germans Upper Barbarians.

[16] Tylor wrote, "…wherever, there are found elaborate arts, abstruse knowledge, complex institutions, these are results of gradual development from an earlier, simpler, and ruder state of life. No stage of civilization comes into existence spontaneously, but grows or is developed out of the stage before it" (1871).

finalism of early nineteenth century physical science. First, social scientists, including those mentioned above, supposed that all societies evolved through the same stages and were progressing toward "civilization" and that Victorian society represented the highest stage. Second, through the comparative method, the development of western society could be understood by studying modern "primitive" societies. Darwin's theories emphasized history but also stochastic processes where there was no preset course of development. That a modern form existed was because that form was subject to its history and to selective pressures which limited the variation in that form. Evolutionary theory as conceived by Spencer, Morgan, and Tylor was altogether different.

EVOLUTIONARY PROCESSUALISM

BACKGROUND

Unilinear evolutionary theory in American social sciences fell out favor under the influence of Franz Boas and historical particularism. He stated that cultures may exhibit similar traits not because of psychic unity but through diffusion and trade (McGee and Warms 1996). A comparable biological argument states that

similar phenotypic characters in different species may not be the result of common ancestry but rather convergent evolution.

Boas argued that environmental conditions, psychological factors, and historical connections must be combined in any study of human culture (Boas 1896). Although Boas, and his students, rejected studying cultures from an evolutionary perspective, their emphasis on history and environment mirrored Darwin's arguments forty years earlier and thus allowed for the eventual development of a Darwinian study of cultural evolution in the late twentieth century.

During the 1930s, anthropologists began to rediscover evolutionary perspectives; however, they were more in the tradition of Spencer than Darwin. Three prominent neo-evolutionists in anthropology were V. Gordon Childe, Leslie White, and Julian Steward. In 1936, Childe argued that two technological revolutions, a Neolithic and an Urban, occurred in three different regions of the world: Mesopotamia, Egypt, and India (Childe 1936)[17]. The Neolithic Revolution introduced domesticated plants and animals where humans first became food producers. The surplus of food gave rise to the accumulation of an economic

[17] In 1936, Childe stated "natural history reveals man creating new industries and new economies that have furthered the increase of the species" (1936). Although Childe refers to natural selection and argued that Darwin's theory had application to social systems, his own application reveals not a Darwinian perspective but a Lamarckian one where an organism, or population, anticipates a future need and makes appropriate changes.

surplus and larger populations. The Urban Revolution, made possible by the plow and even larger economic surpluses, occurred when the city became the significant feature of social and economic life.

Childe adopted Morgan's stagewise evolutionary progression, with each stage characterized by technological improvement, although he gave much more attention to divergent features of change than parallel features[18]. In Europe, the Mediterranean, Egypt, Mesopotamia, and China, the pattern of development was basically the same but that in each case "the intervening steps in development do not exhibit even abstract parallelism" (Childe 1951:161). Childe's unique contribution to social evolutionary theory emphasized diffusion as the major mechanism, together with local circumstances, whereby historic outcomes occurred (Sanderson 1990).

Following Spencer, White argued that cultural development was unilinear, from simple to complex with increasing specialization of parts (White 1945, 1959). Culture exists because it is adaptive, that is, culture is a mechanism for serving

[18] Childe notes, "organic evolution is never represented pictorially by a bundle of parallel lines, but by a tree with branches…In so far as the archaeological picture could be represented by such a figure, it would disclose a process analogous to organic evolution" (1951:166). Here, Childe partially adopts Darwin's "Multiplication of Species" theory that species, or societies, evolve by branching from some common ancestor. But, because he also uses Morgan's developmental scheme, Childe ultimately retains a finalist point of view with civilization as the end of development.

human needs. The components of culture consist of technological, social, and ideological systems, and, since White was a strong materialist, it was the technological realm that largely determined the nature of social systems and ideologies.

For White, a culture was basically a thermodynamic system or mode for harnessing energy; a society's ability to control energy indicated its relative evolutionary stage[19]. There have been two great leaps in human cultural evolution: the Agricultural Revolution, or the domestication of plants and animals, and the Fuel Revolution, White's term for the Industrial Revolution of the nineteenth century. Each of these, he argued, was responsible for major transformations in the other components of culture (White 1943)[20]. White, downplayed the role of history in a specific culture's evolution in favor of general rules which could be applied to all cultures and went so far as to say that "evolutionism has nothing to do with individual tribes or peoples" (Sanderson 1990:86)[21].

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[19] A culture advanced as the amount of energy harnessed per capita per year increases, or as the efficiency with which energy is utilized increases (White 1943).

[20] White's saltational view of change is a natural consequence of his essentialist epistemology. If one believes in evolution and in constant types, then only the sudden production of a new type can produce evolutionary change (Mayr 1970). White saw himself not as a "neo"-evolutionist but as the direct intellectual descendant of Spencer and Morgan (Sanderson 1990).

[21] White wrote, "the temporal-formal [evolutionary] process is determinative: prediction is possible to a high degree. In the decomposition of a radioactive substance one stage determines

Steward, on the other hand, argued that the extreme generality of Childe's and White's theories, as well as the early cultural evolutionists, were "so general that they are neither very arguable nor very useful" (1955:17), primarily because they could not be applied to individual cases. The emphasis on broad generalizations came at the expense of the recognition of divergence and local variation. In the place of general laws, Steward proposed multilinear evolution, which he argued would be concerned with the search for laws dealing with significant regularities in cultural change[22]. The "laws" assumed the existence of parallels in cultural development but at a much more restricted level than those of Childe or White. In order to derive these laws, each culture had to be studied with reference to its particular environment and history. Multilinear cultural evolution, thus in effect, struck a compromise between the highly abstract formulations of the early cultural evolutionists and the historical particularism of Boas (Sanderson 1990).

Cultures in similar environments would tend to follow similar courses of evolution and formulate similar responses to their environment (Steward 1949, 1955). Certain features of a culture, primarily subsistence practices, could be used to define its relative complexity and its position in a developmental

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the next and the course and rate of change can be predicted. In short, we can predict the course of evolution" (1949:230). A decidedly non-multilinear view of cultural evolution.

[22] The search for laws of cultural change demonstrates Steward's essentialist ontology.

hierarchy. Steward delineated five basic stages that each world region had passed through: *hunting and gathering*; an *incipient agriculture*, where early domestication started as a supplement to foraging; a *formative era* during which cultivation was intensified; an *era of regional development and florescence*, marked by expansion of irrigation works and economic specialization; and finally an *era of cyclical conquests* with large-scale militarism, urbanism, and elaboration of social stratification (Sanderson 1990; Steward 1949)[23].

In 1949, Steward was cautious about the scope of application of the regularities he saw, and he stressed that his evolutionary scheme applied only to the arid and semiarid environments where complex societies first developed. Thus it could not be regarded as a global theory[24]. Steward did not believe that cultures followed a single, universal course of development but that a culture could evolve in any number of different ways given its environment. In this he approaches Darwin's concept of individuality in evolution more than any of the early evolutionary anthropologists[25].

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[23] A modified version of Steward's original hierarchy is still used by many archaeologists and cultural anthropologists (band, tribe, chiefdom, state) and can be found in many introductory texts (Kottak 2004).

[24] Carneiro argues that Steward was actually engaged in a weak form of unilinear analysis and that his "formulation was of more general application than he was ready to assert" (1973:94).

[25] He also was much more explicit about his disdain for teleological arguments than early cultural evolutionists, "certainly there is nothing in the evolutionary process which preordained the

Finally, for Steward, ecological variables were the most important causal forces in the evolution of cultures. He followed from Wittfogel's hypothesis that large-scale political control arose in response to irrigation management needs (Steward 1949, 1955). Under certain conditions, a society would reach the limits of agricultural productivity, and the resulting population pressure created inter and intrasocietal conflicts. Conflicts led to larger states, which resulted in expansion of irrigation systems, and, eventually, further population increase. The evolution of civilization was the result of a spiraling process of positive feedback involving several variables but initially set in motion by a particular set of ecological conditions (Sanderson 1990).

With the rise of processualist archaeology in the 1960s and 1970s, researchers turned toward examining the archaeological record as a means for discovering general laws of human behavior (Binford 1965, 1972; Flannery 1968). Binford and other processualists influenced by White argued that, in order to become more anthropological, archaeologists had to turn from the development of

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particular developments that occurred on our planet…likewise, no known principle of cultural development could even have predicted specific inventions such as the bow, iron smelting, writing, tribal clans, states, or cities" (Steward 1977:59-60).

culture histories in favor of empirical generalizations about human behavior[26]. Time played a minor role in these early processual analyses.

BASIC PRINCIPLES AND ASSUMPTIONS

Archaeologists throughout the first half of the twentieth century responded with ambivalence to cultural evolutionary theory, primarily due to the influence of Boas and his student Alfred Kroeber (Lyman, et al. 1997). As the culture historical school developed, however, their chronological sequences began to take the form of culture evolution (Ford 1938; Ford and Willey 1941; Griffin 1946, 1952). The Mississippi Valley sequence, Archaic, Woodland, Mississippian, etc., in particular, borrows its emphasis on technology from Morgan's evolutionary scheme. White's revival of Spencerian evolution was initially limited to sociocultural anthropology[27], although by the late 1960s cultural evolutionism became firmly established as the organizing principle for archaeological research (Binford 1968; Flannery 1968; MacNeish 1972; Spencer 1997)[28].

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[26] Specially culture historical paradigm developed by Ford (1952) and his colleagues (Phillips, et al. 1951).

[27] Most archaeologists had little use for it (Willey 1961). Its first impact concerned the development of complex societies where Kent Flannery was the most systematic proponent (Dunnell 1989).

[28] Many processualists drew particularly upon Steward's cultural ecology, which, although most espoused studying all aspects of culture (Binford 1962), had the greatest immediate application (Trigger 1989).

The processualist school relied on cultural evolutionary theory throughout the 1970s and 1980s producing many comprehensive studies, especially in highland Mesoamerica. Sanders published *The Basin of Mexico*, which used data from regional settlement pattern surveys, site surveys, and excavations to document 3000 years of cultural evolution (Sanders, et al. 1979). In *The Cloud People*, Kent Flannery and Joyce Marcus (1983) produced another long-term research project in Oaxaca Valley. They used a phylogenetic model to trace the development of Zapotec and Mixtec people from the Pleistocene to the arrival of the Spanish and, like Sanders, drew upon data acquired from regional surveys, site surveys, and excavation. They believed cultural evolution in Oaxaca proceeded in three forms:

> *general* [original italics] evolution, or the ascent from one level of sociopolitical integration to another; *divergent* evolution, through which the cultural differences between the ancestors of the present-day Mixtec and Zapotec grew more pronounced; and *parallel* evolution - those cases in which the ancestors of the Mixtec and Zapotec seem to have evolved along similar trajectories for a period of time (without necessarily moving to a new level of integration) (355).

Flannery and Marcus used linguistic differences to estimate when divergence between the Mixtecs and Zapotecs from their ancestral Oaxaca hunter-gatherers began. In the early Archaic period, between 3500 and 3000 BC, there seemed to be little material difference between them through the initial period of small-

scale agriculture. The low population density probably prevented endogamy, thus preventing divergent evolution in the authors' sense of the term, and linked a large region into a single breeding population. During this period, hunter-gatherers were organized into an, "egalitarian, band-level society…with a bilateral kinship terminology of Eskimo or simple Hawaiian type" (Flannery and Marcus 1983:356). The Archaic legacies found among contact period Mixtecs and Zapotecs include techniques of matting and basket weaving, sandal making, net bag manufacture, fire-drills, and atlatls.

The first cases of "divergent" and "general evolution" occurred during the early Formative period (1500 to 995 BC). Valley endogamy began with the first permanent villages, each developing agricultural techniques for particular environmental niches in the Oaxaca highlands[29]. The Zapotec, for example, took advantage of the high water table and small streams in the Oaxaca Valley to establish irrigation canals and wells. In a different valley, people developed dry-farming dependent on brief flooding in normally dry canyons. Increasing endogamy created "drift…reflected in stylistic and artifactual differences that were not necessarily adaptive" (Flannery and Marcus 1983:357). An increase in population size caused "general" evolution in the form of increasing

[29] This is the beginning of what Flannery and Marcus call adaptive radiation in Oaxaca Valley

sociopolitical organization including the rise of the Zapotec state around 500 BC. Development of Mixtec urban centers lagged several centuries behind the Oaxaca Valley, and the earliest ones were clearly influenced by their Zapotec neighbors. Legacies of the Formative Period include almost all agricultural techniques, loom weaving, pottery making, adobe construction, stone masonry, ceremonial bloodletting, human and animal sacrifice, and formalized religious art.

During the Classic period, Zapotec and Mixtec share several cultural features, although Flannery and Marcus have difficulty distinguishing between which features are the result of "parallel" evolution and those which result from one group influencing another. In the early Classic, buildings in Zapotec centers were organized around a main plaza; Mixtec centers had a linear plan that lacked a plaza. Early Zapotec temples were divided into inner and outer spaces; Mixtec temples were one-roomed structures. Zapotec and Mixtec centers shared geographic positions typical of Oaxacan settlements. Most are mountaintop cities in defensible locations, dominated by ritual and administrative structures and none show Teotihuacán-style craft specialty areas or large residential compounds. Classic period features persisted among contact period groups including: a class-endogamous ruling stratum; royal ancestor worship, temples

with professional priests, and military conquest. Flannery and Marcus emphasize that separately "general" and "divergent" evolution is not sufficient to explain the similarities and differences observed in the Zapotecs and Mixtecs. They draw from Steward's work an emphasis on the interplay of internal and external factors that shape a society's development. Ultimately, however, they are tied to an essentialist, stage-wise view of cultural evolution. Change is transformational from one discrete form to another.

The processualists were, in general, interested in addressing large-scale issues using data drawn from empirical research programs, such as the origins of agriculture (Binford 1968; Flannery 1968), the development of social stratification (Carneiro 1981; Flannery 1972), and the rise of state societies (Carneiro 1970; Johnson 1973; Spencer 1982). The theoretical foundation of this work was a combination of Spencerian cultural evolution combined with a positivist approach to explanation and a systems theoretic view of culture (Willey and Sabloff 1980)[30].

[30] That the processualists were interested in developing empirically based laws to explain human behavior, as well as their essentialist epistemology, can be explained by Steward's and White's influence (Dunnell 1980; Leonard and Jones 1987). Binford wrote "Culture was not some ethereal force, it was a material system of interrelated parts understandable as an organization that could be recovered from the past…We were searching for laws. Laws are timeless and spaceless; they must be equally valid for the ethnographic data as well as the archaeological data" (Binford 1972:8).

Political evolution was seen as a change in the way cultural systems are regulated and information is processed (Spencer 1997). Flannery, in particular, promoted systems theory where the two important evolutionary processes are "segregation," the amount of differentiation among the subsystems of a general system, and "centralization," the degree of linkage between the various subsystems (Flannery 1972). These, in turn, are affected by evolutionary mechanisms, "promotion" and "linearization." Promotion occurs when an institution rises to a higher position in the control hierarchy, such as when a temporary leader becomes a permanent chief. Linearization occurs when lower-order institutions are regularly bypassed by higher-order institutions, as when a state organization intervenes in local administration (Spencer 1994).

Directionality is a common feature of most processual evolutionary schemes. Johnson (1978) proposed a model for the development of decision-making organizations in which, "increasing organization complexity is generated…through continued increment in the number of information sources integrated" (91). Cultural evolution meant a movement from simple institutions with little administrative ability to highly organized and compartmentalized ones through a logistic feedback process, "a new institution will appear only

after some critical threshold in need for information-processing is reached; thus, evolution appears step-like" (Flannery 1972:423)[31].

The evolutionary processualism of the 1960s and 1970s was criticized from many quarters for lack of human agency in its models (Hodder 1985, 1986; Shanks and Tilley 1987), its essentialist, typological perspective (Dunnell 1980; Leonard and Jones 1987), and by emphasizing directionality in evolution (Dunnell 1982; O'Brien and Holland 1990; Rindos 1989). Others argued that processual analyses ignored ideology, religion, and symbolism in favor of subsistence and technology (Conrad and Demerest 1984), although, to be fair, interest in these cultural aspects was demonstrated by many researchers (Binford 1962; Flannery and Marcus 1976; Renfrew and Zubrow 1994).

Processualists have responded to these criticisms by incorporating agency theory into their evolutionary schemes[32]. Mithen (1989) argued that a valid evolutionary approach needs to be:

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[31] Change in the processual view appears not only saltational but Lamarckian as well, where new cultural phenomena evolve in response to a perceived need (Rindos 1984). Systems theory received criticism not only due to its adaptationist perspective but also because it seem incapable of explaining change, "Why change should occur becomes a very real problem…because the system has been defined in such a way that stability of a norm. In other words, systems theory…has a theoretical structure describing how a system is maintained but not how it is transformed" (Shanks and Tilley 1987:139).

[32] Practice theory (Bourdieu 1977, 1990) is most often used.

> concerned with active individuals endowed with common psychological propensities to think and act in certain ways rather than others, taking decisions in ecological, social and historical contexts which are unique to themselves (Mithen 1989:491)

Other evolutionary processualists extended this new emphasis by arguing that archaeologists "should recognize that human actors, not reified systems are the agents of cultural change…within a structural context that shapes both its goals and outcomes" (Brumfiel 1992:559). Charles Spencer developed a perspective along similar lines in his analysis of "centralized, non-bureaucratic" authority (Spencer 1993, 1994). He noted that variability in leadership in tribal societies is produced by the internal forces of factional development as well as the external forces of intercommunity relations (Spencer 1994). Following Boyd and Richerson (1985) he viewed the generation of leadership variability as dialectic between a leader's power-seeking interests and the responses of the followers. Most relevant to the development of a "chiefdom"[33] is the concept of "biased transmission" in which potential followers accept multiple aspects of an aspiring leader's authority based on his success at directing a specific activity that happens to be crucial to the fitness of the group as a whole (Spencer 1994)[34].

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[33] Spencer's use of "chiefdom" and its development indicates his continued reliance on a stagewise progression of cultural evolution.

[34] "Biased transmission" is a concept found in evolutionary ecology. This paradigm argues that cultural development is affected by a process analogous to natural selection (Smith and Winterhalder 1992a). Biased transmission, within this framework, occurs when people choose who to imitate and from whom they acquire cultural behaviors. Evolution occurs when fitness is

Flannery (1995) recently addressed the criticisms of directional evolution and social taxonomies asserting that there has been, generally, a long-term trend from simple to complex. He defended archaeological use of these taxonomies, for example band, chiefdom, empires, etc., stating that they served as convenient heuristic devices and that "out of the hundreds of possible ways that human societies could be organized, certain types of organization work so well that they show up over and over again throughout the world" (Flannery 1995:21). A comparative evolutionary study between cultures needs these labels as shorthand references to some very common types of organization. However, Flannery argued, archaeologists should not ignore specific historical and contextual variation in favor of developmental parallels.

In his summation of evolutionary processualism, Spencer (1997) opined that of all the evolutionary approaches in archaeology, processualism had the "brightest future". With its renewed interest in human agency and historical significance "it dovetails more effectively with recent…innovations in macroevolutionary biology, complexity theory, [and] practice theory" (Spencer 1997:247). It places emphasis on human agency and directed variation as evolutionary forces, along

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linked to these behaviors "if we suppose that selection on genes is responsible for the guiding rules behind the people's choices, direct bias will tend to cause adaptive cultural variants to spread" (Richerson and Boyd 1992:65).

with natural selection, which operates on institutions and social groups as well as individuals.

EVOLUTIONARY ECOLOGY

BACKGROUND

Evolutionary ecology, as a defined theoretical study, is no more than 30 years old (Winterhalder and Smith 1992)[35]. Brown's study of avian territorial systems is one of the first to demonstrate the characteristics of an evolutionary ecological analysis (Brown 1964; Winterhalder and Smith 1992). Brown argued that for natural selection to favor territoriality, the aggressive defense of a resource, there must be some relative advantage to it; the advantage must enhance the probability for survival and reproduction. Defendability of, and competition for, the resource are both jointly necessary for aggressive defense to evolve. Resources are more defendable when they are concentrated and predicable in location and that the benefits of defense grow with the degree of competition for the resource.

[35] Although Steward's cultural ecology is an intellectual ancestor, evolutionary ecology accepts natural selection as the prime evolutionary force behind change. Where Steward was interested in the evolution of cultures, i.e. groups of individuals, evolutionary ecologists emphasize the role of the individual in the evolution of behavior.

Field studies by Crook (1965) on weaverbirds and primates (Crook and Gartlan 1966) demonstrated that variation in social organization between and within species could be analyzed as evolutionary responses to local social and environmental conditions (Winterhalder and Smith 1992). By the 1970s, evolutionary ecological theory was formalized by the publication of several textbooks and programmatic statements (Krebs and Davies 1997; Pianka 1974).

Evolutionary ecology is not explicitly an archaeological paradigm although aspects of it do appear in the archaeological literature, specifically the use of models in analysis (Binford 1992), behavioral archaeology (Broughton and O'Connell 1999; Schiffer 1976, 1996), and ethnoarchaeology (O'Connell 1995). For archaeology, the relevance of evolutionary ecology lies in developing ideas about the relationship between archaeological evidence and the processes of evolutionary change, although Boone and Smith (1998) are quick to point out that evolutionary ecology is a theory about behavior not the archaeological record, per se.

BASIC PRINCIPLES AND ASSUMPTIONS

According to Boone and Smith (1998:S142):

> Evolutionary ecology explains cultural and behavioral change as forms of phenotypic adaptation to varying social and ecological conditions, using the assumption that natural selection has designed organisms to respond to local conditions in fitness-enhancing ways.

This process of adaptive phenotypic variation involves the interaction between genetically or culturally evolved cognitive "mechanisms" and variable environmental conditions. From the evolutionary ecological view, natural selection's primary role lies in the shaping of these cognitive mechanisms and not in culling behavioral variation (Boone and Smith 1998). The environment plays an interactive role in creating phenotypic (behavioral) variation, not just a selective one after the fact. The phenotype then, possesses flexibility in its response to environmental conditions, is partially shaped by the environment, and the phenotype's capacity for flexibility is shaped by natural selection.

An organism's phenotypic plasticity to a variety of environmental conditions is its norm of reaction (Lewontin 1974). Phenotypic variation that results from the interaction with the environment does not itself constitute evolutionary change. If the phenotype's norm of reaction is broad, then the potential for change in the

phenotype through time is correspondingly great, without change in the frequency of heritable traits or heritable variances in traits. Many behavioral evolutionists believe that behavior is an organism's adapted trait which allows greater flexibility in responding to a variety of environmental conditions (Boone and Smith 1998; Dawkins 1976). Behavioral plasticity then, allows organisms to adapt to changes much more rapidly than they could through natural selection acting on genetic variation.

Evolutionary ecology generally analyzes phenotypic variation in terms of "adaptive strategies" or behavioral responses to different environmental conditions that enhance fitness (Smith and Winterhalder 1992a). This phenotypic response is based on a set of "rules" that themselves are "genetically evolved cognitive mechanisms that guide development, learning, problem solving, and stimulus response" (Boone and Smith 1998:S144). Natural selection acts only indirectly on behavioral variation as the process that designed the organism to respond "cognitively" to particular environmental conditions.

Evolutionary ecologists argue that because culture, as distinguished from individual learning, is transmitted between individuals, it can be studied using the same Darwinian methods used to study genetic evolution (Richerson and

Boyd 1992). Human populations transmit a pool of cultural variation that is cumulatively modified to produce evolutionary change, in a manner analogous to the transmission of genetic variants. The transmission of cultural variants is heavily influenced by previously evolved cognitive biases or "decision rules." Cultural variants, as opposed to behavioral variants that are acquired individually, are inherited and transmitted in "a potentially endless chain, while variants acquired by individual learning are lost with the death of the learner" (Richerson and Boyd 1992:61). They do, however, recognize that the processes that affect the differential retention of cultural variants are substantially different from processes at the genetic level (Boone and Smith 1998; Smith and Winterhalder 1992b). The environment in which an individual lives is seen as the primary material by which the evolutionary ecologist studies the cultural process. The environment in this context is defined as "everything external to an organism that impinges upon its probability of survival and reproduction. The effects can bear on development, physiology, or behavior, and their sources can be physical, biological, or social" (Winterhalder and Smith 1992:8).

Evolutionary ecologists often use the word "intent" as shorthand to describe certain actions without actually assuming that an organism is actively conscious of its intentions. Boone and Smith (1998) argue that evolutionary explanations of

human history and behavioral change generally need to include human intention as it often provides the link between natural selection and behavioral patterns. That is, past genetic evolution has shaped the human psyche to be very effective at solving adaptive problems through learning and rational calculation[36].

At the heart of the evolutionary ecological program is a hypothetico-deductive methodology based on simple models and a focus on the levels of individual phenotypes and social systems. The hypothetico-deductive method consists of procedures that adhere to specific rules of logic and evidence, but also distinguishes between the creative and evaluative components of scientific research (Winterhalder and Smith 1992). The more inventive aspects of science such as the enlightened guess or flash of insight cannot be codified in protocol and the hypothetico-deductive method accepts a "running adjustment" between ideas and data (Medawar 1982). Winterhalder and Smith argue that because of the nature of evolutionary science's data, e.g. a fragmentary fossil record or phenotypic variation among members of a species that hypotheses occupy an

[36] The role of intent in evolution is a point of contention between evolutionary ecologists and evolutionary archaeologists. Dunnell notes that the inclusion of human intent in explanations of cultural phenomena was the result of attributing "cause to the phenomena being studied rather than [placing] cause in the theoretical system…Human intentions thus are substituted for theory" (1989:37). Leonard and Jones point out, "In setting humans apart from other kinds of organisms in evolutionary studies [by human intent acting as explanation] we, face considerable difficulty in…coming to grips with the historical transition from predominantly genetic to predominantly cultural modes of information transmission" (1987:216).

ambiguous ground between surely right and surely wrong, "rather, hypotheses are more commonly subject to tinkering, adjustment, and repair. They are assimilated into other ideas or, if unproductive…, they simply fade away" (Winterhalder and Smith 1992:12)[37].

Evolutionary ecologists use simple models as heuristic "bridging" devices between the relatively simple idea of natural selection, i.e. differential survival and reproduction, and the complexity and variety of the products of evolutionary processes. These models typically emphasize particular qualities, i.e. realism, generality, or precision, depending on the question asked. For example, if an analyst wishes to construct a theory with broad applicability then the models used should concentrate on generality, on the other hand, if one wishes to distinguish between competing hypotheses then precision may be required (Winterhalder and Smith 1992). In evolutionary ecology, no single model is used in isolation. A simple model is not intended, by itself, to address the entire complexity of a particular question, "simple models are caricatures…capturing a few essential features of the problem in a recognizable but stylized manner, and with no attempt to represent features not of immediate

[37] The hypothetico-deductive method is more compatible with a Darwinian view of evolution where stochastic processes of natural selection preclude the development of concrete statements (laws) about development. This is in contrast with the evolutionary processualist program which emphasized the search for essentialist laws of cultural evolution through the deductive nomological approach (Watson, et al. 1984).

interest" (Richerson and Boyd 1987:35). Any question is addressed through a collection of models, each addressing a particular topic and each having its own limitations.

SELECTIONIST ARCHAEOLOGY

BACKGROUND

Evolutionary archaeology, also known as Darwinian, selectionist, or cultural selectionist archaeology, is viewed by its adherents as a break from the notion of monolithic evolution proposed by White (1943, 1945, 1959), Childe (1936, 1951), and Steward (1949, 1955, 1977) and their followers (for example Sahlins 1960). This paradigm shifts attention away from examining the evolution of culture itself but toward explaining the evolution of cultural phenomena through neo-Darwinian principles of differential persistence of traits through time (O'Brien 1996)[38].

[38] Cultural selectionism shares a theoretical background with sociobiology but focuses on the survival and cultural transmission of cultural phenomena while the latter focuses on how behavior patterns and social structures affect the survival and genetic reproduction of individual organisms (Cullen 1993).

O'Brien (1996) attributes to Dunnell (1978), in a paper delivered to the American Anthropological Association, the first attempt to reestablish an interest in history among archaeologists and, specifically, a Darwinian view of evolution as opposed to White's unilinear evolution. Dunnell pointed out that there were critical differences between Darwinian evolution and cultural evolution, in particular that the latter failed as an explanatory framework because its "laws" were not theoretical propositions but rather empirical generalizations derived from a finite ethnographic record. The laws' structure and content relied on ethnographic observations made during and after the expansion of European civilization. Because many of the indigenous societies were altered, or eliminated, due to contact, there would no reason to suppose that:

> any large fraction of the empirical basis of cultural evolution represents on-going functional adaptations at the time they were described. There is no way to know whether some or all of the stages employed in cultural evolution are societal fragments, stages of extinction, stages of development, or what (Dunnell 1978:2)

Dunnell's paper in (1980) was one of the first programmatic statements of evolutionary, i.e. Darwinian, archaeology[39]. This paper tried to adjust archaeologists' focus from cultural evolution to the evolution of cultural

[39] Although Freeman had made similar arguments somewhat earlier (1974). Campbell (1960, 1965) also used a Darwinian perspective in his analysis of cultural evolution which received little attention until the mid-1980s (Rindos 1984).

phenomena, such as an archaeological record composed of differential frequencies of artifacts. Dunnell argued that differentiation within social groups can actually be recognized rather than just inferred from the archaeological record[40]. Social complexity rises when functional specialization is evident in all areas of a society, that is, from groups of functionally redundant individuals to groups of functionally dependent individuals (Dunnell 1980). At some point, individuals no longer carry the entire code to successfully reproduce the cultural system and hence are no longer reproductive entities.

Mayr (1963, 1970) argued that a species is composed of individuals, of which the group can only be defined at a particular moment in time and that while natural selection acts on individuals, it is the species that evolves[41]. Dunnell (1980) extended this to human groups, which were thought of as "species-like" units using the concept of kin selection. Survival and reproductive ability depend on the behaviors of others, about whom they might have little or no knowledge. If individuals no longer carry all the information to reproduce the human

[40] This contrasted with the processualist practice of defining "kinds" of sociopolitical organization, for example bands, chiefdoms, and states, and then searching the ethnographic and archaeological records for good fits between the expected and actual cases (O'Brien 1996).

[41] Individual organisms that might be grouped together in a species do share properties in common, but they do not share an essence that forces one to treat them as members of a natural kind (Mayr 1970).

phenotype, of which culture is a part, then a shift in the scale of selection occurred.

Most evolutionary archaeological literature has focused on developing theoretical and methodological issues (Bentley and Shennan 2003; Dunnell 1980, 1989; Leonard and Jones 1987; O'Brien and Holland 1990; Rindos 1989) and only recently have researchers begun to apply this perspective in practice (Abbott et al. 1996; Braun 1987; Hughes 1998; Neiman 1995). One of earliest applications of the Darwinian perspective was Rindos' (1980) analysis of the origins of agriculture. Rindos defined domestication as "the result of the evolution of a symbiosis between man and plant" (1980:752), a process that began before the origin and development of agricultural systems.

The domestication process is affected by different kinds of human behavior and occurs in different environments. Initial domestication is the product of dispersal and protection of wild plants by humans. Through time, the developing relationship selects for morphological changes in plants, preadapting them for further domestication (Rindos 1984). The ecological niche of the incidental domesticate is determined by the environment and the exploitative techniques of the human groups. The yields are relatively stable which limits the

size of the groups that the plant population can support. Intensification of dispersal and protection can occur where, instead of simply opportunistic agents, humans become "obligate agents for the plants, enhancing the plants' success while simultaneously changing the basis of human subsistence strategies" (Rindos 1984:132).

Rindos (1984) attributes several effects to this increasing interdependence. First, human dependence on plants may increase to the point that human success is dependent on the success of the plants, which may depend on humans for their success in higher densities in new locations (O'Brien 1996). The plants' ecological niche may expand through mechanisms such as weeding, watering, and burning. Finally, as the coevolving plants increase their productivity, human population growth may increase.

Agricultural domestication is the culmination of these increasingly interdependent relationships and is affected by specific human behaviors, such as seed selection and storage, along with previous behaviors. This "mode" of domestication is the closest to what is "typically thought of as 'domestication,' though it differs substantially in that it is actually a culmination of a long process of plant-human mutualism as opposed to being a 'thing' that arose to replace

previous food-getting behaviors" (O'Brien 1996:204). One can argue for a similar relationship developing between certain animal species and humans. Although meat may actually be a small portion of a group's diet, a relationship may develop where animals are absolutely indispensable for survival. Animals often serve in the production and processing of plant foods. In addition, many hunter-gatherer groups rely heavily on dogs in their hunting techniques. These species in turn, become dependent on the very plants they process and humans to provide feed, thus the relationship between plants and humans possesses a third side, "domesticated" animals.

BASIC PRINCIPLES AND ASSUMPTIONS

The fundamental premise by which evolutionary archaeologists apply Darwinian theory to culture is an analogy between two similar but independent processes, decent with modification of genetic material and descent with modification of "cultural traits"[42]. This position may also defined as a "neo-Darwinian approach to human behavior which focuses on the extra-genetic survival and replication of culturally transmittable phenomena" (Cullen

[42] This is in contrast to sociobiology's extension of Darwinian principles to culture which is based more on homology - the explanation of behavior in terms of genetic process itself (Cullen 1993).

1993:180). Variation between cultures, and cultural products, is not the product of genetic selection, but of a purely cultural selective process.

Since artifacts are a component of the human phenotype, changes in artifact frequencies through time can be explained by similar principles used in evolutionary biology, that is, action of selection on phenotypic variation (Leonard and Jones 1987; O'Brien and Holland 1992)[43]. The production of new phenotypic variants, on the other hand, is conceptually analogous to random mutation and recombination. The symbolic aspects of culture are not "in any sense analogous to the genotype but rather functionally equivalent; because the capacity for symbolling is not directly adaptive, it provides the undirected variation required for a theory of selection-mediated cultural evolution" (Rindos 1985:65). In this perspective, the ability to create symbolic or stylistic aspects in artifacts is neutral with respect to the fitness, in a Darwinian sense, of an individual

[43] Boone and Smith argue that this is a fundamental error with the evolutionary archaeology program, "…the heritability requirement does not specify that inheritance be genetic; it could in principle be cultural. But selection does require that there be replicators - units of heritable variation" (1998:S143). Evolutionary archaeologists counter by noting that Darwin himself did not know what exactly was being replicated "but provided a historical explanation of the similarity of some organisms, the diversity of others, and the adaptedness of all [suggesting] that identifying replicators is not as critical as Boone and Smith suggest" (Lyman and O'Brien 1998:619).

Inclusive Phenotype Perspective

Evolution occurs at the level of a population but it is the individual who possesses traits that are selected for or against. Although evolutionary archaeologists agree to this basic premise, there is debate over the definition of a "population." There are, broadly, two points of view which Cullen (1993) divides into the "Inclusive Phenotype" group and the "Cultural Virus" group. A population, in the Inclusive Phenotype perspective, is a discrete group of biological individuals who are acted upon by natural selection. Cultural phenomena, "Cultural traits" (Dunnell 1980), or artifacts, are the material manifestation of an individual's phenotype and can be viewed in terms of replicated success (Leonard and Jones 1987). These phenomena are linked to an individual phenotype; together they make up the "cultural phenotype which differs from other heritable traits and other parts of the phenotype only by the mode of transmission, that is, cultural or biological (Cullen 1993)[44]. Change in the population of cultural phenomena is "conceived in terms of frequency changes in analytically discrete variables rather than the transformation of a

[44] Cullen, in his critique of the Inclusive Phenotype perspective, charges that cultural traits and genetically reproduced traits are treated as though they share a "coherent, uniform genealogy, jointly comprising an individual organism in just the same way that genetically-transmitted traits normally do" (1993:181). This is contrary to O'Brien and Holland, "we are not suggesting that its is possible to effect a wholesale transfer of biological principles to the study of variation as seen in the archaeological record…Darwin was interested in heritable variation, as are archaeologists, but Darwin's variation was evident generationally and included…the genotype. Variation as seen in the archaeological record does not necessarily pass through the phenotype-genotype-phenotype process" (O'Brien and Holland 1990:33).

variant" (Teltser 1995a:53). Such changes may be the result of natural selection and thus represent shifts in adaptation state or they may be the result of random drift (O'Brien and Holland 1992).

Innovation and intent are considered important sources of new variation but their role is limited. There is more than a little disagreement among Darwinian archaeologists when they consider the definition of innovation; Lyman and O'Brien (1998) cite Bell (1997:6) in their discussion, innovations arise simply because "self-replication is always to some degree imprecise, and variation is a property of self-replicating systems that does not require any special explanation". Intention, or informed decision-making, is not inconsistent with a Darwinian perspective but it best viewed as a way of "increasing variation within the [cultural] system" (Rindos 1989:15).

Intent becomes difficult to demonstrate within the archaeological record viewed from a Darwinian context since evolutionary change contains both stochastic and opportunistic elements. The stochastic components are the result of the initial source of variability and recombination:

> this, if unaffected by other processes, imparts a Markovian structure to change viewed in the temporal dimension and a random appearance when examined synchronically. Opportunistic components arise from the

> effects of natural selection and impart the lack of internal direction characteristic of evolutionary change (Dunnell 1980:39)

The Markovian structure of evolutionary change over time is ensured by inheritance, that is, later traits depend on earlier traits, and the nonrandom, directional appearance is determined by selection (Gould, et al. 1977; O'Brien and Holland 1990). As Lyman and O'Brien state, borrowing a metaphor from Stephen Gould, "an ancestral clay vessel will not beget a space shuttle; it will beget a descendant clay vessel similar to its ancestor. "The descendant…may differ from its ancestor because of recombination, transmission error, or, perhaps, the intent of the replicator" (Lyman and O'Brien 1998:618).

Evolutionary archaeologists often use the term "trait" (Dunnell 1980) or "culture trait" (Leonard and Jones 1987) as a unit of replication, that is, a unit of heritable variation[45]. According to Lyman and O'Brien (1998), cultural traits are ideas in minds of those who create artifacts. Ideas are the replicators that are transmitted between individuals; social learning is both the transmission mechanism and the source of variation resulting from transmission errors and recombination, and

[45] Spencer (1997) says that evolutionary archaeology perceives culture as a collection of traits which has forced it to search for an analog to the gene. Lyman and O'Brien (1998) argue that this is inaccurate since those who have attempted to design or find such a unit, Dawkins (1976) for example, are neither archaeologists nor in the evolutionary archaeology school. The concept of a "replicator" was introduced in biology to denote a unit more or less equivalent to the gene and the idea of a vehicle to represent units equivalent to the phenotype (Dawkins 1976; Lyman and O'Brien 1998).

artifacts are the replicated results of transmission. Because artifacts are not the units of replication, they must be viewed in terms of replicative success (Leonard and Jones 1987), which can, by extension, be tied back to "the potential adaptedness of the human of the humans responsible for the objects' replicative success or nonsuccess" (O'Brien and Holland 1992:37).

Early anthropologists conceived culture as a largely mental phenomenon that was transmitted through the movement of ideas from person to person (Boas 1891; Lyman and O'Brien 2003; Tylor, 1871). Implied in this view is: that language is an efficient mechanism for cultural transmission; that the smallest unit of transmission is a "cultural trait" (Boas 1904; Kroeber 1940); that cultural traits are not inherited in a genetic manner but by acquiring them through imitation and learning (Kroeber 1923); that cultural transmission can be between genetic relatives but also between unrelated individuals; and that cultural transmission is an additive process (Lyman 2003).

The process of transmission and the nature of the unit being transmitted were subjects for debate. Tylor (1871) couched his discussion of cultural transmission in terms of "institutions" and "customs" that could be discovered, in the way that species of animals could be discovered, by the careful ethnographer. Boas

(1891, 1904) believed that culture was composed of ideas that could be discovered through their empirical manifestations, for example, songs, dances, and masks. The analytical unit, for Boas, was the "element" which "consisted of a number of incidents which are very closely connected and still form one idea" (Boas 1891:14). Similarity in the style of an "element" across space was evidence of cultural transmission and continuous distribution "suggests very strongly that a line of migration or of cultural contact may have extended over the area in question" (Boas 1909:536).

Susan Hughes' (1998) study of North American projectile point development is typical of the inclusive phenotype perspective in Americanist archaeology (see also Abbott et al. 1996 and Neiman 1995). She emphasizes engineering analyses as a means of identifying potentially functional variables, in this case tip sectional area, perimeter, and mass, which increase both weapon and human fitness[46]. The engineering study demonstrated that tip size and shape of a projectile point was strongly correlated to the requirements of the "four weapon systems [throwing spears, unfletched darts, fletched darts, arrows] based on their conformance to weapon shafts and balance requirements" (Hughes

[46] Although Hughes makes little connection between weapon system evolution and human fitness other than suggest that increasing hunting efficiency would impart greater fitness to the hunters.

1998:397). Competing requirements of distance and durability versus penetrability were sources of variation in tip size and shape, that is, the point needed to be strong enough inflict damage if it hit yet light enough to serve as an adequate projectile.

The patterns that Hughes observed at Mummy Cave in Wyoming supported an evolutionary trend from spearthrower to bow and arrow, where the bow and arrow completely replaces the spearthrower between 2000 and 1300 years ago. Replacement implies that bow technology was present at the same time as spearthrower technology, overlapped in function, and, ultimately, had greater fitness. "In addition to offering more situational advantages, the bow imparts greater velocity to a projectile resulting in a flatter trajectory and greater effective distance" (Hughes 1998:396). When fletched weapons appeared around 7600 years ago, tip shape becomes thinner and more triangular with increasing use of barbs and serrations. Fletching offers greater accuracy, increased velocity, and increased lift and consequently, tips and shafts decreased in size and mass to take advantage of these characteristics. Over time, fletched darts became smaller and lighter with tips overlapping in size and mass with large arrow tips. Hughes demonstrated that prehistoric weapons were precision instruments, developed under careful experimentation and craftsmanship. Tool makers understood

projectile tip and shaft attributes and controlled for material variance to maintain a successful weapon.

Cultural Virus Perspective

The cultural virus perspective argues that cultural phenomena such as artifacts, ideas, and behaviors can be conceived of as "quasi-organismic" or "viral" parasitic phenomena that compete for survival in a cognitive environment (Cullen 1993). As parasites, they may be adaptive or maladaptive; those which best promote their own replicative success through their transmission between persons undergo differential reproductive success. Human beings, in contrast to the Inclusive Phenotype School, are not the units which are selected along with their phenotypic behaviors, but rather are the units which select. People thus form the environment to which particular groups of ideas and artifacts adapt (Cullen 1993).

Cultural Virus theory draws upon previous research by Dawkins (1974), Blackmore (2000), and Dennett (1995). Dawkins proposed that the "individual" in natural selection is not a discrete organism, like a dog or a cactus, but the sequences of DNA possessed by these organisms, that is, genes. The gene "… happens to be the replicating entity which prevails on our own planet. There

may be others" (Dawkins 1989). He also suggested that human culture might also possess a replicator which he called a meme, combining "memory" and "mimetic" with gene to suggest a unit of cultural transmission, or a unit of imitation (Blackmore 1999).

A meme is any idea or behavior that can be transmitted through imitation from one individual to another (Blackmore 1999). Memes, like genes, are replicators, pieces of information competing to find space in the minds and cultures of humans. An individual, who tells a story, repeats a series of instructions, or ideas, or collections of ideas, to another individual may include details that are forgotten by the second when that person tells it to a third individual. The second person remembers the "gist" of the story and passes that on. The second person has not precisely copied the story but something has been passed to the third person. This is imitation in the broad sense. Everything that is passed from one person to another in this manner is a meme, "this includes all the words in your vocabulary, the stories you know, the skills and habits you have picked up from others and the games you like to play. It includes the songs you sing and the rules you obey" (Blackmore 1999)[47].

[47] The meme as a replicator, like a gene, is not an all or nothing unit. It is a variable piece of information that remains more or less coherent through multiple transferences. Therefore the scale of a meme can vary depending on the type of information. The tune for the Beatles' "She

This definition includes passing on of information by using language, reading, and instruction as well as other complex skills and behaviors. Imitation then includes any kind of copying of ideas and behaviors from one person to the next. This emphasis on transmission rules out all kinds of things we think of that cannot be passed on and therefore cannot be counted as memes. Simple thought that are constantly on our minds, for example "that plant needs watering", do not count as memes. The words used in that thought were obtained through imitation but the image is a different perceptory experience. The behaviors and skills that lead to crops being irrigated might qualify as memes, however, since they were transmitted between individuals.

Memes compete within a mind that possesses limited attention and limited storage capacity. Because of these limitations, memes that possess some advantage within a particular context will tend to proliferate at the expense of memes without that advantage. These concepts obviously derive from Darwin's theory of natural selection, and memetics could be criticized for being biologically deterministic. The memes are a second set of replicators that may be

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Loves You" can be transmitted and recalled almost in its entirety, but most people will only be able to recall first four notes of Beethoven's Fifth Symphony, dum-dum-dum-DUM. The "She Loves You" meme has greater fidelity over a larger field of information than Beethoven's. This variable scale contributes to the critique of memetics in that it is difficult to exactly state what a meme is. Darwin had a similar problem since, having no knowledge of Mendel, he could not describe the unit of transmission (a gene) nor where variation in traits originated (mutation). These problems, nevertheless, had little effect on the robusticity of Darwin's theory.

parallel but independent of biological systems. Culture then, under this theory, is an extra-somatic phenomenon made up of units with interests of their own. Each of these systems has unique features and perhaps the only parallel in a meme-gene analogy is that successful memes and successful genes are those that tend to proliferate more than others do.

Current critiques of memetic theory center on what a "meme", as a discrete bounded unit, is, what is preserved during transmission, and what are their vehicles. Plotkin (1998) states that memes must consist of memories and imitation, both of which are copied in an un-genetic manner. The memory patterns in the synapses of a tutor of a particular action will not match the synapses of the pupil:

> "we cannot assume, and it is most unlikely to be the case, that the neural network state of the observer when performing the action, even when it matches closely that of the tutor, is the same as the neural network state of the tutor" (Plotkin 1998).

Sperber (1994) argues that "cultural information is transformed every time it is transmitted to such an extent that an analogy with biological reproduction or replication is inappropriate". Both Sperber's and Plotkin's arguments rest on the assumption that memes only exist at the moment of transmission, "this is a little

like assuming that a fish has reproduced only when it shows up in a new pond" (Jeffreys 2000:232).

Gould (1991) states that ideas are not exactly subject to "descent with modification" as there is no way to sort out the lines of descent:

> The basic topologies of biological and cultural change are completely different. Biological evolution is a system of constant divergence without subsequent joining of branches. Lineages, once distinct, are separate for ever. In human history, transmission across lineages is, perhaps, the major source of cultural change (Gould 1991)[48]

Where meme theory places the agency of change in a self-replicating, extra-somal unit (meme), Cultural Virus theory places agency in human consciousness and individual action (Cullen 1996). Fundamental to the Cultural Virus perspective are a series of propositions that view ideas as material for selection. The first is a shift in scale of what constitutes an "individual" and a "population" in evolutionary theory when a "population" evolves due to selection upon "individuals." Broadly speaking, anything that is more or less indivisible or that tends to remain undivided may be considered an individual and a group of such

[48] Although the symbiosis of mitochondria and single-cell organisms is an example of a biological "joining of branches" (Jeffreys 2000). Recent research has also shown that branches can link across taxons in the case of certain a thermophillic eubacterium (*Thermologa maritime*) that possesses genes from other thermophillic Eubacteria and Archaea (Nelson, et al. 1999).

phenomena then qualify as a population[49]. In each case the population evolves as a result of the differential reproductive success of its more or less indivisible units (Cullen 1993). A second proposition is that any idea, concept, or technique which can be taught or imitated in a single transmission event or series of events qualifies as a "cultural individual." Third, since cultural phenomena cannot reproduce themselves their closest biological analog is a virus, specifically RNA retroviruses (Cullen 1996)[50].

Most of these cultural "viruses" would be considered domesticates if they were plants or animals, that is, a population of human individuals, together with their rituals and artifacts, compose an interdependent ecological assemblage of genetically transmitted and culturally transmitted phenomena. Cultural phenomena are genealogically independent of their human hosts since they can be passed between non-related individuals but they occupy an ecologically equivalent relationship between domesticate and domesticator. Cullen (1993,

[49] Cullen draws from Dawkins' (1989) definition of a gene as a unit that survives through a large number of successive individual bodies, as "any portion of chromosomal material that potentially lasts for enough generations to serve as a unit of natural selection (Dawkins 1989:28). A gene, in Dawkins' definition is not an all-or-nothing unit but rather a variable that represents a length of chromosome that is less likely to be divided or altered by mutations than any longer string of chromosomal material, although an entire chromosome may qualify in populations where there is no crossing over between chromosomes, for example in asexual stick insects (Dawkins 1989:43).

[50] Viruses are considered to be "individuals" in an evolutionary sense even though they do not reproduce themselves and must rely on more complex cells into which they inject their genetic material (Dawkins 1989).

1996) uses the term cultural virus to embody this combination of dependence and independence in cultural phenomena.

Cultural viral phenomena have three basic tiers to their structure. The first tier is the "idea, remembered manufacture sequence, or manufacturing concept, which consists of a pattern of strengthened synapses distributed within a brain" (Cullen 1996:50). It is these synaptic sequences that make up the hereditary material passed between human individuals. A genetic relationship is not required for transmission, for example a pottery manufacture technique may be imprinted in the synapses of an apprentice; transmitted from an unrelated master potter. The second tier is the action and ritual which consists of behavior or of the regulation of behavior by other ideas. The third tier is the material, that is artifactual, consequences, of such behavior although not all phenomena possess this dimension.

Cullen (1996) uses a pottery assemblage as an example of a cultural virus. Central to this analysis is that human individuals surround themselves with artifacts which can neither reproduce nor be reproduced by their owners. Their role, similar to sterile worker insects, is "to obtain energy from the environment, through the symbolic resonance they excite in the minds of the people who

bought them and may buy them again or in the minds of visitors to the household" (Cullen 1996:53). The stronger the "resonance" an artifact excites, the greater the desire to buy or trade for such phenomena, and the more energy is diverted back into the industry that created the artifact. This energy is used to replicate the manufacturing industry and to reproduce more "sterile" worker artifacts to go out and "forage" for new human communities.

In a pottery assemblage, the hereditary material consists of everything to do with pottery manufacture; raw material acquisition, material preparation, firing, and so forth; the synaptic patterns contained in the potters' brains or the first tier of the cultural viral phenomenon ecologically equivalent to the "queen" structure in insect colonies. The pottery industry itself, the manufacture process and its results, constitute the second and third tiers. The ultimate "goal" of this knowledge assemblage is to replicate itself by drawing new apprentices into the trade (Cullen 1996). Some pots will act as "workers" manufactured for local markets diverting local products and currency back to the workshop.

Cullen (1993) also examined the question of megalith building from a cultural virus perspective. Megaliths exist as phenotypes, "extrasomatic expressions of a lineage of socially-transmitted learned neuronal structures…which display

genealogical independence from the human phenotypes in which they reside" (187). The neuronal structures constitute a body of knowledge of the various techniques of megalith construction which must be socially transmitted in order to survive[51]. The first megaliths would occur as a spontaneous divergence from existing construction concepts, most of which would remain unchanged. Once invented, the megaliths could then be adapted to the perceived needs of local communities, and spread as the result of differential cultural reproduction at the expense of other burial practices. The fitness of the megalith concept is independent of the builders' and "it could even survive if the artisans were a celibate caste with zero fitness" (Cullen 1993:187).

COMMENTS ON THE NORMATIVE CRITIQUE

We may speak of a community of persons as possessing a common cognitive map (Renfrew and Zubrow 1994). From a memetic perspective this map is composed of individual pieces of information that may be transmitted. Each member of a community has a core set of memes that he or she receives through enculturation. Around this core are additional memes that result from

[51] Here Cullen clearly borrows from meme theory (Dawkins 1989; Dennett 1995). The contribution of cultural virus theory is that the megaliths do not reproduce themselves but exist to enhance the meme's fitness and, consequently, the cultural viruses chance of spreading to other "hosts".

independent invention by the individual. Those memes with high fitness are more likely to be incorporated into the "cultural core" that is transmitted between generations and populations.

This kind of concept about culture came under critique in the early days of Processual archaeology. Binford (1965) argued that "normative theorists" attribute three features to culture: culture is an abstract, mental construct consisting of ideas; culture is an internally cohesive set of ideas; and, artifacts are objectifications of normative ideas about proper ways of life (Lyman and O'Brien 2004). Binford believed that "normative" theory ignored variation within cultural systems and was concerned only with cultural transmission.

Early culture historians discussed cultural transmission, but their concept of the unit of transmission was unclear; often referring to cultural traits or ideas (Ford 1949; Kroeber 1940; Willey and Phillips 1958). They were explicit, however, about the unclear relationship between a set of norms possessed by an artifact maker and artifact types themselves "and thus rarely if ever sought norms among artifacts" (Lyman and O'Brien 2004:389). Rouse (1939) wrote that an artifact type was the result of conformity by makers to a cultural standard for the proper appearance for a completed artifact. What the archaeologist defined was

something different. Types or modes of artifacts are "conceptual patterns set up by the archaeologist" (Rouse 1939:19) for the purpose of research. An artifact classification is constructed to address specific questions by the researcher and may or may not approximate actual types recognized by the artifact maker. Artifact types can be treated analytically as if they were norms held by the maker but that does not mean they represent actual empirical manifestations of the makers' ideas.

Several current researchers have written about culture as an extra-somatic phenomena of transmitted ideas (Bentley and Shennan 2003; Jordan and Shennan 2003; Kohler et al. 2004). The normative critique was a "straw man that new archaeologists used to show how foolish culture historians were…and how much better off archaeology would be to adopt the notion that culture was an extrasomatic means of adaptation rather than just information transmitted" (Lyman and O'Brien 2003:390).

CHAPTER THREE

SERIATION AND MATHEMATICAL MODELS OF CULTURAL CHANGE

Seriation, in general, is a method of ordering artifact assemblages chronologically. As such, Thomsen's three-tiered chronology was the first seriation published in 1836. Thomsen's seriation, and subsequent ones like it, are occurrence seriations based on the presence and absence of morphological characteristics (Rouse 1967). Frequency seriation orders artifact assemblages based on the frequency of occurrence of some defined suite of variables (Rouse 1967). Kroeber's (1916) analysis of Zuni ceramic artifacts is the first seriation of this kind. Frequency seriations contain an additional assumption where the distribution of any historical or temporal class exhibits the form of a unimodal curve through time. The reasoning is that any idea or manifestation of an idea has a beginning, a rise in popularity to a peak, and then a decrease in popularity to an end (Rouse 1967).

An artifact seriation becomes a relative chronological device when artifact assemblages are measured in terms of criteria that are reliable chronological

indicators (Teltser 1995). Time is treated as a continuous dimension and change through time is expressed in terms of change in variant frequencies. The persistence of variant frequencies expressed in artifacts can be conceived in terms of evolutionary theory that defines change as the differential persistence of alternative variant frequencies through time. A population of humans can be defined as an ecological environment (Cullen 1996). If this definition is accurate, then the differential persistence of artifact traits through time can be explained by the action of natural selection on those traits that are affected by differential reproductive success or by a process analogous to genetic drift if they are neutral with respect to selection (Teltser 1995).

HISTORY AND THEORY OF SERIATION

Seriation, according to Rouse is "the procedure of working out a chronology by arranging local remains of the same cultural tradition in the order which produces the most consistent patterning of their cultural traits" (1967:157). This definition provides a good starting point for an analysis of seriation although some of the terms are rather vague, for example "traits" and "cultural tradition". In the same article, Rouse identifies three kinds of seriation: occurrence seriation, which uses the presence or absence patterns for ordering, frequency seriation,

which uses frequency occurrence for the same task, and developmental seriation. This last seriation is not an ordering method per se, but, given a known order, it is a means for identifying units with the existing order (Dunnell 1970). Developmental seriations do not inherently order artifact assemblages chronologically, but given an existing order, identify units within the order. This order may be based on stratigraphic analysis, for example, one finds stone tools in the deepest strata and iron tools in the later strata.

Developmental seriation is based on the premise that within any tradition, the constituent modes, types, or phases have an inherent order. Once one has found out this order, one need only take a feature, artifact, or component; identify the mode, type, or phase to which it belongs; and date it by attributing to it the order which its mode, type, or phase has within the corresponding tradition (Rouse 1967:188)

A developmental seriation can only be applied to artifacts recovered from a single artifact fabrication event or occupation surface since the basic requirement is a one-to-one relationship between the seriated units and the seriation criteria (Rouse 1967). Deposition contexts are not appropriate as different artifacts may be mixed from different traditions and temporal units. Only occurance and

frequency seriations are appropriate to this examination of the applicability of Darwinian theory to ordering methods. Occurrence and frequency seriations are different in the way in which classes, combinations of measurable attributes selected for the question at hand, are used to create temporal ordering (Dunnell 1970). In addition, the conditions under which either method is applicable are different. Occurrence type seriations were the first kind developed by archaeologists and so will be the first discussed.

OCCURRENCE SERIATION, HISTORY

Thomsen's chronology of the Danish National Museum collections was probably the first seriation of any kind in archaeology (Lyman et al. 1997; Trigger 1989). Between 1816 and 1819, he organized the artifacts into a series of three groups on the assumption that the local culture had developed through three stages: Stone, Bronze, and Iron. Worsaae later confirmed this sequence in 1839 by excavating several Danish burial mounds and arranging them chronologically by the type of artifacts found in them (Rowe 1962; Worsaae 1844). These initial seriations were based on the presence or absence of weighted attributes, material type, in this case, and the assumption that there is greater complexity through time of this

weighted attribute. The frequency of artifacts within each assemblage is unimportant; the order is based solely on presence or absence.

Thomsen also proposed another seriation approach in which:

> the forms of the objects and of the ornaments with which they were decorated, with a view that by a careful comparison and by accurately noting what sorts are generally found together, we may ascertain the order in which the successive changes took place, and thus determine the periods to which a mere inspection of the ornaments will authorize us to assign the object (Ellesmere 1848:69)

Evans (1850) used this method to seriate early Romano-British coins. He assumed that the more similar the coins were, the closer in age they were to each other (Rouse 1967)[52]. Flinders Petrie (1899, 1901, 1904) used similar approaches in his analyses of Egyptian burials. He arranged a series of 900 graves in chronological order by five criteria: 1) relative stratigraphic position of the graves, 2) chronological development of grave style, 3) stylistic frequency of grave types, 4) groups of graves combined by type, and 5) statistical "dispersion" of graves to determine "natural" breaks in grave style. Petrie assumed that grave types overlapped in time and arranged them on paper so that similar types fell

[52] Rowe (1961) proposed that this method be called a "similarity seriation" to distinguish it from Thomsen's occurrence seriation. The basic criteria, however, do not seem sufficiently different to distinguish the two methods since both are based on the presence or absence of formal attributes. The second seriation only uses more attributes for classification rather than just material type.

on the same temporal axis (Figure 3.1) (Rouse 1967). Grave types that had a long temporal span allowed Petrie to unite seemingly unrelated graves within his chronology in a manner similar to dendrochronology.

Montelius (1903) developed a seriation based on the presence or absence of temporal attributes. His method combined elements of both occurrence and frequency seriations in a tabular form by noting the presence or absence of historical variables and the number or their occurrence. The seriation itself, however, was not a frequency seriation per se since Montelius did not present his data in the form of monotonic curves and did not treat his artifact classes as purely analytical units (Theune 1995). Eggers (1955) developed one of the first comprehensive chronologies for the Roman period in Germany based on artifact assemblage presence or absence (Figure 3.2). He defined four periods (B_1, B_2, C_1, and C_2) each on the basis historical artifact classes and used these classes to assign an absolute date to sites.

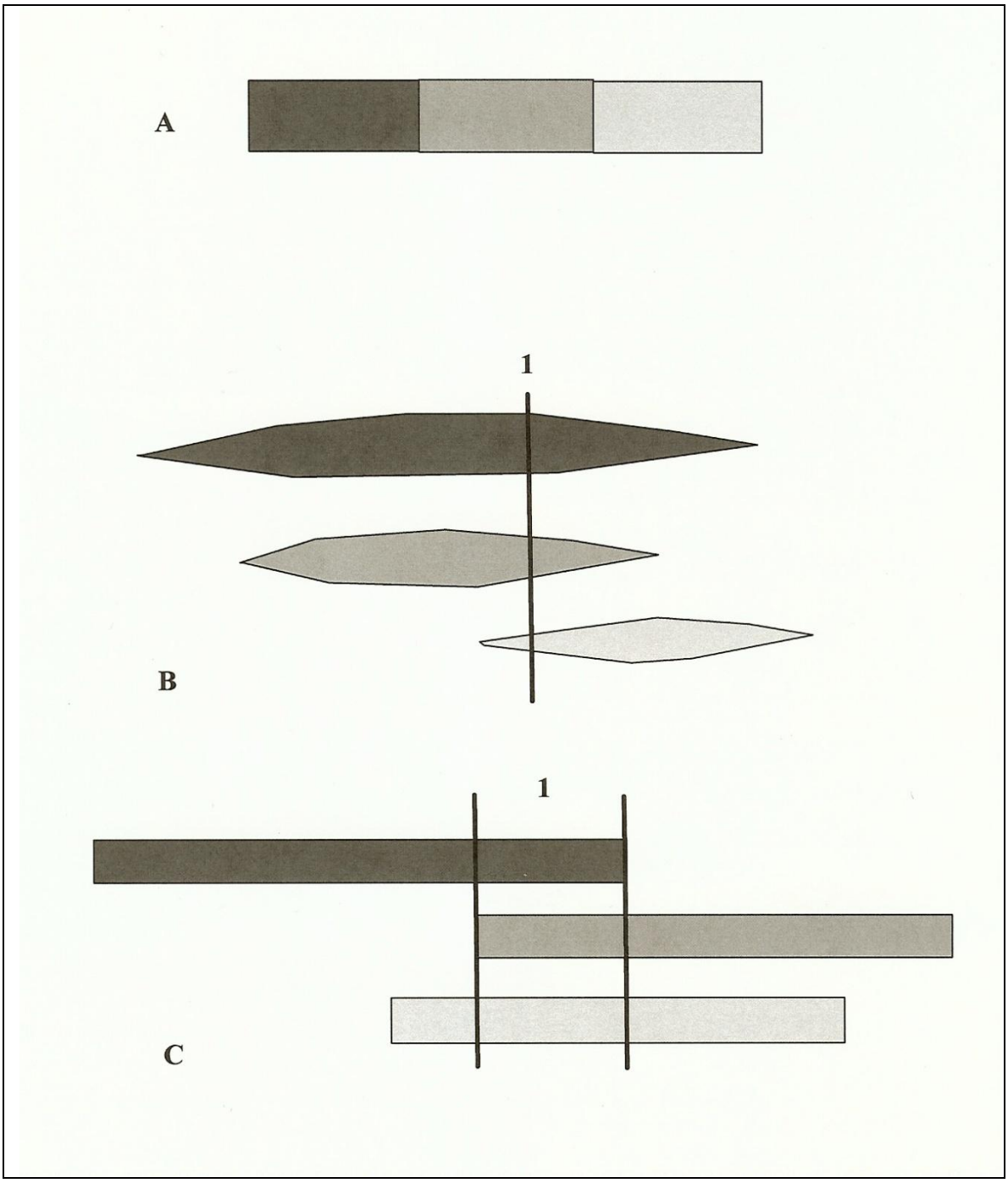

Figure 3.1. Three seriation patterns: A) development, B) frequency, C) occurrence.

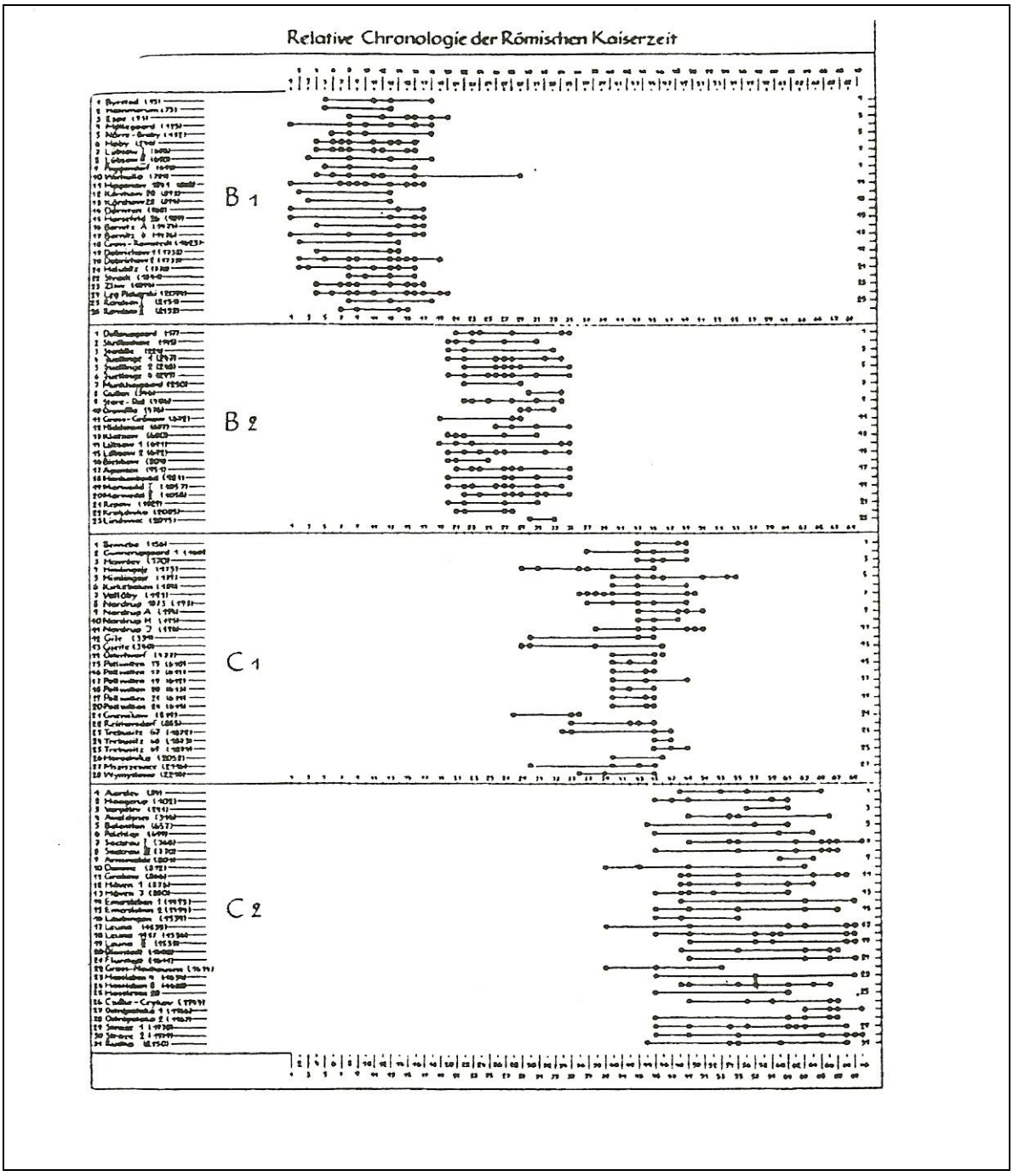

Figure 3.2. Egger's (1955) seriation for Roman period sites in Germany.

OCCURRENCE SERIATION, THEORY

Occurrence patterns consist of a number of overlapping types through time (Rowe 1959). Since overlapping is the key to occurrence seriation only certain kinds of data are applicable for this method. The basic criterion of application is an extended temporal span. Artifacts, features, assemblages, etc. from an occupation surface that represent a single deposition event probably do not exhibit the necessary temporal depth that would overlap with other groups to be seriated. Rouse (1967) states that only deposition units, for example refuse deposits or caches, contain the required temporal depth from which artifacts may be drawn.

An occurrence seriation orders artifact types on the basis of presence or absence of the defining criteria for the class. The frequency of occurrence is unimportant. For example, if horizontal striations and shell temper represent one class and vertical striations and shell temper another class, those artifacts that meet the class membership criteria will be grouped together. But for the purposes of ordering the actual number of artifacts in each class makes no difference. Arranging the groups of the different classes as continuous as possible along an

axis creates the order of the groups, which constitutes the actual seriation and is assumed to be chronological (Figure 3.1) (Dunnell 1970).

This procedure illustrates the single theoretical principle underlying occurrence seriations, that is, the distribution of any historical class is continuous through time. The particular combination of attributes that constitute the class had a single origin and must have had a continuous persistence through time (Rouse 1967). It is on this basis that an occurrence ordering is assumed to be chronological. The order is not inherently chronological, only assumed to be on the basis of the above assumption and if this cannot met then the order is a chronology. Since the classes in a seriation are analytical units, they can be created to fit this assumption which is the reason for restricting class criteria to those which are historical.

FREQUENCY SERIATION, HISTORY

The development of the frequency seriation, although related to the early efforts of Thomsen and Worsaae, occurred primarily among American archaeologists

(Teltser 1995)[53]. Early stratigraphic excavations in the American southwest identified levels in which certain pottery styles occurred in greater numbers than others, and those levels, representing different time periods, could be categorized by distinctive pottery types (Kroeber 1916; Nelson 1916). Kroeber, although he did little archaeological work, appears to have been the first to develop the theoretical underpinnings behind popularity curves in his work on Zuni potsherds (1916) and women' fashion (Kroeber 1919) (Teltser 1995). Kidder (1924) later demonstrated the chronological significance of such patterning.

Kroeber had the impression that corrugated ware was the oldest pottery type in the Zuni region based on its rare association with modern pottery types and its frequent association with ruins. As time passed, he believed, the numbers of this type decreased monotonically relative to new types. This trend allowed him to arrange "the sites in order accordingly" (Kroeber 1916:15). Kroeber initially identified 10 pottery types but used only three types to seriate his Period A sites. The "Three Color" type increased monotonically once it appeared in the sequence and was the most common in the modern Zuni assemblage. The

[53] Although Rouse (1967) attributes the first use of a frequency criteria to Flinders Petrie (1899), Lyman et al. (1997) state that Kroeber (1916) was the first to develop a frequency seriation. The difference may lie in Kroeber's use of attribute frequency as the ordering criterion for his seriation while Flinders Petrie combined frequency with similarity criteria such as the presence or absence of particular grave forms. Kroeber was certainly among the first to treat his groups as analytical units, rather than real, discovered, types, and his seriation as representing a continuous temporal stream.

frequencies of his "Black on Red" type tended to fluctuate in abundance, but his "Any Red" and "Black" types tended to decrease through time. Kroeber's lumping of several types together indicates that he conceived of them as theoretical, rather than empirical, units. The analyst did not discover such units but rather they were created by the analyst to be chronologically sensitive when constructed properly.

Ford (1962; Phillips et al. 1951) first formalized frequency seriation stating that historical types display a "battleship"-shaped distribution through time. The basis of this description was the notion of popularity curves, a historical type originates at some point, grows in popularity, and gradually declines, and that of culture as consisting of shared ideas (Teltser 1995)[54]. In his excavation of Peck Village, Louisiana, Ford used arbitrary levels, determined by the amount of artifactual material collected, "given his belief that culture change was continuous and gradual, it is not surprising that he used such an excavation technique" (Lyman et al. 1997:124). This method was founded on the premises that deeply buried artifacts were older than more shallow ones and that the thickness of his arbitrary levels was unimportant (Ford 1935b).

[54] Ford wrote, "Culture is in reality a set of ideas as to how things should be done and made. It is in a continuous state of evolutionary change since it is constantly influenced both by inventions from within and the introduction of new ideas from without the group…All artifacts were subject to the principle of constant change, hence those on any one site are more or less peculiar to the time that produced them" (Ford 1935b:9).

Ford plotted the proportional frequency of each pottery type in each level of each excavation unit at the Fort Peck site. He then used percentage stratigraphy and plotted the proportion of "marker type" pottery for each of his three decoration complexes per level (Lyman et al. 1997). A "marker type" was a kind of pottery that "typified" the pottery of that particular pottery complex (Ford 1935b). Ford noted that the proportions of marker types changed monotonically from the bottom to the top of each unit and concluded that the complexes must be chronologically sensitive, "thus, he explicitly tested the chronological significance of the decoration complexes and…simultaneously produced an empirical-but not theoretical-warrant for the popularity principle" (Lyman et al. 1997:125). Ford's technique indicated not only the degree of similarity between two groups, but also the actual form and source of the similarity.

Ford believed that the best data source for frequency seriations were surface collections since they represented the shortest periods of time (Ford 1962). Other kinds of deposition units are appropriate for frequency seriation, for example refuse deposits, as long as the artifacts contained in them could be reasonable assumed not to represent a large temporal span. Data from other types of sites, such as occupation or fabrication areas, will probably not seriate as they

represent a single use event or at the most very narrow slice of time (Rouse 1967)[55].

In 1962, Ford outlined the method he used to seriate pottery types from the lower Mississippi Valley. He began by preparing a strip of graph paper for each surface collection. Then he divided each strip into segments, one for each type, and marked the frequency of the type on this segment in the form of a bar graph[56]. Laying the strips horizontally, Ford arranged them until he found the order that best represented the popularity curve model. Once he established this order, he connected the bars on a separate sheet of graph paper, connected them vertically, and produced a series of popularity or "battleship" curves. This was his master pattern to which he compared new assemblages, "if, for example, the frequencies in the new collection conform to those at point A on the curve, then it may be said that the collection dates from point A" (Rouse 1967:186).

Two assumptions underlie this method. The first is that all the artifacts in each surface collection were deposited at the same time. This may be difficult to satisfy especially in cases where people deposited in random parts of the site or

[55] Occupation units built upon refuse deposits, for example Levantine tells or shell midden villages on the Georgia coast, or occupations of long duration would be obvious exceptions.
[56] Modern archaeologists, of course, use seriation software for the same results such as the Bonn Archaeological Statistics Package (Theune 1995) or even Microsoft Excel (Lipo, et al. 1997).

the site was disturbed by subsequent plowing[57]. The second assumption is that artifact types had all the same relative popularity in all neighboring communities at any given point in time. This will generally be true as long as the seriated assemblages represent a "single cultural tradition and a single cultural area" (Ford 1952:36).

FREQUENCY SERIATION, THEORY

As a method, frequency seriation has three important aspects. First, type construction requires a materialist perspective. That is, classes are constructed from a vast number of possible traits possessed by any artifact, assemblage of artifacts, or assemblage of assemblages. These classes exist for the purposes of a given problem and if they do not pass the test of historical significance, that is, seriation, the units are not historical. Second, although frequency seriation provides only ordinal relationships, discrete assemblages are ordered along a temporal continuum. Third, change is expressed in terms of frequency changes of artifact types through time (Teltser 1995).

[57] Although recent research has demonstrated that there is often a close correlation between surface and subsurface deposits (Ammerman 1981; Lewarch and O'Brien 1981; Wandsnider and Camilli 1992).

What is recorded in a frequency seriation, then, is not the occurrence of objects but the distribution of combinations of features that the objects display as attributes (Dunnell 1970). If the definitions of the classes change, the distributions will change and a new ordering results. The order of groups is entirely formal and the chronology must be inferred. Several assumptions form the basis for the chronological inference, and any given seriation tests whether those assumptions are valid for a specific case. Perhaps the greatest assumption is that historical traits conform to a normal frequency curve.

The Popularity Curve

The notion of a normal frequency curve, or "popularity" curve, became central to American culture history since its development by Nelson in 1916 (Lyman et al. 1997). He interpreted the absolute abundances of some of his pottery types as approximating normal frequency curves and one should expect such a pattern because a pottery style comes "slowly into vogue, attained a maximum and then went through a gradual decline…to extinction" (Nelson 1916:167). There was no theory for such frequency distributions, they were accounted for by common sense.

In 1939, Rouse distinguished between the necessary and sufficient conditions (traits or modes) for including a specimen in a type and the specimen itself placed within or identified as examples of a type. This distinction between analytical units and empirical units (artifacts displaying traits) allowed Rouse to measure change through time and variation across space since the units of measurement, that is, modes and types, were unchangeable, atemporal, and aspatial such as other measurement units like an inch or gram (Lyman et al. 1997; Rouse 1939).

The procedure Rouse used for selecting modes produced a testable result, "empirical manifestations of modes and types should, for example, have a basically unimodal frequency distribution through time when measured across specimens of different age" (Rouse 1939:141). The result was a series of analytical units that measured temporal differences. To account for the unimodal shape of his types, however, Rouse relied on such notions as diffusion to explain the spatial distributions of modes and types and persistence to explain their temporal distribution. Although Rouse constructed units that could be used to measure time, and where time was viewed as a continuum, there was still no test of the popularity curve.

Ford had made an empirical link between the popularity curve and stratigraphic units by noting that artifact types changed unimodally from the bottom to the top of his sequence at Peck Village (Ford 1935a; Lyman et al. 1997). By 1949, Ford was attempting to explain the underlying assumptions behind cultural historical notions of the popularity curve and time as a continuum. He noted that the usefulness of an artifact classification lie in its ability "to measure culture history in time and space…to measure culture and trace its change through time and over area" (Ford 1949:38).

Ford made a number of important points in his analysis: 1) "culture is a stream of ideas" (1949:38), 2) within a restricted area, cultural change is normally gradual, 3) rapid change is due to external pressure, 4) culture history is analogous to biological evolution but, because genes are transmitted vertically and ideas are transmitted both vertically and horizontally, evidence of evolutionary relationships must wait for the establishment of chronological relationships (Ford 1949:39), 5) artifact types are artificial units created as a measure of time and space, 6) artifact types reflect some unknown, and probably unknowable, degree of the ideas or cultural norms of the people who made the

artifacts[58], and 7) because of all these elements, carefully constructed artifact types should display approximately normal frequency distributions through time. A type "will appear to have been made first in very small quantities. As time passes it reaches its period of maximum popularity, more or less great. Then it declines in popularity and finally vanishes" (Ford 1949:41). Ford's discussion hinted at a theoretical explanation, that is, the transmission of ideas influences the frequency of their empirical manifestation, however, he did not develop it to any extent (Lyman et al. 1997).

Conditions of Application

Many authors (Dunnell 1970; Ford 1949; Phillips et al. 1951; Rouse 1967) identified three basic conditions which must be met by a frequency seriation in order to be considered a chronology: 1) the assemblages in a seriation represent comparable periods of time, 2) the assemblages are from the same cultural tradition, and 3) they are from the same local area. Since a seriation is a special kind of comparison between groups of objects, or groups of groups of objects, the conditions that the groups must satisfy are really nothing more than statements of their suitability for comparison. The following conditions which groups must

[58] A view which Ford maintained in a series of debate papers with Spaulding (Ford 1954a, 1954b, 1954c; Spaulding 1953, 1954a, 1954b). The concept of an artifact as a mental template has been revisited several times since (Chang 1967; Eggert 1977); most recently, and rigorously, by Renfrew (Renfrew and Zubrow 1994).

satisfy basically state that the groups are identical except for their temporal position (Dunnell 1970). The first assumption is that all groups included in a seriation must be of comparable duration. A short duration of a particular group helps to make a finer temporal distinction, however, it is only necessary for each group to be of a similar duration, not necessarily a short one[59]. This condition assures that the distributions used in the seriation are not a function of variation in the duration of the groups but are due to their temporal position (Rouse 1967).

It cannot be assumed *a priori* that all groups in a seriation represent similar time periods. How much variation, then, is acceptable before groups are no longer compatible for a given seriation? Some means of evaluation is, therefore, necessary. A fairly simple answer would be any group that exhibits enough variation to disrupt the required distribution, that is, the unimodal curve, that, then, group cannot meet this condition (Dunnell 1970). If the variation is of such magnitude then the groups will not seriate at all or a few groups will be in obvious conflict with the model required for frequency seriations (Figure 3.3). Variation from the model can be tolerated where it is predicable, at the

[59] Ford (Phillips et al. 1951) insisted that the temporal span of a seriated group must be short. Rouse (1967) believed that this was not necessary, only that the groups were of a similar duration.

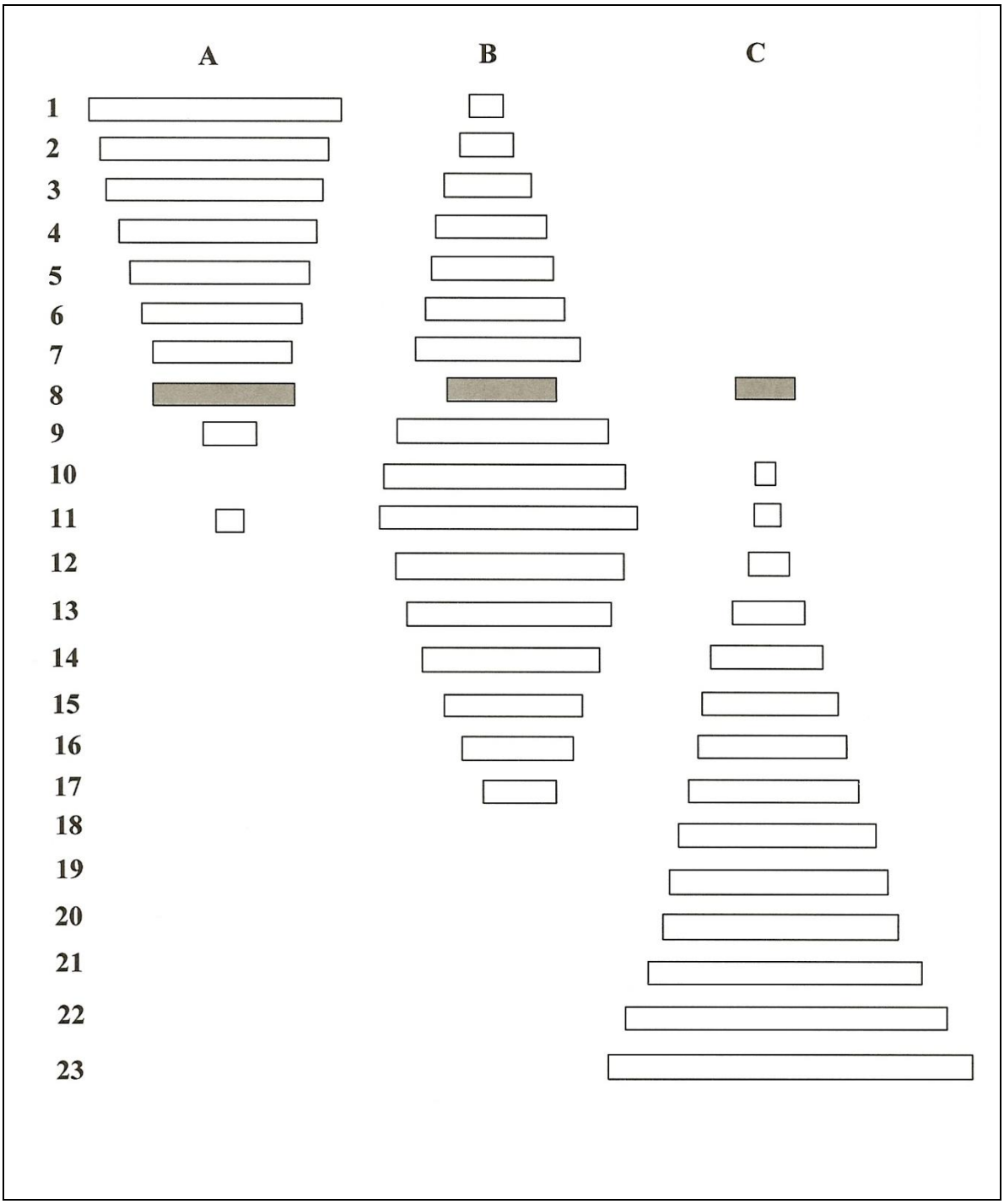

Figure 3.3. A seriation where one group is composed of an incompatible duration. A – C are classes, 1 – 23 are groups, and group 8 is incompatible.

beginnings and ends of distributions and in sparsely populated classes (Rouse 1967).

Second, all groups in a seriation must belong to the same cultural tradition (Dunnell 1970). Obviously, the term "cultural tradition" is problematic since its definition can vary depending on the researcher. What this condition emphasizes is that one must assume that a "genetic" continuity exists between all of the units seriated (Rowe 1961)[60]. This condition rules out migratory groups from a seriation, conversely a seriation in which groups do not conform to expected distributions one might argue, in an evolutionary framework, that a mechanism analogous to gene flow is the cause of problem. When this condition is met, it assures that the distributions used in a seriation are not the result of different stylistic traditions (Dunnell 1970).

Similarly to the first condition, one cannot assume *a priori* that all groups in a seriation belong to the same "cultural tradition". What constitutes cultural comparability? For the purposes of a given seriation, all that is required is that the set of classes used to do the ordering be relevant to all the units (Dunnell

[60] Ford (Phillips et al. 1951) stated that one must assume that, 1) a stable population existed over the time being considered; and 2) that this period of time is represented by gradual change. Rouse (1967) realized that two groups of people may have lived in the same area but used unrelated stylistic elements, thus the need to assume a "genetic" relationship.

1970). If more than one tradition is represented in the groups, the seriation model will produce as many independent orders as there are traditions represented (Figure 3.4)[61]. If the groups are not distributed more or less evenly throughout the period of time represented in the seriation, a similar result may occur, that is, a noticeable break creating two or more independent segments within a single graph. The final condition states that all groups in a seriation must come from the same local area. Diffusion through space can affect distributions to the extent that it becomes unclear whether seriated groups represent temporal or spatial change[62]. When this condition is met, it assures that the distributions used by a seriation are not the result of spatial variation.

This is, however, more complicated then it appears on the surface. For the purposes of a seriation, it would be necessary to demonstrate that within a "local area" every point in time at any location had the same set of variables for each group of artifacts used in a seriation and in the same proportions (Dunnell 1970). Certainly a difficult, if not impossible, task. One of the necessary assumptions of a seriation model is continuous variation of form through time. Spaulding (1978) states that space is a similarly continuous dimension while the notion of a "local

[61] Conversely, the presence of independent orders in a seriation may give the indication of intrusion of new cultural traditions and perhaps the inference of migration.

[62] Rouse defined a local area as "…a clustering of sites within which it is reasonable to suppose that there has been little, if any, geographic variation in culture" (1967:178).

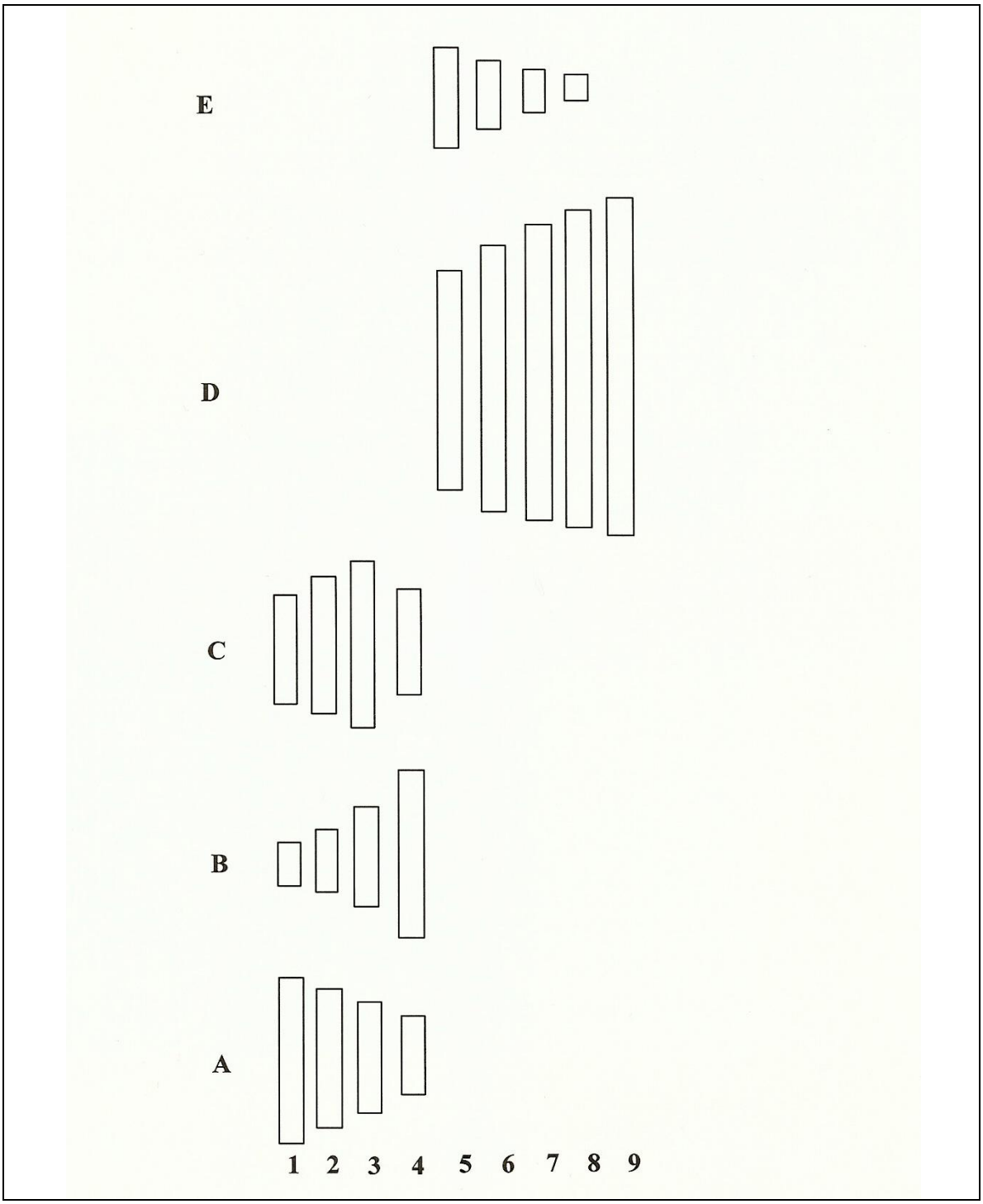

Figure 3.4. A seriation composed of two different stylistic traditions.

area" is dependent on discontinuous variation of space or of blocks of space in which there is no variation. In their study of New England gravestones, Deetz and Detlefson (1965) demonstrated that samples of known duration and drawn from the same "cultural tradition" cannot be assumed to be homogeneous through space at any point in time.

The solution to this problem must lie in the attributes selected to define artifact groupings. If the attributes show little variation in space and much variation in time, the classes created will have distributions that are primarily the result of change through time and not change through space. All classes of artifacts in a seriation are biased by the selection of attributes for their definition from the nearly infinite field of possible attributes that could be distinguished and used for definition (Dunnell 1970). Those classes defined on the basis of attributes which show little variation across space and high variation through time provide the basis for inferring that a seriation is a chronology. What must be done when defining "stylistic" or "temporal" attributes in not only sensitivity to change through time, but a greater sensitivity to change through time than to change across space. It is, of course, impossible to eliminate spatial variation; one can only reduce its effects. The size of the area from which groups are drawn will

affect how many variables will meet the requirements of a "historical" class (Rouse 1967). The larger the area the fewer classes will meet those requirements.

SERIATION AND DARWINIAN EVOLUTION

Evolutionary theory, in its broadest sense, defines change as the differential persistence of variant traits through time. Change is conceived as frequency changes of diverse traits rather than the transformation of the variant. An artifact can be conceived as the nexus of a near-infinite number of attributes, for example weight, length, color, material type, etc., that were combined at the time of manufacture. Among artifacts of the same type, for example projectile points, pottery sherds, automobiles, etc., the same attribute is likely to vary in some way between specimens of the type. What makes an automobile of a particular year, make, and model perform better or longer than another of the same type? Differences in use-wear patterns, manufacturing errors, molecular variance in materials, etc., will create subtle differences between two specimens. The variability in any artifact attribute makes evolutionary theory a suitable platform for studying the archaeological record.

From an evolutionary perspective, frequency seriation is interesting for two reasons. First, the method is based on temporal change of formally similar groups and phylogenetic relationships between groups. Evolutionary change occurs within historically related populations, and any method that demonstrates such relationships in space and time is potentially important for evolutionary studies (Teltser 1995). Secondly, seriations produce relative chronologies in a way that treats time as a continuous dimension, and change is viewed as change in variant frequencies through time. Many of these concepts were articulated by culture historians (Ford 1949; Rouse 1939) but they were unable to implement them within a truly evolutionary framework as they relied on commonsense explanations such as diffusion and popularity (Lyman et al. 1997). They may have viewed time as a continuous stream but in practice they sliced time into phases or periods that viewed change as transformation and variation beyond the average as noise (Phillips et al. 1951).

A framework of evolutionary theory seeks not only to understand variation but also the origins and histories of traits as well as why some traits persist through time and space. In an archaeological framework it is necessary to discern between functional traits, those which are affected by selective pressure, and those which are selectively neutral. This quality of a trait is dependent on the

question at hand, in some contexts a trait may be "functional" and so under selective pressure, in other cases it may be "stylistic" and selectively neutral. It is necessary, then, at the outset of analysis to determine which traits may be used to address one's question and their state relative to selection. Since functional and stylistic traits are subject to different pressures they are likely to have different distributions through time and space (Dunnell 1978).

Because stylistic traits, and variants of traits, are selectively neutral, there is no external pressure to determine the direction in which they change[63]. In archaeological terms, the differential persistence of neutral traits is "confined to the fact that actual frequencies in one generation can generate a probability distribution for expected frequencies in the next generation, but in any one sample, actual frequencies will depart from expected frequencies" (Teltser 1995:60). In the absence of selective pressures, the frequency of any variant has an equal probability of increasing or decreasing at any point in time. However, because variant frequencies in the present are dependent on the frequencies of the immediately preceding period, the randomness of the fluctuation is limited within defined parameters.

[63] Several authors have made the analogy between random stylistic change and random genetic drift (Neiman 1995; O'Brien and Holland 1990) although the mechanisms and direction of transmission can be quite different.

Random processes, to some extent, produce predictable patterns through time at the level of the population. Gould et al. (1977) demonstrated that real and random clades produced unimodal distributions similar to those produced by frequency seriations (Teltser 1995). Neiman (1995) simulated the distributions of neutral traits through social transmission. Neutral trait frequencies began and ended at zero and reached a maximum near their midpoints. In addition, most variants in Neiman's simulation were relatively short-lived and disappeared within three to four transmission events, "this aspect of the simulation appears to be due to the stochastic nature of the transmission of neutral traits" (Teltser 1995:61).

A chronology based on the transmission of neutral traits must still meet the three conditions outlined by culture historians for frequency seriations. It is important to note, however, that these conditions are archaeological or anthropological in nature, and have little to do with Darwinian evolutionary theory (Teltser 1995). Many of the processes that affect artifact assemblages, such as rates of discard and duration of use, are a part of the archaeological record as determined by human behavior.

While selectively neutral traits will produce a classic population curve, transmission events that are under selection will produce additional distributions. Boyd and Richerson (1985) defined different modes of cultural transmission. Unbiased transmission occurs when each individual acquires their behavior simply by copying from another individual within a population. The result is that each individual is equally likely to be copied, while each variant is copied in proportion to its frequency. Drift, in this case, will ultimately limit the number of possible variants in the absence of mechanisms that introduce new variants. Prestige–biased transmission takes place when an individual adapts the cultural attribute of someone who appears to be more successful in terms of some accepted criterion even if the attribute is not the reason for their success (Bentley and Shennan 2003). This can produce a feedback system where prestigious persons become more prestigious because their behaviors are copied. The act of imitation adds cultural legitimacy to practices that have no adaptive value outside the social environment. Artifacts associated with prestigious persons will also acquire prestige and will tend to be manufactured and distributed in greater numbers.

Boyd and Richerson (1985) also describe conformist-biased transmission which is the tendency to copy the most frequent behavior in the population. Prestige-

biased and conformist-biased transmissions are selective processes that can be explained under a Darwinian framework. It can be difficult to distinguish between the two in the archaeological record since both favor the popular trait in a population.

Bentley and Shennan (2003) discuss the survival of cultural variants when independent decisions were most influential as well as under unbiased and biased transmission events. Independent decision is the case where each individual decides whether or not to adopt a certain variant based strictly on personal preference.

CHAPTER FOUR

ROMAN AND GERMAN INTERACTION:

HISTORICAL EVIDENCE

This chapter examines the primary literary sources that depict Roman contact with native peoples in southwest Germany. I broadly divide these sources into early and late accounts and within each of these groups, archaeologists typically reference one or two authors most often.

EARLY ACCOUNTS: FIRST CENTURY BC – FIRST CENTURY AD

Caesar is the earliest source for the name "Suebi". He places them just east of the Rhine referring to them as a single people. In the late first century, Tacitus describes them more generically, using the name to include all of the peoples of northern and eastern Germany. Researchers have long recognized that "Suebi" stood for a confederation of many different, smaller groups, any one of whom might be given the name in contemporary accounts (Frahm 1930). The relationship between the first century BC Suebi and those in the third and fourth centuries AD is difficult to establish from historical sources due to the 200 years of silence from Tacitus' account to Zosimus. In the interval another

confederation, the Alamanni, dominate contemporary histories of southwest Germany[64]. Wenskus (1961) argued that the pan-Germanic character of groups such as the Suebi and Alamanni indicates that these designations were not new terms. Rather they offered a regional identity that eventually out competed, in many respects, local identities in southwest Germany.[65]. The names may have also offered flexible collective terms by which scattered bands could rally against their enemies but not impinge on local authority (Hummer 1998). The Greek historian Cassius Dio lends support to this hypothesis, "The Suebi, to be exact, dwell beyond the Rhine (though many people elsewhere claim their name)" (LI, 6).

Peschel (1978) outlines two points of view in historical accounts of the Suebi. In the first, the Suebi were a small band among those living between the Elbe and Rhine rivers. During some local crisis, other bands would form around the Suebi when it was convenient. This loose organization remained active through Drusus' campaigns (12 - 9 BC). After this period, however, the Suebi appear to shift to the east as sources only refer to them living in on the Elbe or on the middle Danube.

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[64] Gregory of Tours wrote that "Suebi" and "Alamanni" were different names for the same people living east of the upper Rhine.

[65] Modern Germans refer to southwest Germany as *Alemannien*, the local German dialect is *Alemannisch*, and the French call Germany *Allemagne*. The Germans in Baden and Württemberg refer to people east of the Black Forest as *Schwaben*.

Peschel's second point derives from the dual character of the contemporary accounts of the Suebi. Although some authors point to a defined group called "Suebi", the borders of their territory may not be accurately fixed since warlike bands from throughout Germany were drawn to the Rhine and mixed with the indigenous people there (Peschel 1978). One may be able to gauge roughly, where they came from based on archaeological and historical evidence but details concerning their origin may be difficult to decipher. This potential mixing of peoples and cultures is important for archaeologists concerned with culture contact since historical and ethnographic accounts combine many different culture groups into one Suebic category. We must ask the question, how do eastern groups alter the archaeological record of the indigenous Rhenic people?

Greek writers were aware of peoples in the upper Rhine/Danube area, whom they referred to as *Keltoi*[66]. Posidonius, whose work survives through other authors, divided northern Europe between the Celts, including the Cimbri, in the west and the Germans in the east (Peschel 1978, Wenskus 1961)[67]. The Romans

[66] Herodotus (33) wrote that the source of the Danube was inhabited by the *Keltoi* (Wells 1999).

[67] It was Strabo, however, who gave names and locations to the various German groups (Müllenhoff 1900). Strabo wrote at the end of the first century BC, "Here too is the Hercynian Forest [Black Forest], and also the tribes of the Suevi, some of which dwell inside the forest as, for instance, the tribes of the Coldui, in whose territory is Boihaemum, the domain of

referred to the northern people generally as Gauls. After the wars with the Cimbri and Teutones (113 to 101 BC), the Romans began to distinguish between various groups, eventually calling the peoples east of the Rhine German, based on the writings of Posidonius. Although the notion of *Germania* and the differences east of the Rhine existed before Caesar, he defined the differences between *Gallia* and *Germania*, and the tribes (*nationes*) (Peschel 1978).

CAESAR'S *BELLUM GALLICUM*

Caesar uses the word Suebi to refer to a Germanic tribe living along the upper Rhine during his campaigns there in 55 and 53 BC. He describes them as the largest and most warlike of the Germans who "have a hundred cantons from each of which they draw one thousand armed men yearly for the purpose of war outside their borders" (IV, 1). Caesar speaks of the Suebi in a political-historical sense as one group as well as a representative term, with both political and cultural connotations, for a more or less united conglomeration of tribes[68]. This is

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Marabodus…in addition to the aforementioned Lugii (a large tribe), the Zumi, the Butones, the Mugilones, the Sibini, and also the Semnones, a large tribe of the Suevi themselves" (7, 1, 3).

[68] Caesar writes "The Aedui came to complain that the Harudes, who had lately been brought over into Gaul, were devastating their borders…The Treveri reported that one hundred cantons of the Suebi had settled on the banks of the Rhine" (I, 37). Envoys from the Usipetes and the Tencteri, who were occupying areas of Gaul in 55 BC, spoke to Caesar "Let the Romans either grant them lands, or suffer them to hold the lands their arms had acquired. They yielded to the Suebi alone, to whom even the immortal gods could not be equal…" (IV, 7). Later, during

the source of the Suebic *gens* by which other *civitates* and *nationes* are supported (Peschel 1978).

The Suebi, according to Caesar, hold their land in common and no family is allowed to stay in one place for more than a year[69]. They also do not cultivate wheat but subsist mainly on milk and meat that they procure by hunting. In 53 BC, Caesar crossed the Rhine a second time but had to withdraw because of the lack of supplies, "when Caesar had ascertained through scouts of the Ubii that the Suebi had retired into the forests, he decided to advance no farther, fearing scarcity of corn, because…all the Germans care naught for agriculture" (VI, 29). Caesar goes on to write of the Suebi: "Moreover, they have regularly trained themselves to wear nothing, even in the coldest localities, except skins…" (IV, 1).

Caesar's first raid into Germany, "The Suebi, when they had discovered by means of scouts that a bridge was being built, held a convention according to their custom…ordering the people to remove from their towns, to lodge their children and all their stuff in the woods…" (IV, 19) and during the second raid in 53 BC, "…he was informed by the Ubii that the Suebi were collecting all their forces into one place and proclaiming to the tribes under their dominion that they must send auxiliaries of foot and horse" (VI, 10).

[69] Strabo's description of the Suebi seems to derive from Caesar who uses common assumptions of other nomadic groups, for example Scythians and Celts (Peschel 1978). Strabo writes, "It is a common characteristic of all the peoples in this part of the world that they migrate with ease, because of the meagerness of their livelihood and because they do not till the soil or even store food, but live in small huts that are merely temporary structures; and they live for the most part off their flocks, as the Nomads do, so that, in imitation of the Nomads, they load their household belongings on their wagons and with their beasts turn where they think best" (7, 1, 3).

The last three statements run contrary to most of the archaeological evidence already presented. The settlements and hillforts throughout this area indicate sophisticated construction skills many of which were in place decades, if not centuries, before the Romans arrived. The large numbers of fibulae recovered from Diersheim, as well as many other sites could have been used to pin animal skins, but it is just as likely they were used to secure clothing. Many of the *grubenhäuser* served as weaving facilities based on the presence of loom weights (Donat 1980). Caesar seems to be employing literary devices to establish the Suebi as an "other", not only from the Romans, but also from the Gauls, who presumably wore clothing. In this way, he is setting the stage for separating peoples east of the Rhine from those in the west.

The Suebi, again according to Caesar, do not engage in trade:

> they give access to traders rather to secure purchasers for what they have captured in war than to satisfy any craving for imports…they suffer no importation of wine whatever, believing that men are thereby rendered soft and womanish for the endurance of hardship (IV, 1).

This is, again, contrary to a body of archaeological evidence that demonstrates importation of goods by central European elites dating back to the early Iron Age (Cunliffe 1994). At Diersheim there are a few Roman artifacts recovered from

graves dating to the very earliest years of the first century AD indicating that the Suebi developed a taste for imports not long after his description of them.

TACITUS' *GERMANIA*

Tacitus uses the word "Suebi" as a generic term while he distinguishes between the constituent bands of the confederation that includes the Semnones, Hermunduri, Marcomanni, and the Quadi[70]. Tacitus' Suebi, in general, farm and practice crop rotation (26), brew beer (23), possess slaves (24), and worship in tree groves[71]. The Semnones, in particular, are the most ancient of the Suebic tribes and are considered to be the leaders of the Suebi (39). These are the people many modern historians consider to be the ancestors of the Alamanni after they moved from their original settlement along the upper Elbe into the *Agri Decumates* (Hummer 1998; Musset 1965; Wenskus 1961)[72].

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[70] Ptolemy, writing in the mid-second century AD, continues this trend in his Geography, "moreover, if we approach from the north [of Germany along the Rhine], we find the less Bructeri and the Sygambri who inhabit Germania near the Rhine river, below whom are the Suevi Langobardi…of the races who dwell in the interior the greatest are the races of the Suevi Angili, who are to the east of the Langobardi extending toward the north as far as the middle part of the Albis [Elbe] river, and the Suevi Semnones whose boundaries extend beyond the Albis toward the east as that part…that touches the Suevus river" (II, 10).

[71] Tacitus writes that their distinguishing mark is a hair style, "One mark of their race is to comb the hair back over the side of the head and tie it low in a knot behind: this distinguishes the Suebi from other Germans, the free-born of the Suebi from the slave" (38).

[72] Keller (1993) argues that there was no Suebic connection. The Alamanni were a new confederation of peoples, arguing that if there were a tradition of "Suebic" identity, why did they fail to adopt the "legendary and venerable Suebic designation" (Hummer 1998:5).

The Hermunduri are closest to the Rhine, and during the period in which Tacitus wrote (AD 98-99) were engaged in active trade with the Romans:

> The Hermunduri: they are loyal to Rome, and with them alone of Germans, business is transacted not only on the riverbank, but far within the frontier in the most thriving colony of the province of Raetia. They cross the river everywhere without supervision…we have thrown open our houses and homes, because they do not covet them (41).

This passage is indicative not only of the amount of trade between the empire and trans-Rhenic people, but also gives a sense of the permeability of the frontier. At the end of the first century AD, there is a dramatic decrease at Diersheim in the number of graves containing weapons and an increase in the number of Roman artifacts including coarser ware pottery produced in Gaul and areas closer to the Rhine (Nierhaus 1966, 1982).

The Marcomanni and the Quadi lived east of the Hermanduri along the upper Danube(42). Although Tacitus describes them as aggressive peoples, even winning their territory from the Boii, their kings are clients of Rome supported by the Roman army and subsidies. Their land is hilly and contains little land for farming so their settlements are confined to valleys and "summits of mountains" (43).

LATE ACCOUNTS: SECOND CENTURY – SIXTH CENTURY AD

The connection between first and fifth century Suebi is difficult to discern from historical accounts. The term disappears from the sources around AD 180, in which they are mentioned during Marcus Aurelius' (AD 161-180) campaigns in the middle Danube, only to reappear around AD 400 along the Rhine (Hummer 1998). During this period, the Alamanni, another confederation of Germanic tribes, dominate accounts of this area. They occupied a region bounded by the Main River in the north, the Alpine foothills in the south, the upper and middle Rhine Valley in the west, and the Lech River in the east. Despite their separations into several semi-autonomous populations the archaeological appearance of Alamannic settlements, and features of settlements, seem relatively uniform (Damminger 1998). The Alamanni reached the peak of their power in the late fifth century. By around AD 500, however, the Franks conquered their northern range and in AD 536, the remaining portion of *Alamannia* lost its independence.

Historical sources place the Suebi in the area of a firmly established Germanic confederation around AD 400. If this is correct, what was the relationship

between these two groups? What archaeological signatures, if any, are likely to distinguish the Suebi and Alamanni?

The Suebi appear in AD 406 in Zosimus' history, written for the period from AD 192 to 406, allied with the Alans and Vandals attacking Gaul, "the Vandals in conjunction with the Suevi and Alani crossed these Alps and plundered the provinces beyond them" (6,3,I). Orosius (6,7,7; 6,9,1; 6,21,16; and 7,15,8) mentions the Suebi four times before or during the Marcomannic wars (AD 170s), disappearing during the third and fourth centuries, only to reappear four more times between AD 406 and 408.

In one of the few third century exceptions, the Suebi briefly appear in Ammianus' history, "but he (Constantius, AD 337-361) was alarmed by constant trustworthy reports, stating that the Suebi were raiding Raetia and the Quadi Valeria (in Pannonia)…" (XVI, 10, 20). Hummer (1998) believes that this brief account indicates that the Suebi were located in close proximity to the Quadi and Sarmatians who lived on the middle Danube north of Pannonia and Moesia. Both Eutropius and Jordanes place the Suebi in this region. Jordanes states that the Suebi lived near Pannonia, raided Dalmatia, and formed an alliance with the Sarmatians, Gepids, Sciri, and Rugii against the Goths around AD 470,

> "…for Dalmatia was near Suavia and not far distant from the territory of Pannonia, especially that part where the Goths were then staying…The kings of the Suavi, Hunimund and Alaric, fearing the destruction that had come upon the Sciri, next made war upon the Goths, relying upon the aid of the Sarmatians…" (274, 277).

Procopius, writing about the mid-sixth century, places the Suebi further west, north of the Adriatic[73].

The historical accounts lead to several conclusions about the "latter" Suebi. First, a group called the Suebi existed from the later third century in a region on the middle Danube at the edge of the Pannonian Plain. Second, these people were related to those who appeared on the Rhine around AD 400. Third, the Suebi were often associated with the Sarmatians by historical sources (Hummer 1998). Since there is no account of Suebic movement prior to AD 406, Lotter (1968) and Hummer (1998) use the closely associated Sarmatians as surrogates for the causes of their migration west. The process may have begun with the movement of the

[73] Procopius mentions the Suebi in three passages, "And beyond them [the Gauls] toward the east were settled the Thuringian barbarians, Augustus, the first emperor, having given them this country. And the Burgundians lived not far from them toward the south, and the Suebi also lived beyond the Thuringians, and the Alamanni, powerful nations" (5, 12, 11); "And beyond that point is Liburnia [Croatia], and Istria, and the land of the Veneti extending to the city of Ravenna. These countries are situated on the sea in that region. But above them are the Siscii and Suebi…who inhabit the interior" (5, 15, 25-26); "So he [Vittigis] sent to Dalmatia a great army with Asinarius and Uligisalus as its commanders in order to recover Dalmatia for the Gothic rule. And he directed them to add to their own troops an army from the land of the Suebi…and then to proceed directly to Dalmatia and Salones" (5, 16, 9). Procopius probably set his Thuringians east of the Alamanni who occupied southwest Germany. His Suebi therefore are somewhere on the middle Danube, north of the Adriatic Sea.

Goths from the region north of the Black Sea in the late third century and continued with the incursions of the Alans and Huns in the middle fourth century.

The historic association of the Suebi and the Sarmatians placed the Suebi close to the scene of conflicts between the Sarmatians and the Goths and, later, between the Goths and Huns. Hummer writes, "A close association must have developed among the three [Suebi, Vandals, and Alans] during their move to the Rhine, for together they assailed the Franks in 406 and continued to Spain where the Suebi and Vandals jointly seized Galicia" (1998:16). Lotter (1968) argued that after AD 400 the Suebic name began to encompass Marcomannic and Quadic groups. The former becomes prominent as the terms for Marcomanni and Quadi begin to disappear from the sources. These groups, according to Lotter, retained a memory of a common Suebi heritage and adopted the name as their designation lost meaning, or when they found themselves surrounded by non-Suebic neighbors (Hummer 1998)[74]. These, then, are the groups that returned to the Rhine in the fifth century.

[74] Hummer (1998) argues that it is conflict not submerged memory that resuscitated Suebic identity. Suebic warriors may have managed to extend their control over other groups and assimilated them as Suebi as bands often formed and reformed around warlords.

By the end of the third century, the Suebi no longer appear in accounts of southwest Germany, and instead a new group, the Alamanni, appear to occupy this region. The Alamanni first enter the historical sources in the history of Dio Cassius (LXXVIII, 13, 4) when Caracalla (sole emperor AD 211 – 217) first campaigned against them, occupied their territory and later murdered many of them[75]:

> Antoninus made a campaign against the Alamanni and whenever he saw a spot suitable for habitation, he would order, "There let a fort be erected. There let a city be built." And he gave these places names relating to himself, though the local designations were not changed; for some of the people were unaware of the new names and others supposed he was jesting. Consequently he came to feel contempt for these people and would not spare even them, but accorded treatment befitting the bitterest foes to the very people whom he claimed to have come to help. For he summoned their men of military age, pretending that they were to serve as mercenaries, and then at a given signal — by raising aloft his own shield — he caused them all to be surrounded and cut down, and he sent horsemen round about and arrested all the others.

The Romans considered the Alamanni to be a confederation or a mixture of various other groups. Agathias, writing in the sixth century and quoting Asinius Quadratus of the third century, states that the Alamanni are "a mixed and mongrel people, and their name signifies this" (I, 6).

[75] The *Historia Augusta* (10, 5), probably written in the fourth century, attributes the name "Alamannicus" to Caracalla stating that he had defeated them. This was not a term that appears on contemporary inscriptions associated with this emperor and was probably applied retroactively. The first likely use of the name "Alamannicus" occurs with the emperor Constantius II (AD 337-361).

AMMIANUS MARCELLINUS' *RES GESTAE*

Ammianus Marcellinus is one of the few Roman historians who wrote from personal experience and his accounts of the Alamanni in the third century, though few, provide clues to their settlement patterns and behavior. Although Ammianus was primarily concerned with diplomatic events and not Alamannic ethnography, he is, nevertheless, one of the most cited contemporary sources for the Alamanni (Bücker 2003: Demandt 1993; Hoeper 2003; Hummer 1998; Müller 1975).

Underlying Ammianus' account of the Alamanni are themes of conflict between civilization and other. For Ammianus, civilization was not only culture and the arts, it was also the binding force that held society together (Seager 1986)[76]. Any person or group that acted out of accordance with "civilization" lacked *humanitas* and was a barbarian. The most common characteristic of barbarism was a lack of emotional control or moderation in material wealth. Throughout most of his work, Ammianus draws an antithesis between civilization and barbarism; a tension that can occur between groups as well as within them (Seager 1986).

[76] In this, Ammianus draws upon a theme that can be traced almost 600 years back to the Hellenic period, where it was "civic life" which provided humans with *humanitas*.

Two traits commonly associated with Ammianus' Germans are inordinate pride (*superbia*) and savagery (*immanis*) (Seager 1986). The Lentienses, for example:

> …they (Lentienses) gathered into one place the inhabitants of all the villages, and with forty thousand armed men, or seventy thousand, as some boasted in order to exaggerate the emperor's glory, full of pride (*sublati in superbiam*) and confidence broke into our territory. (XXXI, 10, 5).

The Alamanni as a whole are often associated with fearsome adjectives:

> …and as they gnashed their teeth hideously (*frendentes immania*) and raged beyond their usual manner, their flowing hair made a terrible sight, and a kind of madness shown from their eyes (XVI, 12, 36).

> Confiding in this peace, three very savage (*immanissimus*) kings finally appeared, though still somewhat apprehensive since they were of the number who had sent aid to the vanquished at Strasbourg…(XVII, 1, 13).

Macianus, an Alamannic king, is portrayed as "monstrously puffed up as if her were going to dictate terms" (Seager 1986:6) when he approached Valentinian for peace as a man who "would attack the cities themselves if he were not pacified" (Ammianus XXX, 3, 3).

The juxtaposition between civilization and barbarism that underlies Ammianus' work s not always apparent nor is it constant among the individuals and peoples described. While most of Ammianus' Germanic and Roman barbarians serve as foils who, through their deeds, only enhance the *humanitas* of men such as Julian

(emperor AD 361 – 363). Ammianus, however, was not blind to the faults of his exemplars as even Julian was capable of "barbaric" anger. There are numerous encounters throughout the narrative where the relationship between Rome and Alamannia appears to be more complex than a simple division between polar opposites. Examples of this complexity are passages depicting Alamanni serving in the Roman army.

Constantius II (emperor AD 337 – 361) was suspicious of his own Roman commanders. He promoted several Alamanni to high positions assuming that they would be loyal only to him. In AD 353, Constantius brought his army to the Rhine intending to cross over into Alamannia:

> …and there the army might have been led over, while the enemy's attention was turned elsewhere, and devastated the whole country without opposition, had not a few men of that same race (Alamanni), who held military positions of high rank, informed their countrymen of the design by secret messengers, as some thought. Now shame of that suspicion fell upon Latinus, count in command of the bodyguard, Aglio, commander of the targeteers, who were then highly regarded as having in their hands the defense of the state (Ammianus XIV, 10, 7-8).

Ammianus, as a former army officer serving in Gaul, may have been privy to information regarding this incident; one suspects however, that this betrayal by Alamannic commanders may have more in common with cultural expectations than actual events. Probably, a cautious Constantius would have not allowed

individuals to hold such sensitive commands if they were held untrustworthy simply because of their ethnicity. There is also the possibility that accusations were leveled against these men after the Romans failed to cross the Rhine and Ammianus accepted this account as indicative of typical Germanic behavior.

Another highly placed Alaman is mentioned by Ammianus serving in the bodyguard of Gratian (emperor AD 375 – 383):

> One of their nation, who was serving among the emperor's armor-bearers, returned to his home because of pressing business, and being a loose talker, when many asked him what was going on in the palace, he told them that Gratian, summoned by his uncle Valens, would presently march east (XXXI, 10, 3).

In AD 378, Gratian attacked the Lentienses who, after fleeing for the hills, sued for peace:

> …they obtained mercy as the result of humble supplications, and surrendered; then giving their strong young manhood (as they were ordered) to be mingled with our recruits, they were allowed to go without permission to their native lands (Ammianus XXXI, 10, 17).

Under the circumstances, the quality of these recruits must have been questionable although Ammianus does not seem to view this type of conscription as uncommon.

The Alamanni in Ammianus' account are grouped into rural cantons (*pagi*) (Table 4.1).

Table 4.1. List of Alamannic Cantons.

Group	Named Leaders	Location	Sources
Brisigavi	Vadomarius	southern Black Forest	Ammianus (c. AD 375)
Bucinobantes	Macrian, Rando	Main river	Ammianus (c. AD 359)
Lentienses		area around Lake Constance	Ammianus (c. AD 355 and 378)
Juthungi		north of Danube and Altmühl rivers, east of Black Forest	Roman monument near Augsburg (c. AD 260); Panegyrici Latini VIII 10.4 (c. AD 297); Ammianus 17,6 (c. AD 375); Sidonius 7, 233 (c. AD 430)

The most southerly *pagus* was opposite the Roman fortress and bridge of *Castrum Rauracense*, modern Kaiseraugst, in Switzerland (Figure 4.1). Matthews (1989) states that based on the modern name Breisgau; this was the *pagus* of the Brisigavi. The Bucinobantes lived south of the Taunus Mountains in the valley of the lower Main River opposite Mainz (*Moguntiacum*) (Ammianus XXIX 4, 7). The Lentienses occupied the northern shore of Lake Constance and could only be approached from the south (Ammianus XV, 4, 2). The Franks lived to the north and the Burgundians were to the east. The Alamanni marked their border with the Burgundians by a series of boundary stones (Ammianus XVIII, 2, 15) which

may have followed the old *limes* (Matthews 1989). This area was in dispute, especially the salt deposits near Schäbisch Hall (Ammianus XXVIII, 5, 11).

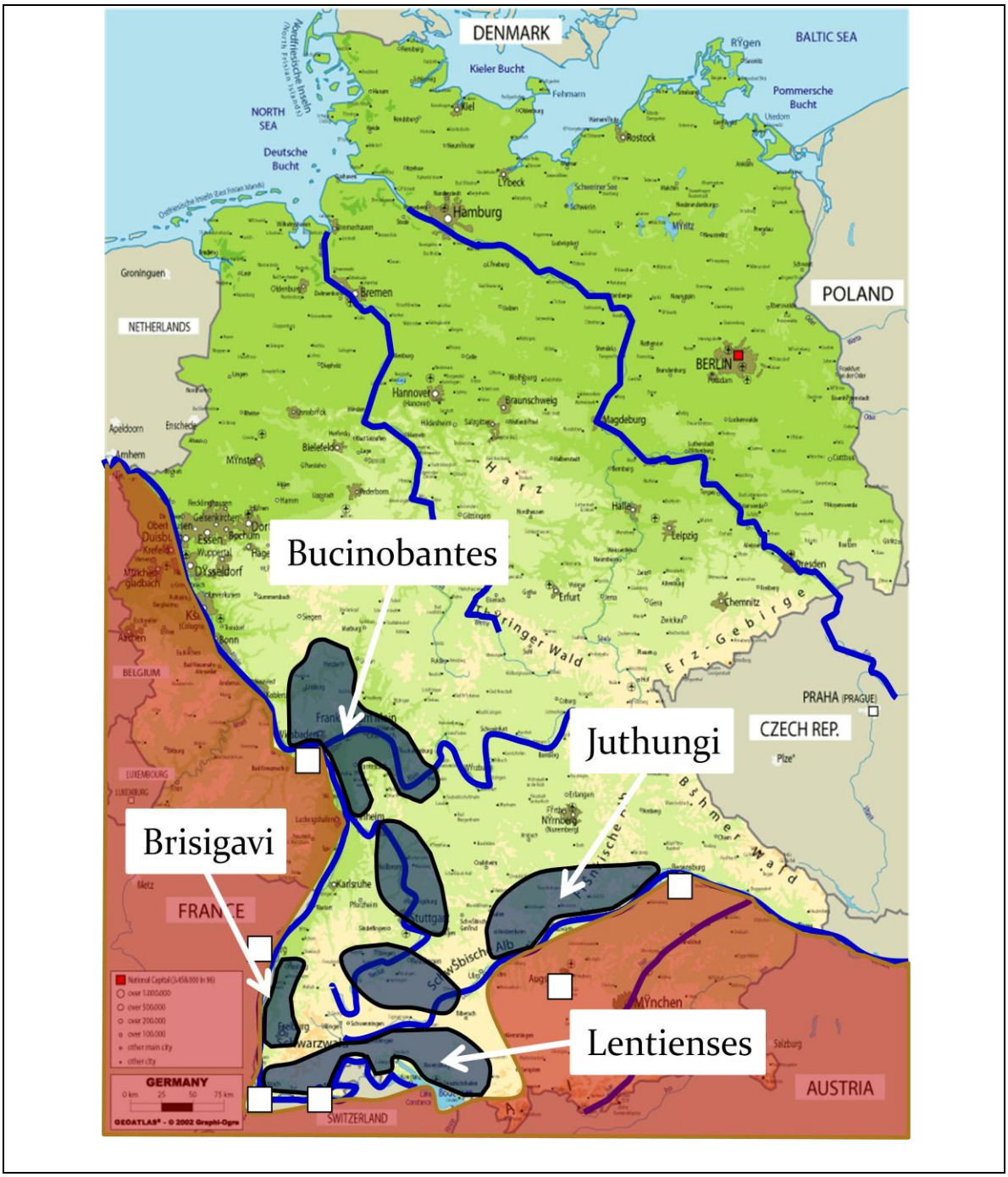

Figure 4.1. Possible locations of Alammanic cantons.

East of the Rhine, much of the Roman infrastructure remained after their departure. In addition to the forts and guard posts of the old limes, there were towns, such as modern Rottweil, smaller hamlets, *villae rusticae*, and an extensive road network. Ammianus states that the Alamanni avoided towns out of apprehension, "for the towns themselves they avoid as if they were tombs surrounded by nets" (XVI, 2, 12). Mathews believes this is a characteristic common to Germans who, like the post-Roman Britons, "could think of them as the 'works of giants' and imagine the life that had gone on inside" (1989:308). This seems unusual, however, considering how familiar the Alamanni were with Roman culture through trade, proximity, and service in the army. In addition, there are several archaeological sites that indicate that Alamannic individuals built their houses in and among crumbling Roman *villae rusticae* (Steuer 1997). Ammianus mentions that some Alamanni inhabited houses in the Main valley "carefully built in the Roman style" (XVII, 1, 7) and archaeological evidence suggests that some of these new settlements were built using Roman construction techniques (Werner 1975).

Ammianus indirectly reveals that the Alamanni were a largely rural people, living in sedentary villages and supporting themselves by farming. In several passages, Roman raiding parties cross the Rhine devastating crops and herds

(XVI, 11, 14; XVIII, 2, 19; and XXVII, 10, 7[77]) to the point where the Alamanni are reduced to near starvation (XVII, 10, 9 and XXIX, 4, 6 [78]). While there are indications that many Gallic towns began to fortify themselves during the fourth and fifth centuries (Wightman 1975), presumably in response to Germanic raids, east of the Rhine, a similar construction effort occurred earlier. Several Alamannic farmhouses were built using materials from ruined *villae rusticae*

[77] While the fortifications of the camp were rapidly rising and part of the soldiers were garrisoning the country posts, part gathering in grain warily for fear of ambush, a horde of savages, outstripping by their extraordinary speed any rumor of their coming, with a sudden attack set upon Barbatio and the army he commanded, which was separated from the Gallic camp; and they followed them in their flight as far as Castrum Rauracense (Kaiseraugst), and as much farther as they could; then, after seizing the greater part of his baggage and pack animals, together with the camp followers, they returned home again (XVI, 11, 14). But when they themselves also, after the burning of their harvests and homes and the capture or death of many men, sent envoys and made supplication as if they too had committed these sins against our people, they won peace on the same terms; and among these conditions it was especially stressed that they should give up all the prisoners whom they had taken in their frequent raids (XVIII, 2, 19). Then, guided by men who knew the roads, and carefully reconnoitering the approaches, they at once marched slowly onward, through a widely extended tract of country, while the soldiers, moew and more eager for battle, ground their teeth in a threatening way, as if they had already come upon the savages. But since after the lapse of several days no one could be found to oppose them, all the fields and dwellings they saw were laid waste by devouring flames kindled by a band of the cohorts, with the exception of such foodstuffs as doubt about the outcome of affairs forced them to gather and keep (XXVII, 10, 7)

[78] Finally the king was summoned by Caesar to an interview and reverenced him with trembling eyes; and overcome at the sight of the conqueror, he was forced to accept these hard terms, namely, that inasmuch as it was fitting that after so many successes the cities also should be rebuilt which the violence of the savages had destroyed, the king should furnish carts and timber from his own supplies and those of his subjects. And when he had promised and taken oath that if he did any disloyal act, he should expiate it with his heart's blood, he was allowed to return to his own domains. For as to supplying grain, as Suomarius did, he could not be coerced, for the reason that his country had been ravaged to the point of ruin, and nothing to give us could be found (XVII, 10, 9). Valentinian was robbed of this glory (of taking an Alamannic king prisoner), not by his own fault or that of his generals, but by the indiscipline of the soldiers, which has often caused the Roman state heavy losses; so, after reducing the enemy's territory to ashes for fifty miles, he returned sadly to Treves (XXIX, 4, 6).

(Werner 1975), while in the Swabian Alb caves were enlarged and fortified as possible *refugia* (Donat 1988).

During the fourth though sixth centuries several Iron Age, pre-Roman, hillforts were reoccupied and new ones established by members of the Alamannic elite (Fingerlin 1990; Hoeper 2003; Steuer and Hoeper 2002). Although Ammianus never refers to, nor directly describes a highland settlement, a few passages mention highland defensive systems. In the summer of AD 368, Valentinian I (emperor AD 364 – 375) raided the Neckar valley. The German withdrew as the Romans burned crops and farmsteads:

> And in fact, the enemy...trusting to their knowledge of the ground and in general agreement with one another, had stationed themselves on a lofty mountain, surrounded on all sides by rocky and precipitous heights and inaccessible except on the northern side, where it has an easy and gentle slope (Ammianus XXVII, 10, 9).

The Romans stormed the three steeper sides of the hill, forcing the defenders back down the slope on the north side where Valentinian had prepared troops for ambush. This appears to be a hillfort where steep slopes protect three sides and access to the fort is via a gentler slope controlled by walls and ditches.

In AD 378, Gratian attacked the Lentienses:

> ...the Lentienses, who were almost annihilated by the disasters to their people and were stunned by the emperor's sudden arrival..., made for the hills, which were beset by pathless crags. There taking their place round about on the sheer rocks, the tried to defend their possessions and their dear wives and children (Ammianus XXXI, 10, 12).

The emperor, after suffering severe losses, decided to starve the Germans into surrender although many managed to slip away during the night. Another passage, where Roman soldiers cross the Rhine and begin to fortify a hill, "Mount Pirus" (XXVIII, 2, 5), is less clear although this is considered a significant enough threat by the local Germans that they attack the construction party and destroy the defenses.

As an agrarian people, the majority of Alamanni lived in the lowlands near rivers and smaller bodies of water. Ammianus portrays the east bank of the Rhine as a fertile region where the inhabitants raise crops and livestock (XVI, 11, 10). Farmsteads appear in Ammianus however, only indirectly:

> ...they fled across the river, Menus (Main) by name, to bear aid to their kinsfolk...Upon their departure our soldiers marched on undisturbed and plundered farms rich in cattle and crops, sparing none (XVII, 1, 7).

> After firing the fragile huts that sheltered them...our soldiers reached the region called Capillacii or Palas where boundary stone marked the frontiers of the Alamanni and the Burgundians (XVIII, 2, 15).

The form of rural houses and Alamannic settlement pattern is known primarily through archaeology and will be discussed in Chapter 5. Ammianus' history ends in AD 378, and the reader's overall impression is that the interactions between Romans and Alamanni, when they are not in Roman service, are violent and most are battles between large armies (Table 4.2). But as Whittaker (1994) correctly states, neither the earlier *limes* frontier nor the later Rhine frontier could have existed without the active participation of the very people who were supposed to be the enemy. Indeed, archaeological evidence suggests that trade, of both ideas and goods, was common and that individuals could easily move between both worlds.

Table 4.2. Major Battles with the Alamanni

Year	Location	Result	Source
AD 268	Lake Benecus (Lake Garda, Italy)	Emperor Claudius II defeats Alamanni: Alamanni occupy northern Italy	
AD 271	Placentia (Piacenza, Italy)	Alamanni defeat Emperor Aurelian	
AD 271	Fano, Italy	Emperor Aurelian defeats Alamanni; Alamanni retreat from Italy	
AD 271	Pavia, Italy	Emperor Aurelian defeats Alamanni	
AD 298	Ligones (Langres, France)	Caesar Constantius Chlorus defeats Alamanni	
AD 298	Vindonissa (Switzerland)	Caesar Constantius Chlorus defeats Alamanni	
AD 356	Rheims (France)	Alamanni defeat Caesar Julian; Alamanni occupy Rhine's west bank	Ammianus
AD 357	Argentoratum (Strasbourg, France)	Caesar Julian defeats Alamanni; Alamanni pushed east of Rhine	Ammianus
AD 367	Solicinium (Heidelburg, Germany)	Emperor Valentian partial victory with heavy casualties	Ammianus
AD 368	Moguntiacum (Mainz, Germany)	Alamanni raid Roman city/fortress	Ammianus
AD 378	Argentovaria (near Colmar, France)	Emperor Gratian defeats Alamanni	Ammianus
AD 496	Tolbiac (Zülpich, Germany)	Frankish King Clovis I defeats Alamanni; end of Alamannic independence	

CHAPTER FIVE

ROMAN AND GERMAN INTERACTION:

ARCHAEOLOGICAL EVIDENCE

Archaeological and historical research concerning the early Roman period in southwest Germany has been ongoing since the early nineteenth century. Wielandt (1811), Weick (1822), and Bissinger (1885) conducted some of the earliest archaeological excavations, examining the settlement history of the entire upper Rhine valley. Wagner (1911) and Schumacher (1923) authored early compendia for the increasing evidence of Roman settlement. Müllenhoff (1900) and Zeuss (1904) are among the first German historians to examine the question of the Suebi and trace the development of Caesar's account from earlier authors such as Posidonius and Strabo. Frahm (1929, 1930) developed the hypothesis that the name "Suebi" was adopted by Germanic tribes far from the Roman frontier through tribes that had been given the name by Roman traders and explorers[79]. Most of these works approached their subject from the Roman point of view, being interested in Romanization of the native population or they

[79] Perhaps a good hypothesis for why the name appears first on the Rhine, then on the middle Danube, and again on the Rhine among people whom then migrate into Spain.

simply ignored the question of what happened to the natives upon arrival of the Romans.

The early questions concentrated on how to observe Roman settlement through its earliest traces. Three settlement features appeared first, although there was little agreement as to which element was the most important (Fischer 1990); the Roman road (*Kinzigtalstraße*) built around AD 73 by Cn. Pinarius Cornelius Clemens; the incorporation of southwest Germany into a new province, *Germania Superior*, around AD 80; or the establishment of the larger settlements with early Flavian (around AD 72) dates such as Badenweiler, Bad Krozingen, or Lahr. Fritsch's (1910) work on dating terra sigillata pottery from Riegel am Kaiserstuhl demonstrated that settlement may have occurred perhaps a decade earlier, based on the presence of Claudian (AD 41 - 56) ceramics. He posed a new hypothesis: that the right side of the upper Rhine was settled before the construction of Clemens' road or after the military occupation of the area. Until recently, the near-absence of pre-Flavian artifacts has been a problem for Fritsch's first hypothesis

Much of the archaeological research in this region tends to be divided along culture-historical lines, for example Late Iron Age, Roman, and Merovingian.

For multi-component sites, a researcher will tend to write only about the period that interests him or her and leave the remaining periods for others to analyze. This tendency gives a very disjointed view of the archaeological record and promotes the idea of population replacements. There are three sites, however, which provide excellent examples of continuity and change through time in the upper Rhine valley: Diersheim, Weil am Rhein, and Bötzingen am Kaiserstuhl.

TECHNOLOGY TRANSFERS

The earliest evidence for Roman trade north of the Alps appears in the form of ceramic wine amphorae dating to the middle of the second century BC, not long after the Romans established control over the Po River plain (Wells 1984). The majority of these amphorae are found in France and southern Germany reflecting the ease of transportation along the Rhone River. The scarcity of wine amphorae in Central and Eastern Europe is probably a result of the more difficult trade routes into this area. Werner (1961) postulated that most of the wine was transported away from the rivers in wooden casks and animal skins, neither of which would preserve in archaeological contexts.

After wine amphorae, bronze wine vessels are the most common early Roman import found north of the Alps. The majority are found in the hilly region of central Europe, south of the Northern European Plain between the lower Seine River and central Bohemia (Wells 1984). In addition, other pieces of wine drinking equipment found in burials and settlement sites, for example pans, sieves, ladles, and handled beakers, while less common, indicate that the enthusiasm for wine drinking among central European elites persisted from the sixth century. The exporters of Mediterranean culture changed through time, from Greeks, to Etruscans, to Romans, but the source of that culture seemed to make little difference to the consumers.

By the first century AD, the population of Germany was a complex mixture of pre-Roman inhabitants and Gallo-Roman settlers who first occupied sites, for example Riegel and Bad Krotzingen in Baden-Württemberg, on the Rhine's right bank (Figure 5.1). In addition, Roman army gave veterans representing a variety of ethnic backgrounds land east of the Rhine near the legionary fortresses at Argentoratum (modern Strasbourg) (Aßkamp 1989). At the fort and vicus at Dangstetten (Figure 1.1) the presence of non-Roman, handmade pottery with kammstriech design is indicative that populations interacted in complex and unexpected ways (Fingerlin 2003). This influx of new populations and mixing

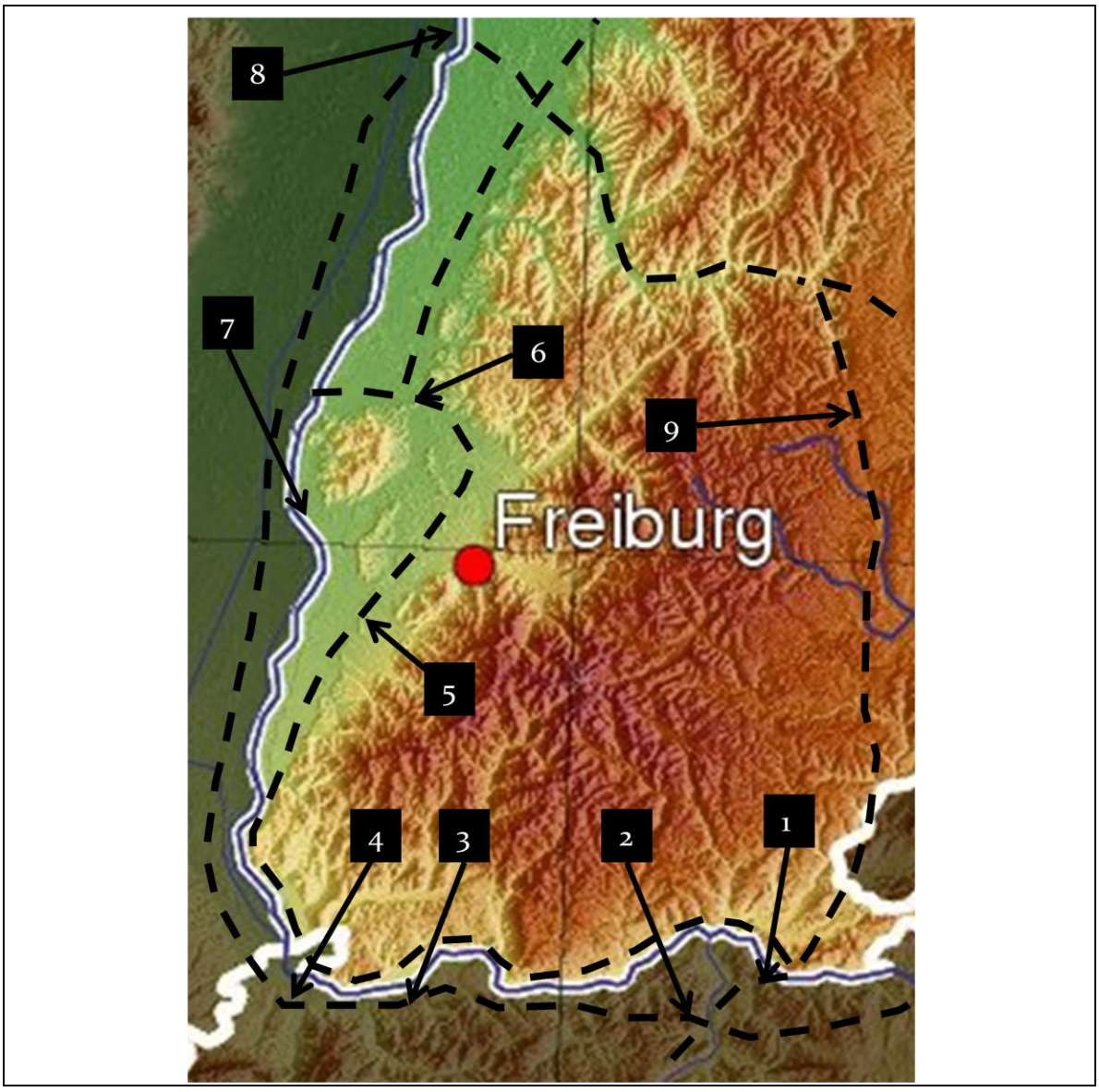

Figure 5.1. Important Roman settlements near Breisgau in the second century AD (Aβkamp 1989) (basemap from Mapsorama.com).

Dashes represent known and likely Roman roads.

1. Zurzach
2. Vindonissa
3. Augst
4. Basel
5. Bad Krozingen
6. Riegel
7. Breisach
8. Strasbourg
9. Rottweil

with the old produced an environment where the rate of transmission of ideas, including not only technology, but also how identity may be expressed, increased substantially.

One example of this is the presence of terra cotta Roman-style bowls designed for grinding grain (*Reibschalen*) in several non-Roman settlements in southwest Germany. These bowls are presumably made locally, based on temper sourcing studies, by non-Roman potters (Bücker 1997). The manufacturers may have learned their skills in the empire but they were producing their wares for non-Roman consumers. The grinding bowls represent the transfer of several ideas into a new context including the all the knowledge needed to produce the bowl. In addition, the habit of using these bowls for processing grain was transferred into a context where other behaviors had dominated previously. The sites at Weil am Rhein and Bötzingen am Kaiserstuhl are good examples of the shifting use of imported goods and use of stylistic imitation in frontier communities.

WEIL

The site at Weil lies in Southwest Germany on a terrace between the southern edge of the Black Forest and the eastward bend in the course of the Rhine River

opposite the Roman city Baslia (modern Basel) (Figures 1.1 and 5.1). Archaeologists have identified several sites in the area that date to the early Roman period and appear to be occupied by people whose ceramic material culture was a combination of Roman and non-Roman wares. Dehn and Fingerlin (1981) excavated 95 cremation burials from the site dating from the mid-first century to the last quarter of the second century AD. Twenty burials had been disturbed prior to excavation by road construction through the middle of the site. They identified four burial types including simple urn graves without associated artifacts (*Urnengräber*), graves with scattered burned artifacts in addition to cremation urns (*Brandschüttungsgräber mit urne*), graves with scattered cremated remains and burned artifacts but no urn (*Brandschüttungsgräber*), and small pits with cremated remains only (*Brandgrubengräber*). The urns varied in origin and manufacture type including hand-formed pots with non-Roman stylistic elements, Roman terra nigra ware, glass urns, and several types of non-Roman wheel-turned pots.

Aßkamp (1989) dated the burials based on associated artifacts, most commonly, coin finds and datable terra sigillata pottery, and divided the burial assemblage into four periods. Period 1 (around AD 40 - 70) includes the reigns of the emperors Claudius and Nero; Period 2 (around AD 70 - 110) the Flavian

emperors through Trajan; Period 3 (around AD 110 - 150), Hadrian and Antoninus; and Period 4 (around AD 150 - 180) late Antonine through Marcus Aurelius. Period 1 graves were spatially and artifactually distinct from those that came later (Aßkamp 1990). They were found in a cluster at the northeastern end of the site separated from the others by about seven meters.

Typically, Period 1 grave finds included pre-Flavian fibulae, indeed the only fibulae recovered from the site, pre-Flavian terra sigillata, and terra sigillata imitations similar to those produced by non-Roman groups in the area of modern Basel (Aßkamp 1989; Drack 1945). The majority of graves (57.1 percent) in this period were excavated pits (around 1.5 meters in diameter and 1.3 meters deep) containing an urn and associated burned grave artifacts for example, fibulae, ceramic and glass vessels, and animal bones. Other grave types included large graves similar to the first type mentioned above but without an associated urn (21.4 percent in Period 1), urn graves without associated burned materials (14.3 percent in Period 1), and small (around 50 cm in diameter) pits typically with burned remains but without urns (7.1 percent in Period 1) (Table 5.1).

Table 5.1. Grave types at Weil by period.*

Period	Urn only	Burned remains with urn	Burned remains without urn	Cremation pits	Total
1	2 (14.3%)	8 (57.1%)	3 (21.4%)	1 (7.1%)	14 (99.9%)
2	3 (14.3%)	7 (33.3%)	4 (19.0%)	7 (33.3%)	21 (99.9%)
3	6 (23.1%)	9 (34.6%)	4 (15.4%)	7 (26.9%)	26 (100.0%)
4	3 (16.7%)	8 (44.4%)	4 (22.2%)	3 (16.7%)	18 (100.0%)
Total	14	32	15	18	79

*Percentage of grave type per period in parentheses

The popularity of large pit graves either with or without urns declined during Periods 2 and 3 (AD 70 - 150) relative to small cremation pits and urn only graves. During the early Claudian period large pit graves accounted for almost 80 percent of the graves but by the middle of the second century AD, only half of the graves were excavated in this manner. There was slight resurgence in the last half of the second century (Period 4) but they still did not approach previous levels by the time of the cemetery's abandonment. Aßkamp (1989, 1900) believes that the change in burial practice during Periods 2 and 3 reflects an influx of Roman or Romanized people into the community or perhaps imitation of burial practices by non-Roman inhabitants of practices that occurred in more fully integrated communities such as the ones at Basel and Augst.

Ceramic artifacts from Period 1 burials included non-Roman wheel turned vessels (34.6 percent), imported terra sigillata pots, bowls, and cups (25.0

percent), terra sigillata-imitation and Belgian ware plates and bowls (23.1 percent), handmade urns produced in indigenous styles (13.5 percent), and imported terra nigra shouldered vessels (3.8 percent) (Table 5.2). The stylistic elements on the imported terra sigillata suggest that they were manufactured in southern Gaul indicating the persistence of trade connections between southern Germany and this area of the Mediterranean world. Drack (1945) defined imitated terra sigillata forms in northern Switzerland and southwest Germany based on the quality of stylistic elements on a vessel. Generally, the stylistic elements found on the former are cruder and not as well defined and the shape of the rim is thicker and more rounded than true terra sigillata forms. In addition, imitated forms generally have larger temper particle size although this characteristic is highly variable.

Table 5.2. Counts of ceramic vessel types by period at Weil.*

Period	Terra Sigillata	Terra Nigra	TS-Imitation	Hand Formed Ceramic	Non-Roman Wheel Turned	Total
1	13 (25.0%)	2 (3.8%)	12 (23.1%)	7 (13.5%)	18 (34.6%)	52 (100.0%)
2	90 (53.9%)	13 (7.8%)	0	6 (3.6%)	58 (34.7%)	167 (100.0%)
3	60 (66.7%)	3 (3.3%)	0	1 (1.1%)	26 (28.9%)	90 (100.0%)
4	31 (45.6%)	2 (2.9%)	0	2 (2.9%)	33 (48.5%)	68 (99.9%)
Total	194	20	12	16	135	377

*Percentage of ceramic vessel type per period in parentheses.

During Period 2 (AD 70 - 110) the amount of imported terra sigillata vessels found in graves relative to most types of vessels increases dramatically (Figure

5.2). Over half of the vessels from burial contexts in this period might be considered luxury items and reflecting a continuance of the elite's enthusiasm for wine-drinking equipment.

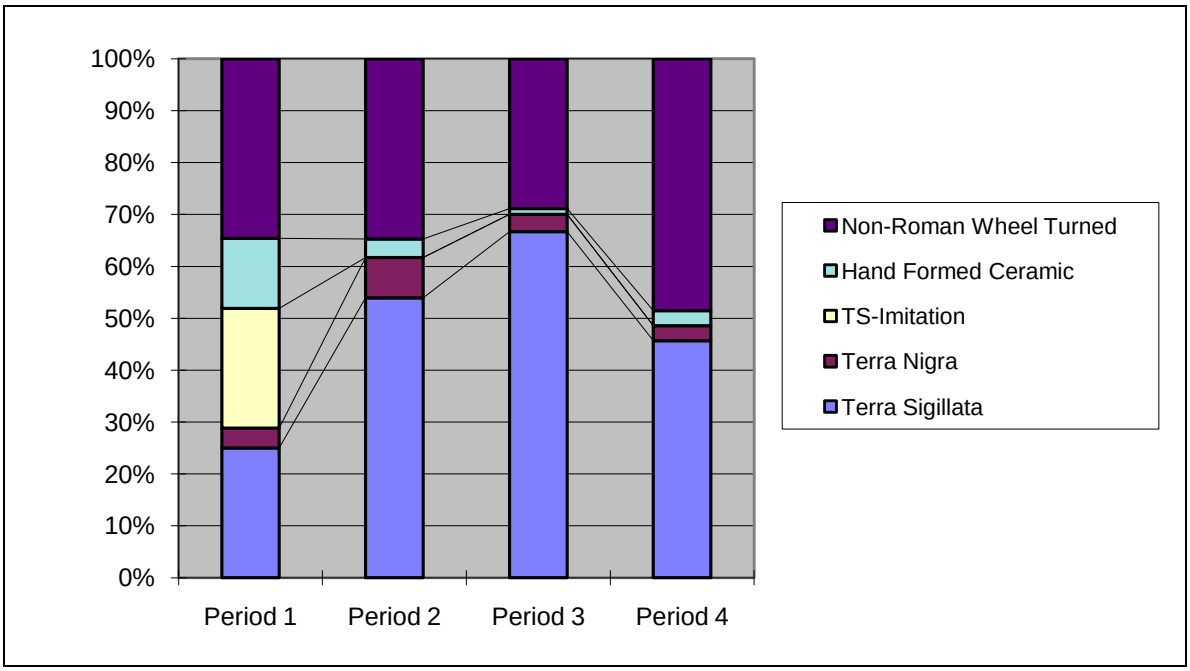

Figure 5.2. Relative percentages of pottery types at Weil.

However, of the 21 graves belonging to Period 2, most contain at least one terra sigillata plate, bowl, or cup. This suggests that there was greater access at most levels of society to imported fine ceramics and that the notion of these objects as status symbols had spread throughout the community. While there was still a measurable difference in the amount of fine ceramics placed in graves, for example, only two graves had more than 10 terra sigillata vessels in them, the difference in the degree of access had certainly decreased. Again, items placed in

graves do not necessarily reflect items used in life by an individual and his or her family. A poor family might well commit a very high percentage of its resources to acquire an imported fine ceramic to place in a relative's grave and use locally produced wares at other times. Even in this case, then, terra sigillata might be considered an elite vessel.

Figure 5.2 shows that the major difference between the Period 1 and Period 2 pottery assemblages lies in the amount of imported terra sigillata found in graves relative, not to non-Roman or locally produced wheel-turned pottery, but to terra sigillata-imitation wares and locally produced hand-formed pottery. The amount of imported terra nigra vessels generally remains constant throughout the cemetery' use as does non-Roman wheel-turned pottery until Period 4 when in increases relative to all types including imported terra sigillata. Non-Roman wheel-turned pottery had been the most common pottery type in graves during Period 1 by a small margin (34.6 percent) but only if one separates imported terra sigillata from imitated terra sigillata forms. Together, the latter two pottery types are the most common type (48.1 percent) and represent an idea of what constitutes high status. The imitation wares might reflect an effort on the part of less wealthy members of the community who did non possess the resources for

"real" terra sigillata yet wanted the status such items provided for their deceased.

Yet, despite the presence of terra sigillata vessels and their presumed status, there remained a counter-notion of "nativeness" or separateness from the Romans reflected in the persistence of non-Roman wheel-turned pottery throughout the cemetery's use. From around AD 40 through the middle of the second century, these locally produced wares were present in all of the graves and represented roughly a third of the pottery assemblage in each period (Table 5.2). In the last half of the second century they increased from 28.9 percent to 48.5 percent of the pottery assemblage while imported terra sigillata had decreased to 45.6 percent. There is much evidence to suggest that even as Roman-produced goods became more available and elites used imported items as status objects, there were non-Roman stylistic elements and ideas of artifact manufacture that persisted throughout southwest Germany not only in non-Roman settlements but also Roman settlements including the forts and fortresses themselves (Bücker 1999; Wieland 1993). It appears at Weil, the inhabitants, while certainly not rejecting the trappings of Roman material culture, and began to emphasize their "nativeness" in the latter part of this period.

BÖTZINGEN

The site at Bötzingen lies on a terrace above the Dreisam valley on the southwest corner of the Kaiserstuhl, a large basalt feature on the Rhine in Baden-Württemberg (Figure 5.1). Several archaeological sites in the area around the Kaiserstuhl attest to an intense occupation since the Hallstatt period, including hilltop settlements at Breisach and Limberg (Fingerlin 1985; Steuer 1990). In addition to Bötzingen, sites dating to the earliest Roman period (around early first century AD) are known throughout the area surrounding the Kaiserstuhl including settlement sites at Riegel, Sasbach and Biesheim, and a military site at Jechtingen (Aßkamp 1989). These sites predate the period traditionally given for the Roman expansion into southwest Germany by about 40 years; the province of *Germania Superior* was organized around AD 80. For this reason, the local inhabitants and the persons buried in the cemetery are assumed to be non-Roman natives who maintained close contact with the empire.

Bötzingen was excavated due to pending road construction in 1972 by archaeologists from the State Archaeological Preservation Office in Freiburg. The archaeologists identified 24 cremation graves dating from the middle of the first century through the beginning of the second century AD. In addition, they

excavated six house pits dating to the early La Tène period (around 200 BC). Although they did not find any settlement evidence for the later period, there does seem to be continuity of occupation over several centuries, if only that the location remained in the consciousness of local people as a good place to bury their dead.

The cemetery at Bötzingen varies from the one at Weil in several categories including the duration of occupation, the types of burials present, and the frequencies of pottery types present in burials. Aßkamp (1989) dated the burials based on associated artifacts; again, as at Weil, imported terra sigillata and coin finds provided a rough chronology. This cemetery was used for a much shorter period perhaps only around 30 years during the first century AD. Despite its limited duration, however, it is interesting to compare this site with Weil as an example of the variation that might occur in a grave artifact assemblage in similar regions. Sixteen burials were dated to the early Claudian period (around AD 40) (Period 1); another eight belonged to the early Flavian period (around AD 70) (Period 2). I assigned the burials to the same temporal scale and typology used at Weil for comparison.

There was no spatial distinction between Period 1 and Period 2 graves and there was less variation in grave type than at Weil. Urn graves and cremation pits were missing at Bötzingen and in Period 1, out of 16 graves, 8 were large pits with urns and associated burned artifacts and 8 were large pits without urns (Table 5.3). The associated burned artifacts typically included whole pots and pottery fragments, burned animal bones, coins, glass, and, in five burials, fibulae. There was no distinction between burials with urns and those without with regards to the artifacts contained in the burials. Fibulae, glass, and terra sigillata fragments were distributed evenly throughout the site. The burial pits were slightly smaller in diameter (around .85 meters) but similar in depth (around 1.3 meters) to those at Weil.

Table 5.3. Grave types at Bötzingen by period.*

Period	Urn Graves	Burned remains with urns	Burned remains without urns	Cremation pits	Total
1	0 (0%)	8 (50%)	8 (50%)	0 (0%)	16 (100.0%)
2	0 (0%)	6 (75%)	2 (25%)	0 (0%)	8 (100.0%)
Total	0	14	10	0	24

*Percentage of grave type per period in parentheses.

There were only eight graves assigned to Period 2. Six (75 percent) of these were large pit graves with urns and two (25 percent) were pit graves without urns. The numbers of grave types in each period are probably too small to make statements of statistical significance or even subjective statements regarding

grave type frequency in each period. Perhaps what is most significant is the lack of simple urn graves and cremation pits. At Weil, these types seemed to be an important option for burials that actually increased in frequency during the period of increasing Roman presence and similar small cremation pits had been used since the first century BC (Wells 1984). Cemeteries in Roman settlements consist typically of simple cremated pits with a lack of burial goods; perhaps the local inhabitants at Bötzingen were not in immediate contact with Roman ideas of burial.

Ceramic artifacts from Period 1 (AD 40 - 70) burials included non-Roman wheel-turned vessels (38.1 percent), imported terra sigillata bowls and cups (25.4 percent), imitation terra sigillata plates and bowls (15.9 percent), imported terra nigra cups and bowls (11.1 percent), and handmade pots with a combed surface treatment (9.5 percent) (Table 5.4). As at Weil, the stylistic elements on the imported terra sigillata vessels suggest that they were manufactured in southern Gaul. Some of the imitated terra sigillata, however, reflects stylistic elements from indigenous pottery in northern Gaul and southern Belgium, including the size and profile of the rim and the surface treatment (Aßkamp 1989).

Table 5.4. Counts of ceramic vessel types by period at Bötzingen.*

Period	Terra Sigillata	Terra Nigra	TS-Imitation	Hand Formed Ceramic	Non-Roman Wheel Turned	Total
1	16 (25.4%)	7 (11.1%)	10 (15.9%)	6 (9.5%)	24 (38.1%)	63 (100.0%)
2	8 (21.6%)	1 (2.7%)	3 (8.1)	4 (10.8%)	21 (56.8%)	37 (100.0%)
Total	24	8	13	10	45	100

*Percentage of ceramic vessel type per period in parentheses.

During Period 2 (AD 70 - 110), the amount of imported terra sigillata decreases slightly, imported terra nigra vessels fall sharply, and the imitated terra sigillata decreases by almost half (Table 5.4). Relative to these types hand formed vessels slightly increases and the relative percentage of non-Roman wheel-turned forms increases 18.7 percent. These trends contrast sharply with those shown at Weil where imported terra sigillata and, to a lesser extent, terra nigra vessels increased in frequency through time.

There was a different response than that at Weil by its presumably non-Roman users to the increasing presence of Romans across the Rhine only five miles to the west. The amounts of imported terra sigillata remained generally constant while terra sigillata-imitated persist into Period 2; those at Weil stopped placing it in their graves by the middle of the first century. From the Period 1 through Period 2 the people at Bötzingen placed more non-Roman wheel-turned pottery in their graves than those at Weil.

Figure 5.3 shows the change in the relative percentages of pottery types in Bötzingen's graves.

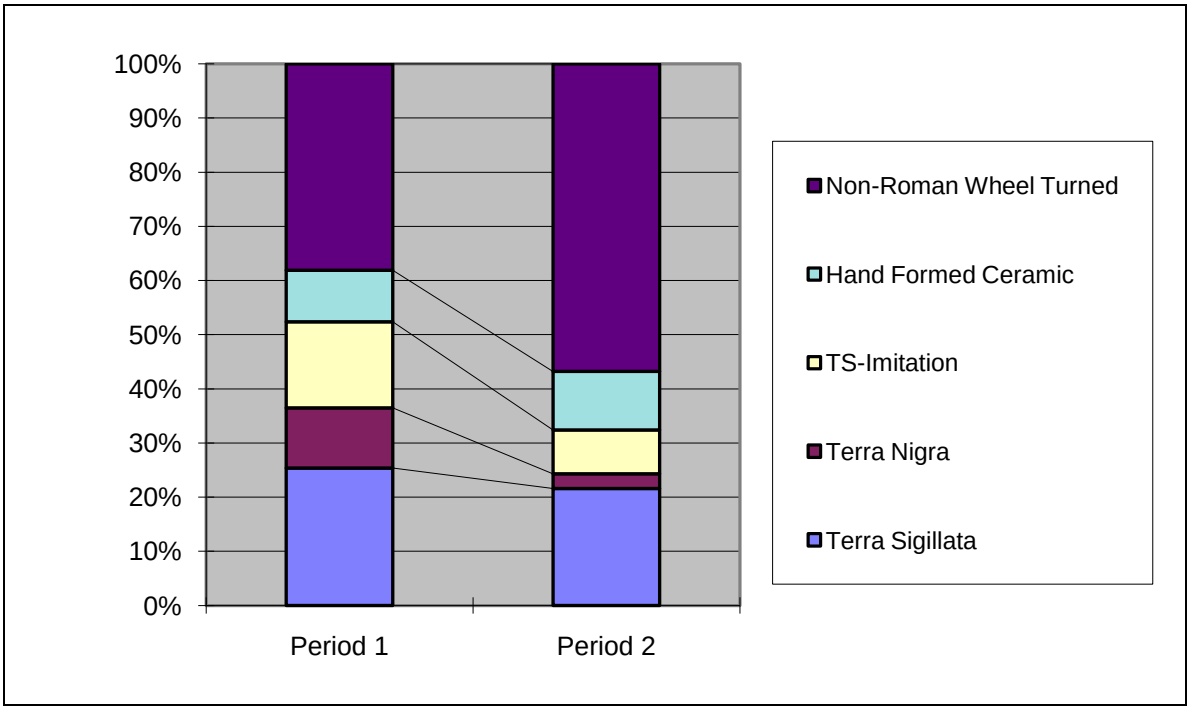

Figure 5.3. Relative percentages of pottery types at Bötzingen.

During the last half the of the first century AD, a Roman road (*Kinzigtalstraße*) built between the Kaiserstuhl and the Black Forest by Cn. Pinarius Cornelius Clemens (around AD 73); southwest Germany was organized into a new province, *Germania Superior*, around AD 80; and several large Roman settlements, for example Badenweiler, Bad Krozingen, and Lahr, were established (around AD 72). The ultimate response to this pressure seems to have been the abandonment of the Bötzingen cemetery since there are no burials dated after

this period. Prior to this, the inhabitants established their identity, at least in what is reflected in the burial artifact assemblages, through a complex suite of Roman and non-Roman pottery forms. They maintained their terra sigillata-imitation forms into Period 2 at a much-reduced rate relative to non-Roman wheel-turned forms. Although imported terra sigillata generally remained an important, whether as a sign of wealth or as some other marker, indigenous pottery became more important, perhaps as a response to encroaching Roman influence.

SETTLEMENT PATTERNS

SETTLEMENT PATTERNS DURING THE FIRST CENTURY AD

Donat (1991) writes that approximately 120 settlements dating to the period between the late pre-Roman Iron Age and the early Merovingian period have been sufficiently investigated and 75 percent of these are found in the northern lowlands of Germany and the Netherlands. The dominant house form at the beginning of this period combined a farmer's living quarters in one half of the structure and a stable in the other half (*Wohnstallhaus*). A single row of posts formed the walls and there is little evidence for an interior row of posts

supporting the crossbeams. A fence surrounded the main building and several outbuildings most often interpreted as hay barns and corrals. The farmsteads are usually clustered together, oriented in a similar direction, and facing a road (Donat 1991)[80]. Many settlements appear to have built a palisade of evenly spaced posts around the houses, although this may have been more common in northern Germany (Jankuhn 1976).

The *Wohnstallhäuser* are gradually replaced in southern and central Germany by single- and double-aisle houses in the first century AD although some persist through the third century (Donat 1991). They appear to serve only as dwellings with the stall facilities removed to one of the outbuildings. Lauchheim (Figure 5.1), in Baden-Württemberg, provides a good example of farmstead development. The initial settlement was composed of a single-aisle house with posts set into a trench for a wall and a second set of posts in a parallel line, between 1.5 and two meters from the first post line, supporting the roof (Stork

[80] Tacitus describes German settlement patterns in *Germania*, "It is well known that none of the German tribes live in cities, that even individually they do no permit houses to touch each other: they live separated and scattered, according as spring-water, meadow, or grove appeals to each man: they lay out their villages not, after our fashion, with buildings contiguous and connected; everyone keeps a clear space round his house…They have not even learned to use quarry-stone or tiles: the timber they use for all purposes is unshaped, and stops short of all ornament or attraction…They are in the habit also of opening pits in the earth and piling dung in quantities on the roof, as a refuge from the winter or a root-house…" (16).

1990)[81]. In the second phase, the house posts were still set into a trench, but the walls were constructed from shaped planks. By the third phase, the house posts were arranged in pairs sunk individually into the ground. In each phase a fence created a yard around the house and two or three pit houses. At Kirchheim (Figure 5.1), in Bavaria, the rectangular houses were similar to those at Lauchheim but here the normal type was a two-aisle building. Thirty-six house outlines showed a double row of posts, each pair between 1.5 and two meters apart. The houses were between 14 and 21 meters long with a total area between 70 and 120 square meters.

Most of the settlements in southwest Germany are located in areas that had been plowed since the Neolithic period where the soil is easily tilled. Settlements across southern Germany are composed of these farmsteads, each conforming to a similar construction plan for houses and each occupying a similar position in the landscape. Donat (1980, 1991) and Nesselhauf (1951) argue that the similarities in house construction and settlement pattern are evidence for similarities in social structure. Based on demographic data derived from cemeteries and economic models, Donat (1980) suggests that the average farmer's family comprised four to six adults and nine to twelve children. He

[81] This house is similar to the Odoorn C house type found in the Netherlands and northern Germany (Donat 1991).

further assumes, again based on economic models, that the farmer was assisted by farm hands. Together with the family of farm hands, also two adults and four children, the total population of the farm was between 20 and 25 persons[82].

Although most people lived on single farms or in farming communities, there were also a few large population centers located on prime trading routes such as the Rhine and other rivers. Fortified hilltop settlements developed throughout western and central Europe during the late Iron Age (around 200 BC). These communities served as production centers producing, among other things, iron, glass, gold, and leather good for the emerging trade with Rome (Wells 1984). Caesar encountered several of these large, fortified centers, that he called *oppida*, through his campaigns in Gaul (58 - 50 BC) and his descriptions indicate some of the sophistication of these centers[83]. Although Caesar only describes the *oppida* in Gaul, archaeologists have used the term for any large, fortified settlement dating

[82] Damminger (1998) believes the number of children is overstated. Demographic studies of a cemetery at Calw-Stammheim suggest that up to 45 percent of the burials belong to children. Using this number Damminger estimates about half the number of children Donat used in his calculations.

[83] Caesar writes regarding Gallic *oppida* walls, "Balks are laid on the ground at equal intervals of two feet throughout the length of the wall and at right angles. These are made fast on the inside and banked up with a quantity of earth, while the intervals…are stopped up on the front side with big stones. When these balks have been laid and clamped together a second course [of balks and stones] is added above…the whole structure is knit together stage by stage until the proper height of wall is completed…and it is eminently suitable for the practical defense of cities, since the stone protects from fire and the timber from [the battering-rams], for with continuous balks, generally forty feet long, made fast on the inside it can neither be breached nor pulled to pieces" (VII, 23).

to this period, including settlements at Basel, Breisach, and Limberg on the upper Rhine (Fischer 1990) (Figure 5.1)[84]. Archaeologists identified several phases at Basel demonstrating its development from a rural community to a fortified *oppidum*.

SETTLEMENT PATTERNS DURING THE FIFTH CENTURY

Non-Roman settlement patterns during the fifth century can broadly be divided into three types: lowland settlements, hilltop settlements, and settlement or occupation in and around Roman military sites.

Lowland Settlements

To date there is no comprehensive summary of house types found in Alamannic areas (Damminger 1998). However, there is evidence from several sites that can serve as examples of the variety in house construction. Broadly, Alamannic houses can be divided into above ground and semi-subterranean post structures[85]. At Lauchheim (Figure 5.1), the largest buildings range from 10-20 meters long and around seven meters wide. The smaller buildings were

[84] Ptolemy (II, 10) writes of a large Celtic settlement called Tarodunum. Fingerlin (1983) and Nierhaus (1983) believe this is the site at Kirchzartener Talkessel.

[85] In most cases, the house outlines are represented by posthole stains or narrow trenches.

generally shorter (less than 12 meters) and only four to five meters wide. None of the houses had a central row of supporting posts (Stork 1990). At Heidenheim, Biel (1984) identified three houses each with different construction patterns. The largest building measured 20 x 7.5 meters. Its outlines were defined by large post-holes; five double posts were standing along each of the longer walls. The smaller buildings measured 10 x 4.5 and 13.5 x 6 meters. A double row of posts supported the walls of the first building, the second building's outline showed as a trench with faint evidence of posts. At Forchheim (Figure 5.4), the floorplan is divided into two aisles by a central row of posts, which supported the ridge beam.

Upright posts were dug into the ground individually to support the weight of the timber construction or they could be set into trenches. Bedding trenches could have also held horizontal sill beams that served as a ground frame into which the posts of the house were mortised (Damminger 1998). The basic elements of the timber construction were pairs of posts lying opposite each other in the longer walls connected by a beam running across the house. In the two-aisle houses there was a central row of poles supporting the crossbeam. The rafters rested on beams that connected the outer posts on the long side (Donat 1991) (Figure 5.4). There is little archaeological evidence to indicate regional

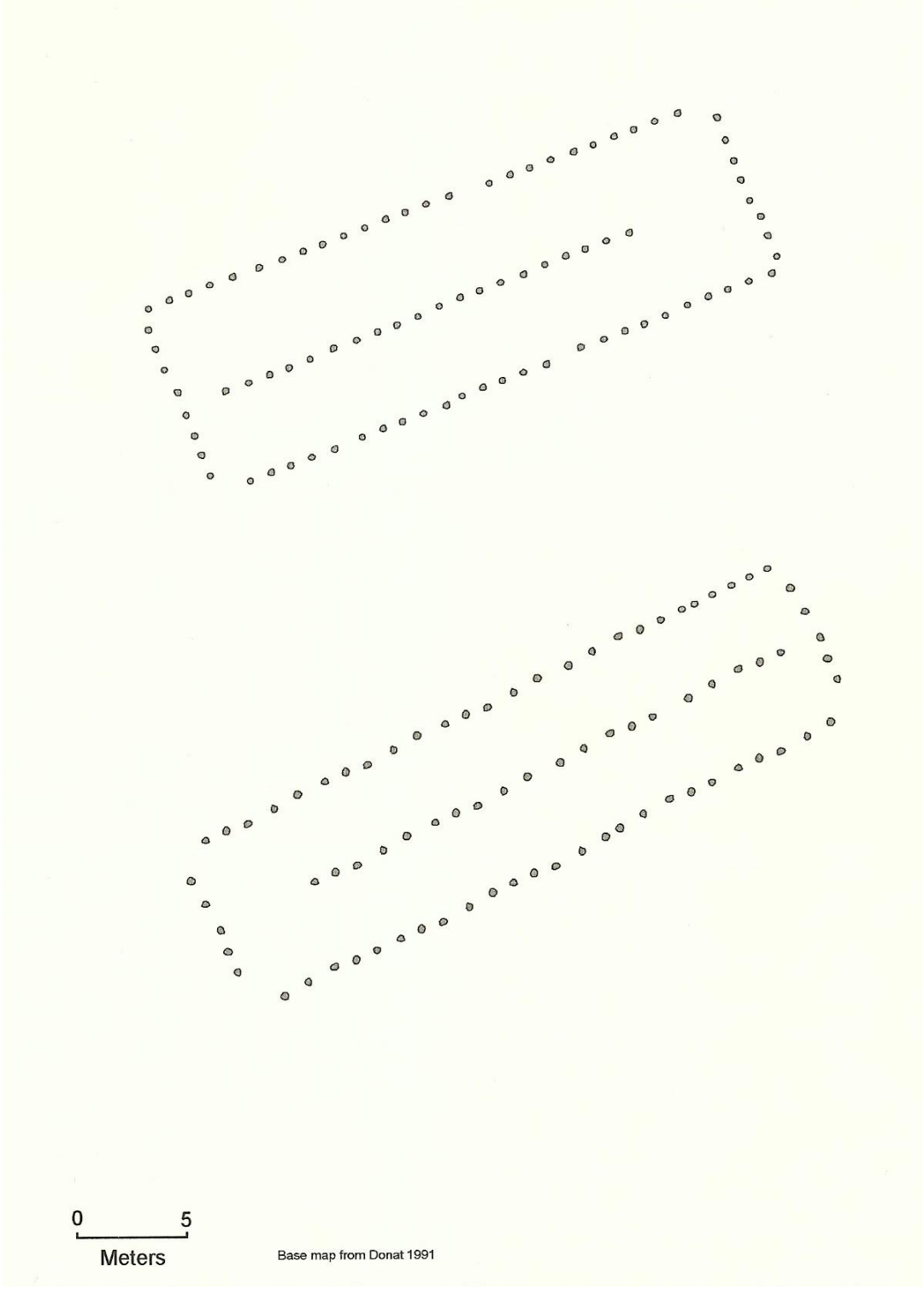

Figure 5.4. House plans from Forchheim, fifth century AD.

preferences in wall construction. However, it is likely that wattle and daub, timber, or a combination of both was used.

Damminger (1998) states that construction of a farmstead's main building required skilled, even specialized, labor. An example of the importance of such skills is a carpenter's plane excavated from a contemporary grave in Bavaria. The basic house building techniques represent a tradition that existed as far as the late Bronze Age (Luley 1992, Rind 1992, Sage 1969, Wells 1984). Roman techniques may have had little impact in areas not under their direct control although late Roman construction traditions may have lasted in Bavaria and areas west of the Rhine under Roman control until the early medieval period (Christie 1992)[86]. Although Roman techniques emphasized stone construction, timber post houses are known from *Germania Superior* and other provinces north of the Alps. These techniques may be adoptions by local people, but, generally, it is difficult to separate Roman and provincial Roman influences from local "Germanic" construction traditions solely on the basis of archaeological evidence.

[86] Although Damminger (1998) believes that this is less likely for areas that had been occupied by the Alamanni since third century.

Compared to the combined living house-stables found on the lower Rhine and in northern Germany, the main houses in Frankish and Alamannic areas are rather small with an interior between 60 to 90 square meters. Donat (1980) suggested that these two-aisle post buildings served only as living areas. Farmsteads with separate stables and dwelling house may have developed in most of the Germanic regions by the seventh century, replacing the *Wohnstallhaus*, if not several hundred years earlier among the Alamanni[87].

Pit houses are the most common structures identified by archaeologists on sites of this period. They are distributed between the Elbe region and the Rhine valley including eastern France. The earliest pit houses are from southern Germany dating to the late Iron Age. They are most common however beginning in the first century AD (Donat 1991). Pit houses tend to be rectangular, three to five meters long and two to three meters wide. The floor lies 50 centimeters to a meter below the surface. Generally there are three post-holes on each of the narrower sides of the house (Figure 5.5). Beams probably connected the posts of each row, the center posts carried the ridge beam, and rafters would be attached to the ridge and supporting beams. The middle post is usually shifted to the

[87] Christlein (1978) assumed the existence of the combined dwelling-house and stable in southwest Germany but it was only recently until it was confirmed by excavations at Lauchheim, where four large houses appear to be subdivided into living and stable components based on the pattern of post-holes and different concentrations of phosphates (Stork 1993).

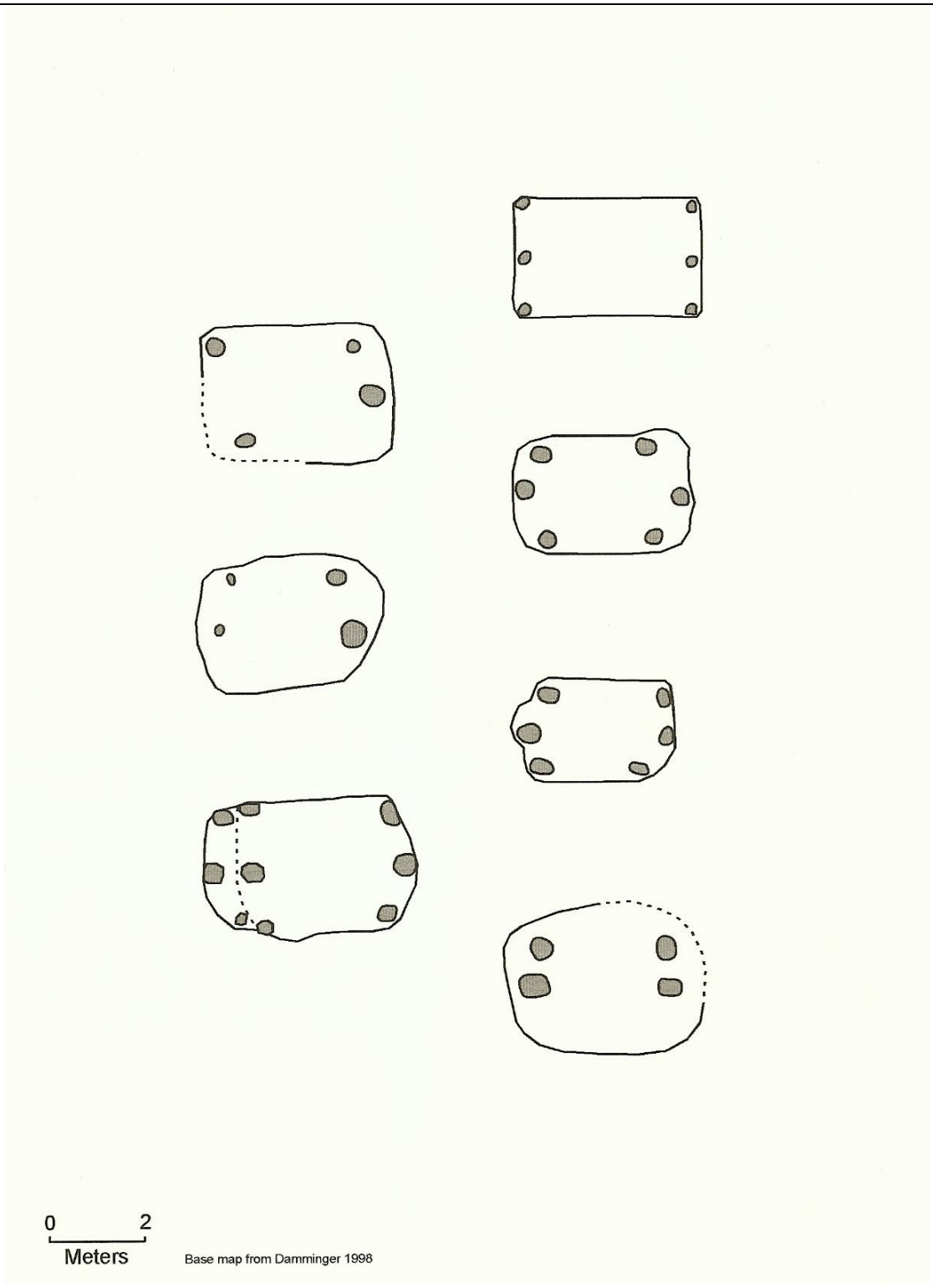

Figure 5.5. Floor plans for pit houses (*Grubenhäuser*) at Kirchheim.

outside possibly to avoid a complicated connection between the middle post and the connecting beam suggesting that these pit houses not were constructed by specialized carpenters (Damminger 1998). Pit houses probably served a variety of functions. They are usually interpreted as workshops, especially weaving cellars. The environmental conditions provided by the sunken floor may have been favorable for processing textiles and in the fill of many pit houses bone spindles and loom weights have been found (Damminger 1998). In some cases traces of the standing looms were preserved (Donat 1980, Stork 1993). The smaller huts may have been used for food storage, cooking, or as pigsties and sheep pens.

The literary sources as well as the archaeological features characterize the fifth century farm as consisting of a main house and several smaller buildings, each with a distinct purpose. The continuity of farms with a large combined dwelling house and stable surrounded by smaller buildings goes back to the Bronze Age. During the first century AD, with the appearance of the pit houses, the farms reached a form that remained unchanged through the Merovingian period (Damminger 1998; Donat 1991). The *Leges Alamannorum* was written in the early eighth century but can probably be applied to an earlier setting as well. A fence surrounds the farm (*curtis* or *villa*). The main house (*domus*) (*Leges Alammanorum*

LXXVI), a large one-roomed building with walls around nine feet high, was the center of social life. The *domus* was surrounded by several minor buildings including: barns (*scuria*), storage buildings (*cellaria*), pigsties (*porcatoria domi*), and buildings were the women worked (*genitia*) (*Leges Alamannorum* LXXVII). Many of these buildings do not appear in the archaeological record apart from the main house. The *genitia* may be found in some of the pit houses used as weaving cellars as well as those that probably housed animals (Damminger 1998).

Fifth century, and through the early seventh century, settlements tended to be located near rivers or creeks at the base of gentle slopes in contrast to settlements during the Roman period which tended to be located in valleys (Damminger 1998). The settlements occupied loess deposits of southwest Germany that had been plowed more or less since the Neolithic period (Hoeper 2001). These settlements consisted of several farms aligned, more or less, in rows facing a road of some kind. Most are associated with a cemetery; however, churches generally do not appear within the settlement until the early seventh century (Christlein 1978).

Highland Settlements

Beginning in the fourth century, highland locations throughout southwestern Germany are occupied, particularly along the Main, Rhine, and Danube rivers (Figure 5.6)[88]. Interestingly, several settlements in the Rhine River valley are located directly opposite Roman military sites: Geißkopf and Kügeleskopf southeast of Strasbourg (*Argentoratum*), Zähringer Burgberg east of Breisach (*Mons Brisiacus*) and Sponeck, and Hertenberg north of Kaiseraugst (*Augusta Raurica*) (Figure 5.6).

The archaeological components of these settlements are variable; some show evidence for extensive glass and metal production facilities (Runde Berg) while others have only slight evidence for any occupation (Kügeleskopf). Most highland settlements had a large structure, assumed to be the residence of Germanic elite, and a few smaller buildings (Hoeper 2003). Highland settlements differ from Late Iron Age *oppida* in that they are typically small, averaging only 60 by 70m in area, and there is little evidence for any defensive enclosures. Large-scale construction did occur at some of these sites (Zähringer Burgberg), but walls similar to those protecting the *oppida* 500 years earlier were not built. Two of the most extensively investigated highland settlements are the

[88] Currently 65 highland settlements are known in southwest Germany although only 10 have been extensively investigated (Hoeper 2003).

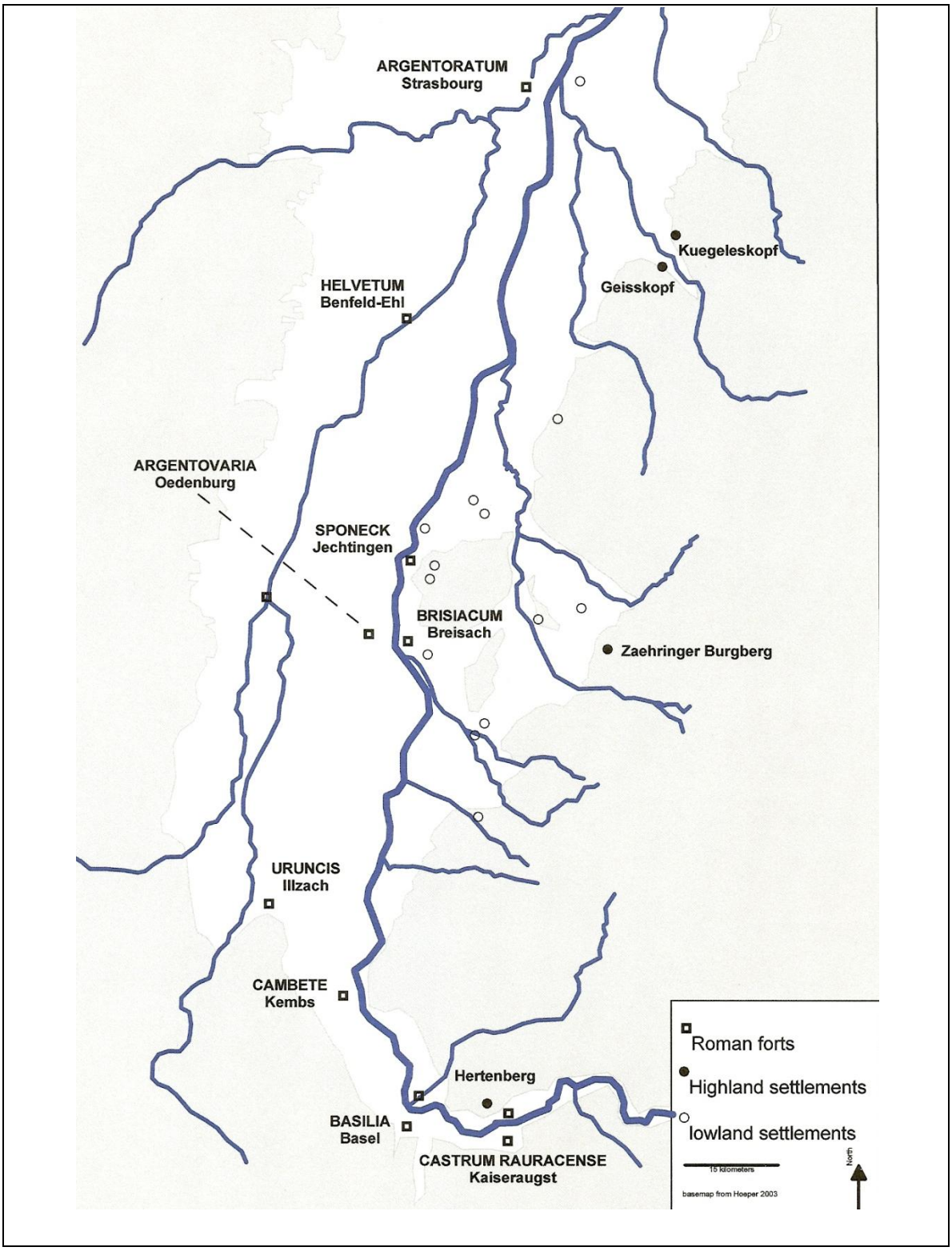

Figure 5.6. Upper Rhine Roman forts and non-Roman highland settlements.

Geißkopf (along with nearby Kügeleskopf) and the Zähringer Burgberg and among the more interesting given their proximity to Roman military establishments (Figure 5.5).

Geißkopf/Kügeleskopf The Geißkopf and the Kügeleskopf lie on opposite sides of the Kinzal river valley approximately 25 km east of the Roman fort at Strasbourg (*Argentoratum*) (Figure 5.6). The occupation area for both sites (Geißkopf: 100 m by 150 m; Kügeleskopf: 20 m by 50 m) is comparable to many other highland settlements of the period. An interesting difference lies in their proximity to a major Roman fortress and a large assemblage of military artifacts[89].

Approximately 1300 metal artifacts were recovered from the Geißkopf including: 18 Roman coins, 60 complete pieces and fragments of Roman military belts, 13 fibulae, and 50 bronze vessel fragments (Hoeper 2003). Out of 732 iron artifacts, 77 were complete or fragmentary weapons: nine javelin or spear points, 10 arrow points, 25 ballista bolt points, 29 axe fragments, and four sword fragments. Much of the weapon assemblage dates stylistically to the last half of the fourth century to the first half of the fifth century, with the axe fragments dating slightly

[89] Inscriptions place *Legio VIII Augusta* there in AD 371.

later. The fibulae include both Roman (2 of 13) and non-Roman forms (11 of 13). The Roman forms (*Emailscheibenfibe*l and *Zwiebelknopffibel*) were worn by army officers as badges of rank with the latter apparently given to non-Romans serving in the Roman army (Koch 1985)[90].

Five javelin points are similar to those recovered from Roman military establishments and the remainder are forms similar to those from east of the Rhine and even Scandinavia. Researchers interpret this assemblage as the result of individuals who, having served in the Roman army returned home with their borrowed equipment (Hoeper 2003). The presence of Roman military belt pieces is also indicative of this and this evidence, in general, points to an ability of individuals to move between "Roman" and non-Roman spheres of influence. The arrow points are a non-Roman form that has also been recovered from highland settlements throughout southwest Germany. The weapon finds are distributed more or less evenly across the surface of the Geißkopf except for the spear points which tend to be concentrated on the eastern side of the hill and the bolt points which tend to found on the saddle to the west of the main plateau.

[90] This type appears on the famous diptych of Stilicho.

A significant portion of the artifact assemblage points to a domestic occupation of the Geißkopf in addition to the military component including: knives, fire starters, tools for textile and leather working, metal combs, and woodworking tools. Stylistically, these finds are similar to those from sites throughout Germany, indicating a non-Roman origin.

Approximately 137 metal artifacts were recovered from the Kügeleskopf, a substantially smaller number than the assemblage from the Geißkopf. Out of 94 bronze objects: six were Roman coins, three fibulae, a needle, 29 complete and fragmentary pieces of Roman military belts, five bronze vessel pieces, with the remainder being unidentified fragments. Forty three iron objects were recovered including: two arrow heads, four fragmentary axes, five household implements, two nails, and a number of unidentified fragments (Hoeper 2003).

Two of the bronze fibulae are a style (*Emailbügelfibel*) that is also known from the Roman settlement at Riegel near the Kaiserstuhl, approximately 30 km to the south of the Kügeleskopf. This fibulae type dates at Riegel to the second and third centuries (Hoeper 2003). The third fibula is a non-Roman type (*Armbrustfibel*) that is similar to types from the northern Elbe region dating to the middle of the fourth century (Schulze 1977).

Zähringer Burgberg The Zähringer Burgberg is a small prominence in the foothills of the western Black Forest (Figure 5.6). Its peak offers an unobstructed view of the Dreisam river valley, north and south, as well as the Kaiserstuhl, on the Rhine where in the fourth century two Roman forts (*Brisiacum* and Sponeck) were located.

This site had been occupied during the Hallstatt period (3200 – 2500 BP) during which a small bank-and-ditch ring fort was constructed. During the first century AD, the Romans quarried stone from the hill. The Alamannic settlement had two phases. The first phase, early in the fourth century, a ditch and embankment system was built although no other structures were identified (Bücker 1994). Construction of large stone and timber terraces occurred during second phase in the late fourth century. The builders used approximately 20,000 cubic meters of stone from nearby quarries to fill the space behind a wall of alternating stone and timber courses (Hoeper 2005). The terraces were more than six meters high in some places, and extended the inhabitable space for the highland settlement to about 4.5 ha[91]. Aside from the terraces that are built upon earlier Hallstatt foundations, the evidence for other structures, for example post holes, is sparse.

[91] The earliest construction at this site is a Hallstatt period earth and timber wall (Steuer and Vollmer 1991). The Runde Berg occupation, in contrast, was only about .33 he (Hoeper 2003),

The artifacts recovered include weapon (sword and spear) and armor fragments, silver hair-needles, jewelry, glass beads, manufacturing tools, Roman and non-Roman glass vessel fragments, and non-Roman ceramics. In addition, several military belt fragments and bronze and silver neck rings were recovered. These finds are similar to those recovered from Roman forts at Breisach and others on the Rhine and reflect the fluid nature of cultural contact in this region. Although, the Zähringer Burgberg lacked the large production facilities observed at other highland settlements the presence of weapons, trade goods, and the large terraces is indicative of an elite, either a person or group. The terraces, although not as obvious a defensive measure as an *oppidum*'s walls, could nonetheless serve to protect a ruler from attack and from the position of the highland settlement persons living there could have ample ability to influence movement and trade from the Rhine into the interior of the Black Forest. In addition, the terraces represent a large investment of labor and the ability to organize such a project is indicative of a person of great authority.

Combined Settlements

The lack of obvious defensive structures at the Geißkopf/Kügeleskopf and the Zähringer Burgberg is interesting in light of some of the lowland settlements that developed in the region between the Black Forest and the Rhine. In the fourth

century, and certainly later, artifact assemblages show interesting combinations of "traditionally" Roman and non-Roman traits. As demonstrated first century sites at Weil and Bötzingen, individuals could choose from different kinds of artifacts or assemblages of artifacts to express their particular identity. During the fourth century, artifact distributions indicate that individuals could move between "German" and "Roman" contexts with little difficulty. Military belt fragments, insignia (neck rings), and weapons from the Zähringer Burgberg are nearly identical to those from the Roman forts at Basel, Kaiseraugst, and Breisach. It appears archaeologically as if the Roman soldiers protecting the borders are the same people whom the Romans are supposed to be defending against. An interesting example of this cultural mixing occurs at the Roman fort at Sponeck.

Sponeck The late Roman fort at Sponeck lies on a side channel of the Rhine at the northeastern corner of the Kaiserstuhl (Figure 5.6). The structural remains at the site consist of partial wall foundations, traces of wooden buildings, and, outside the walls, a cemetery interpreted by Fingerlin (1990) as "Alamannic". Within the fort and the cemetery are artifacts typically associated with "Roman" sites, for example glassware, coins, and terra sigillata, and artifacts that are typically "German", for example, hand-made pottery. Researchers (Neirhaus

1966; Schönberger 1969) have suggested that in the late 1st century BC, and prior to occupying southwest Germany, the Romans actively encouraged settlement by trusted clients near their forts as an additional means of securing the eastern bridgeheads over the Rhine. Perhaps a similar policy existed during the third century as well and the inhabitants at Sponeck were Germanic clients of the Romans.

The artifact assemblage, however, suggests something more complex. The architecture of the wall, and the construction techniques used to build it, are similar to those found throughout Gaul. The artifact assemblage, as mentioned above, is a mixture of trade goods and locally produced items and similar to assemblages from the hilltop settlements. A unique aspect of the Sponeck assemblage is that many of the stylistic elements present on in the ceramics do not occur in any of the other ceramic assemblages in the region, either Roman or non-Roman. In addition, some of the graves in the cemetery do not conform to expectations what a "Germanic" cemetery should look like. One in particular is that of a female who was buried with a military belt around her waist (Bücker 1997) and, in contrast to other similar female burials of this period, no other military objects. The blending of Roman and non-Roman objects suggests a garrison whose inhabitants were supplied from a variety of sources. However,

the addition of some unique features in the artifact assemblage may be indication that the inhabitants here were also participants in a developing culture that was neither entirely Roman nor non-Roman.

THE FRONTIER CULTURE

This chapter has examined some of the archaeological evidence for cultural interactions between Roman and non-Romans in southwest Germany. At the beginning of the first century AD, the inhabitants of this region were varied in their response, as it can be measured by the material culture, to the incoming Romans. From Weil and Bötzingen we see a gradual adoption of some new burial practices as well as retention of old ones. Through time we see a reintroduction of burial practices that had been missing for decades. Some aspects of the material culture, such as house construction, varied quite little over the period of Roman occupation. In the third century and later, we see that the material culture continued to be a blending of Roman and non-Roman artifacts and, presumably, patterns of behavior. The overall picture provided is that what develops in southwest Germany from the first through the fifth centuries is a new culture, a frontier culture and a unique one that did not conform to picture of the frontier provided by historical sources or archaeological analyses based on

those sources. The next chapter will present a method of analysis for this new culture.

CHAPTER SIX

CULTURAL PERSISTENCE AND CHANGE

IN SOUTHWEST GERMANY

METHODOLOGY FOR ESTABLISHING CULTURAL LINEAGES

On one level, frequency seriations treat each artifact identified as a member of a class as hypothetically related phylogenetically to every other member within that class given that they satisfy the above conditions. Lyman and O'Brien (2000) refer to this level as the "type/species sense of heritable continuity" (46). On a broader scale, multiple seriated classes are hypothetically related phylogenetically. Since the heritable continuity at both levels is hypothetical, the phylogenetic relationships of the classes are testable. If the requirements of seriation are met, then the frequency distribution of each class over time will display a unimodal curve (Detlefsen and Deetz 1966; Lipo, et al. 1997; Lyman and O'Brien 2000; Neiman 1995).

Combined stylistic elements in combinations with singly occurring elements can be seriated to display their frequencies through time. A disruption in the seriation sequence may be indicative of an intrusion of new memes into the

original group. Bentley and Shennan (2003) developed models that demonstrate the transfer of memes, that they call cultural traits, in situations of innovation, and adopting or resisting new cultural traits. Briefly, they support Blackmore's (1999) statement that invasion can occur when the fidelity of social learning and the fitness advantage of the new variant are high and the dominance of the old variant and the cost of selective imitation are low.

The seriation itself is a method to test the hypothesis that phylogenetic relationships of expressed memetic variants exist through the period under consideration. Neiman's (1995) calculation of the rate of adoption of new stylistic variants will allow me to address how quickly change occurred. In a defined time period, any individual will adopt a variant from any other individual with the probability, $(N - 1)/N$, and will retain their previous variant with the probability, $1/N$, in effect learning from themselves. These probabilities will be accurate in the absence of any selective pressure. Lipo et al. (1997) developed a model for artifact change in the Mississippi Valley based on Neiman's original formula imposing selective pressures such as varying interaction of persons across space and across cultural boundaries. They found that lineages of artifact variants tended to represent amorphous "clouds of interaction within a background of continuous transmission" (Lipo et al.

1997:327). Kendal and Laland (2000) developed mathematical models to describe the process of meme transmission and selection in an environment where there is competition between multiple versions of the meme.

A first step in analyzing a stylistic distribution should be to consider whether it constituted a meaningful social difference, or whether it has no greater significance than identifying the limits of a system of production and exchange. Hodder (1974) identified boundries of social groups by plotting the frequency of various artifacts with increased distance to find changes in the slope of the falloff curve. Voss (1987) used similarity measures. Rapid decreases in similarity could be interpreted as boundaries between style zones. In both cases, inflection points could be interpreted as boundaries, but the nature of the social or political group enclosed was not specified. Emberling (1997) believes that a stylistic distribution larger than the scale of production and distribution suggests that some larger social meaning maintained the unity of style.

SUPPORTING THEORIES AND METHODOLOGY

The concept of the "individual" is a cornerstone of modern selectionist theory (Darwin 1859; Mayr 1976, 1982). Individuals are the units of selection, but

necessary to this idea is the "population" of individuals that evolves. Individuals are selected and, as a result, populations evolve. In most evolutionary analyses the "individual" unit of selection is a self-contained organism displaying traits, usually physical or behavioral, that are the manifestation of some underlying code, for example genes. Selective forces act upon variation present in these organisms and adaptive variants will generally occur more frequently in future generations, in the absence of random events or migration.

Memetic Theory

In the final chapter of *The Selfish Gene*, Dawkins speculated that human culture might be hiding an additional replicator in addition to the gene, which he called the "meme", a combination of memory and mimetic with gene to refer to "a unit of cultural transmission, or a unit of imitation" (Dawkins 1989:192). Examples of memes included "tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches" (Dawkins 1989). The meme's environment is the brain, or perhaps media such as books or computers, and they are transmitted through imitation, reconstruction, and other learning mechanisms (Blackmore 1999; Reader and Laland 1999).

Memes, however, are not tied to the fitness of the biological structures they inhabit, they represent an entirely independent evolutionary sequence, "Once this new evolution begins, it will in no necessary sense be subservient to the old" (Dawkins 1989:194). This is different from genetically programmed features of organisms such as immune systems and synaptic connections, characteristics that are also shaped by selective processes analogous to natural selection but which ultimately serve the reproductive success of the genes (Jeffreys 2000).

Blackmore (1999) correctly states that for something to be a replicator, an "individual", it must be transmitted, and through transmission, variation can be introduced although it must retain some amount of fidelity through a series of transmission events. Errors of transmission, which are incomplete or incorrect messages sent or received, result in new expressed variants rather than in the replication of the original variant. The variant must exist to be transmitted, but it does not necessarily need to be transmitted simply because it exists (Lyman and O'Brien 2000). There must also be selection and retention in the new environment. Dennett (1995) phrased the necessary characteristics of a meme as: transmission-fidelity, fecundity, and longevity. While it is true that selection works on an individual, what are actually being selected for or against are phenotypic features that are manifestations of deeper units. The deeper units

themselves, genotypes or memotypes, are only indirectly sorted. Sorting events can be a source of change but they are generally undirected and randomly occurring, such as random sampling error during transmission or extinction events.

Cultural Virus Theory

Cultural Virus Theory (CVT) is an approach that focuses attention on the survival and reproduction of particular ideas, artifacts, and behavior patterns in and of themselves, rather than as traits of human individuals (Cullen 1993, 1996a, 1996b). This is however, more than just the old "artifacts as organisms" argument. It is based on a different set of premises; that artifacts, ideas, and behavior patterns (cultural phenomena) are not "organisms" as such, but rather "quasi-organisms" or "viral" parasitic phenomena, competing for survival in a cognitive environment. Since ideas and artifacts are genealogically independent from people, they are ecologically equivalent to domesticates; yet since they do not exhibit most of the processes associated with life (such as breathing or growing) to the same extent as organisms, some other term is required. Cullen (1996b) uses the term viral phenomenon to capture this combination of dependence and independence, and of living and non-living. One drawback to the viral metaphor is our lack of understanding of the full range of viral

capabilities. Certainly not all viruses act as retroviruses do, and the analogy may break down under closer scrutiny. Perhaps a better term for a cultural phenomenon is "expressed memetic variant" or, more simply, "expressed variant" (EV).

As viruses, they may be benevolent, or malevolent; as quasi-organisms, those that best promote their reproductive success through their transmission from person to person undergo differential reproductive success. The term viral phenomenon is simply an arbitrary category designed to summarize as many of the peculiar qualities of cultural phenomena as possible without limiting them to a role as "doppelgangers" of microbial viruses.

CVT may also be contrasted with meme theory by the fact that it developed in the context of Australian archaeology rather than modern evolutionary biology. It is distinctly artifact-oriented, influenced by the ideas of Clarke (1968), Dunnell (1989, 1992), Hodder (1982), O'Brien and Holland (1990), Renfrew and Zubrow (1994), Rindos (1986), and Shanks and Tilley (1987). CVT drew its neo-Darwinian theory from Dawkins rather than meme theory. Where Dawkins tends to place most of the "agency" for change in the self-replicating meme, CVT locates the primary agency in human consciousness and individual action.

According to Cullen, then, the conscious agent is then viewed as domesticating or selectively breeding and actively replicating cultural phenomena. CVT, in contrast, draws from Dawkins the idea that cultural phenomena themselves are the smallest indivisible units or "individuals".

> A typical human psyche is made up of countless thousands of separately transmittable ideas, concepts, and techniques. Any idea which can be taught or imitated in a single moment of comprehension, or in a series on interdependent moments of comprehension, must surely qualify as a "cultural individual" far more rigorously than an entire human psyche (Cullen 1993:184)

Combining Memetic and Cultural Virus Theories

A meme, once it has been "infected" by an EV, may have its fitness increased if the virus can collect sufficient energy from the environment in competition with other infected memes. Increasing energy returning to the meme may create a feedback system where the supporting environment for EVs improves due to more energy, allowing more EVs to be supported, and thus allowing for greater variation among EVs. An automobile manufacturer may begin by producing only a limited number of models, but if the models are successful, greater energy is returned to the manufacturer, which allows for the production of other kinds of models. Selection acts not on the meme itself but rather on its phenotypic expression produced by EVs. The meme may be the idea or memory, but the virus is the behavior and/or artifact produced by the idea. The virus, i.e.

behavior or artifact, is supplied with an environment and a means of transmission.

Culture as a Meme-set

Cullen's "cultural individual" is an idea existing in the human brain and this individual is roughly analogous to a genetic *locus* on a chromosome. In genetic terms, the sums of these *loci* comprise a genotype which is then physically expressed as a phenotype with great influence from the environment. Groups of organisms who share a genotype are a species and contained within this are considerable amounts of variation.

An individual's cultural identity can be conceived of as a set of memes that are acquired through contact with others (culture is shared). Within memetic identity is a core set that represent those ideas about oneself that are especially resistant to change, that is they have the highest fitness. Surrounding this core-set are successive "clouds" of memes that also contribute to identity but have reduced fitness (Figure 6.1). These outer clouds represent those areas where changing ideas about how a cultural organism conducts oneself within culture reside. When memes invade though interaction or are conceived of through

innovation they reside within these outer meme clouds. If the meme has sufficient fitness then it may eventually reside within the inner cloud of identity.

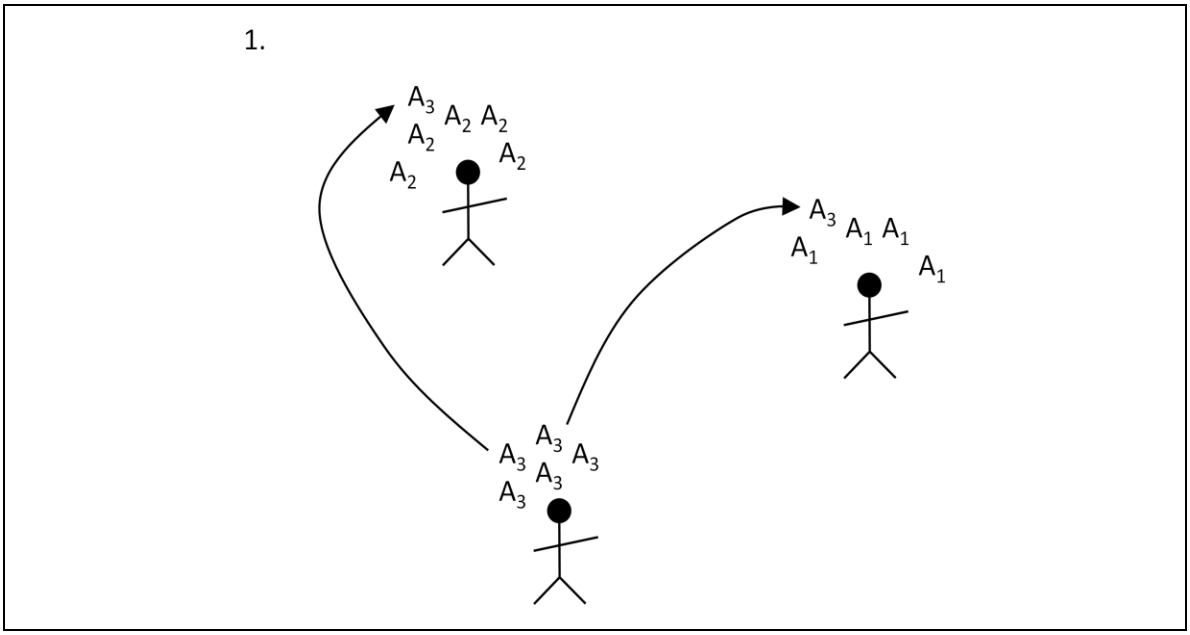

Figure 6.1. Individuals from a community will possess similar cultural nuclei or meme-set (A). Each individual will possess variants, for example A_3, which may invade neighbors if it possesses high enough fitness.

A culture can be conceived of as a group of individuals who share core meme-sets. Just as there is variation in meme-sets between individuals there is variation in meme-sets between cultures. The variants with the lowest fitness would reside in the "highest" meme clouds while core cultural memes reside within the higher fitness clouds. Cultural contact results in an exchange of memes that, depending on the rates of their fitness, can reside in different meme clouds (Figure 6.2). Cultural change occurs through this kind of contact as well as innovation of new memes produced by individuals within a culture and the

success of these memes in entering and residing in particpants' meme clouds. Cultural assimilation occurs when one culture's meme-set possess greater fitness than another's which also regulates the speed of assimilation. If neither culture's meme-set is more fit then mutual transference occurs and a creolization may occur.

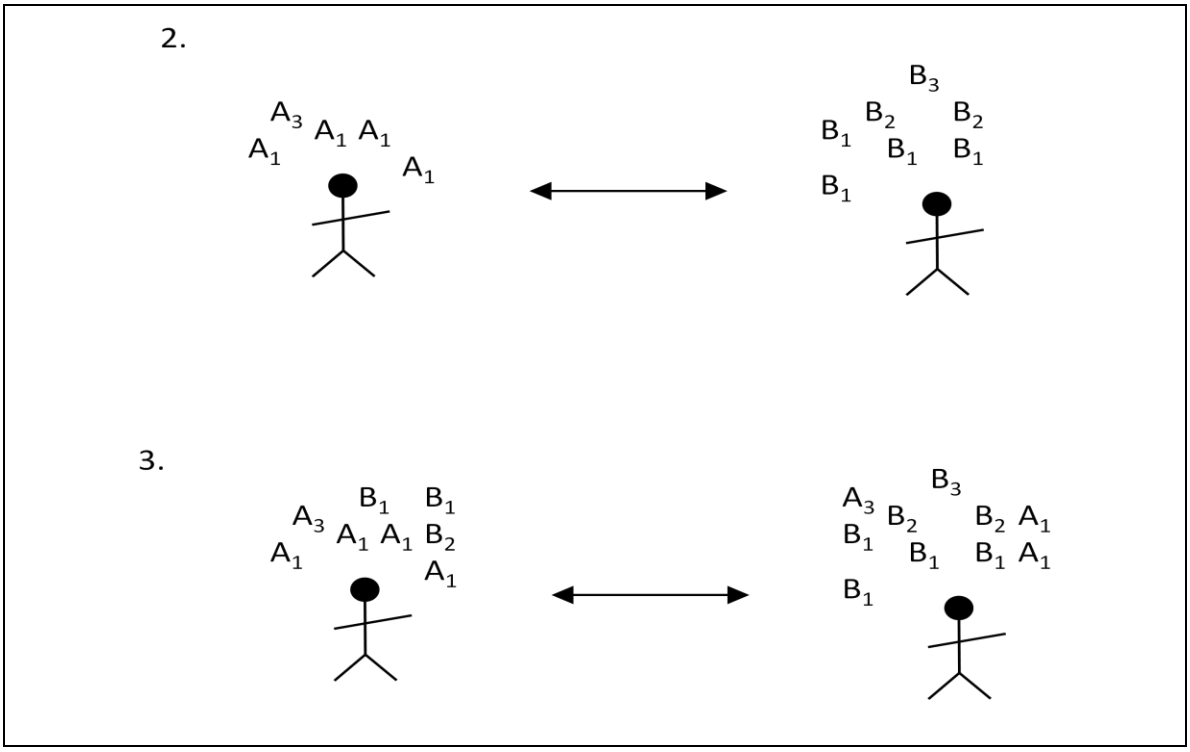

Figure 6.2. Different cultures possess different meme-sets, for example A and B. When cultures come into contact meme transference can occur if meme fitness is high enough.

DATA SOURCES AND COLLECTION

Data were collected from 14 sites in southwest Germany (Table 1.1).

For this analysis I created a paradigmatic classification for ceramic artifacts concentrating on stylistic and formal variables (Table 6.1). The intersection of dimensions in a paradigmatic classification creates classes based on a set of mutually exclusive alternative features or modes (Dunnell 1971). All class definitions are based on the same set of dimensions of features; individual classes are distinguished from one another by the unique intersection of features from the set of alternative features. Dimensional variability is divided into mutually exclusive categories called modes.

Table 6.1. Formal and stylistic dimensions.

Vessel Shape	Orifice Shape	Position of Rim Thickness	Shape of Thickened Part of Rim
1: spherical	1: unrestricted (greater than max. diameter of body)	1: interior	1: rounded
2: ellipsoid	2: restricted (less than max. diameter of body)	2: exterior	2: tapered
3: ovaloid	3: neck	3: interior/exterior	3: squared
4: cylindrical	4: collar	4: indeterminate	4: flared
5: hyperboloid	5: other	5: not applicable (body or base sherd)	5: other
6: conical	6: unknown		6: not applicable
7: other			
8: unknown (broken)			

Table 6.2 (continued). Formal and stylistic dimensions.

Junction of Thickened Part with Wall	Point of Greatest Rim Thickness	Characteristic Point	Surface Treatment
1: abrupt	1: at lip	1: end point only	1: paddled
2: gradual	2: medial	2: vert. tangency, upper 1/3	2: scraped
3: not applicable	3: low	3: vert. tangency, mid 1/3	3: trimmed
	4: not applicable	4: vert. tangency, lower 1/3	4: smoothed
		5: corner point, upper 1/3	5: burnished
		6: corner point, mid 1/3	6: brushed
		7: corner point, lower 1/3	7: striated
		8: inflection point, upper 1/3	8: combed
		9: inflection point, mid 1/3	9: textured
		10: inflection point, lower 1/3	10: other
		11: other	11: unknown
		12: unknown	
Element Position	**Element Slope**	**Element Type**	**Element Association**
1: interior rim	1: horizontal	1: incised line	1: single element
2: exterior rim	2: diagonal	2: expressed line	2: two associated elements
3: neck/collar	3: vertical	3: appliqué line	3: three associated elements
4: medial	4: undecorated	4: incised geometric	4: four associated elements
5: low	5: circular	5: expressed geometric	5: five associated elements
6: other	6: circumflex	6: appliqué geometric	6: greater than five associated elements
	7: other	7: punctate	7: not applicable
		8: combed	
		9: pinched	
		10: undecorated	
		11: other	

Under a paradigmatic classification, an artifact is a nexus for a near-infinite number of measurable dimensions. Some are created through manufacturing processes, taphonomic processes add other dimensions, and archaeologists add still more during excavation and curation. Consequently, the dimensions chosen for this analysis are not the only ones available, merely ones used to address the questions at hand. None of the dimensions in a paradigmatic classification are weighted relative one to another. The presentation in Table 6.1 and the following description is entirely arbitrary. These dimensions are, in a memetic perspective, the manifestations of algorithms that, residing in a maker's mind, code for the expression of identity through ceramic style.

Form is classified by the curvature or angling of the vessel contour (characteristic point), shape defined by geometric solids and surfaces (vessel shape), and orifice characteristics (orifice shape, position of rim thickness, junction of thickened part with vessel wall, point of greatest thickness, shape of thickened part) (Rice 1987, Shepard 1976). Five dimensions refer to probable stylistic modification to the vessel's surface (surface treatment, element position, element slope, element type, element association) (Rice 1987). Dimensional variation that did not apply to a particular specimen, for example "mouth shape" for a body sherd, were classified as "unknown".

A vessel has three essential components: orifice, body, and base (Rice 1987). The body is between the orifice and the base and contains the point of maximum diameter. The position of orifice in relation to the maximum diameter of the vessel strongly determines the shape of the vessel. If the diameter of the orifice is equal to or greater than the maximum diameter of the body, the vessel form is unrestricted (Figure 6.3).

If the orifice diameter is smaller than the maximum diameter of the body, the vessel form is restricted. The orifice can be raised through a neck or collar. A neck is a restriction of the opening of the vessel beginning above the point of a vessel's maximum diameter while a collar begins at the point of maximum diameter. The rim of the vessel is often shaped, sometimes thickened or thinned, however not all of this treatment may be stylistic. Shepard (1976) argues that rim thickness may be related to a vessel's ability to resist thermal cycles and thus is a functional characteristic that may not be associated with social communication. However, I assume that even prosaic, functional dimensions can be considered the products of memes residing in a maker's mind.

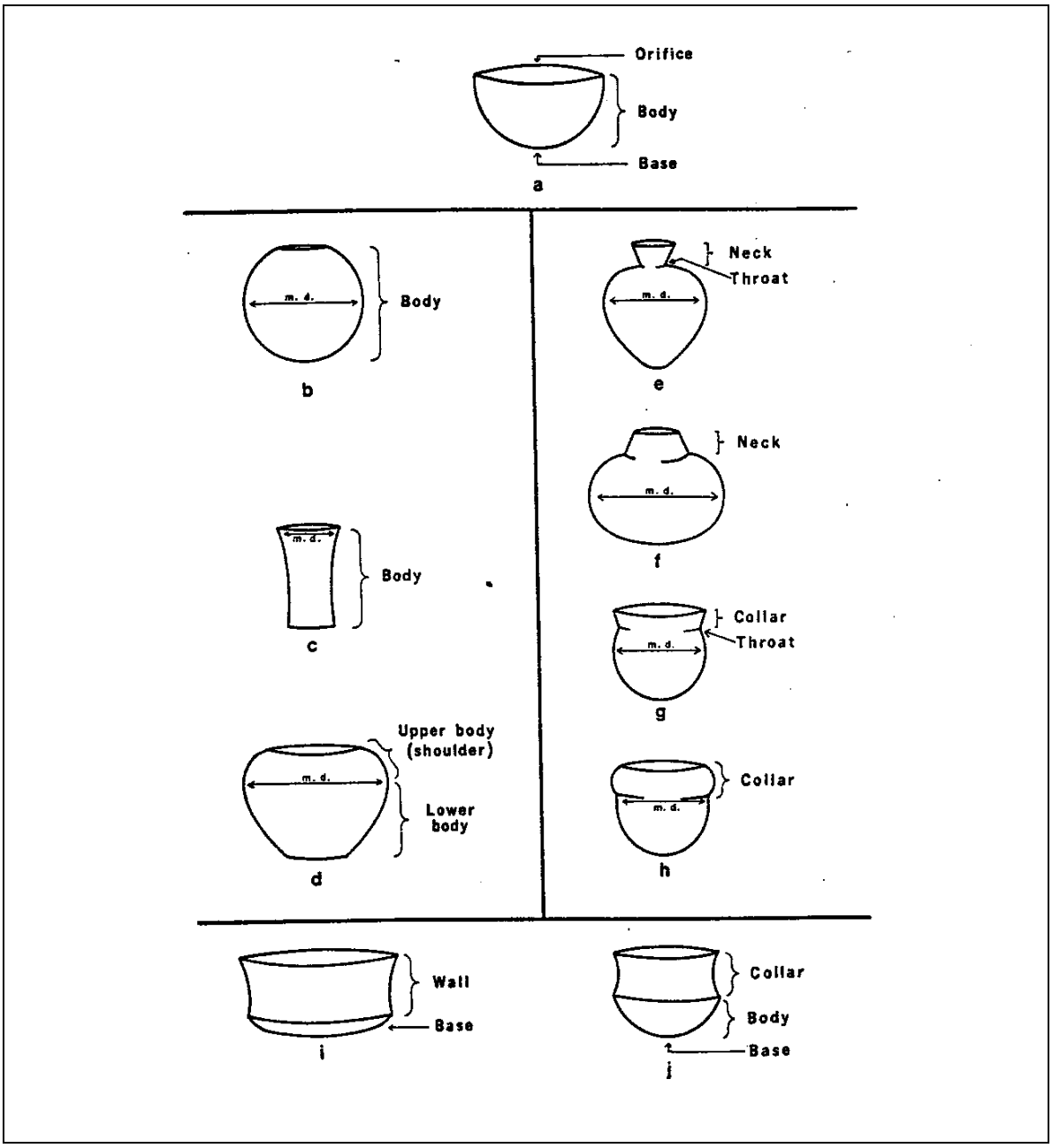

Figure 6.3. Vessel shapes (from Rice 1987).

Shepard (1976) defined four characteristic points that determine the contours of a vessel silhouette (Figure 6.4). End points are the points at the top and bottom of the wall silhouette, defined by the vessel's mouth and base. Tangent points are

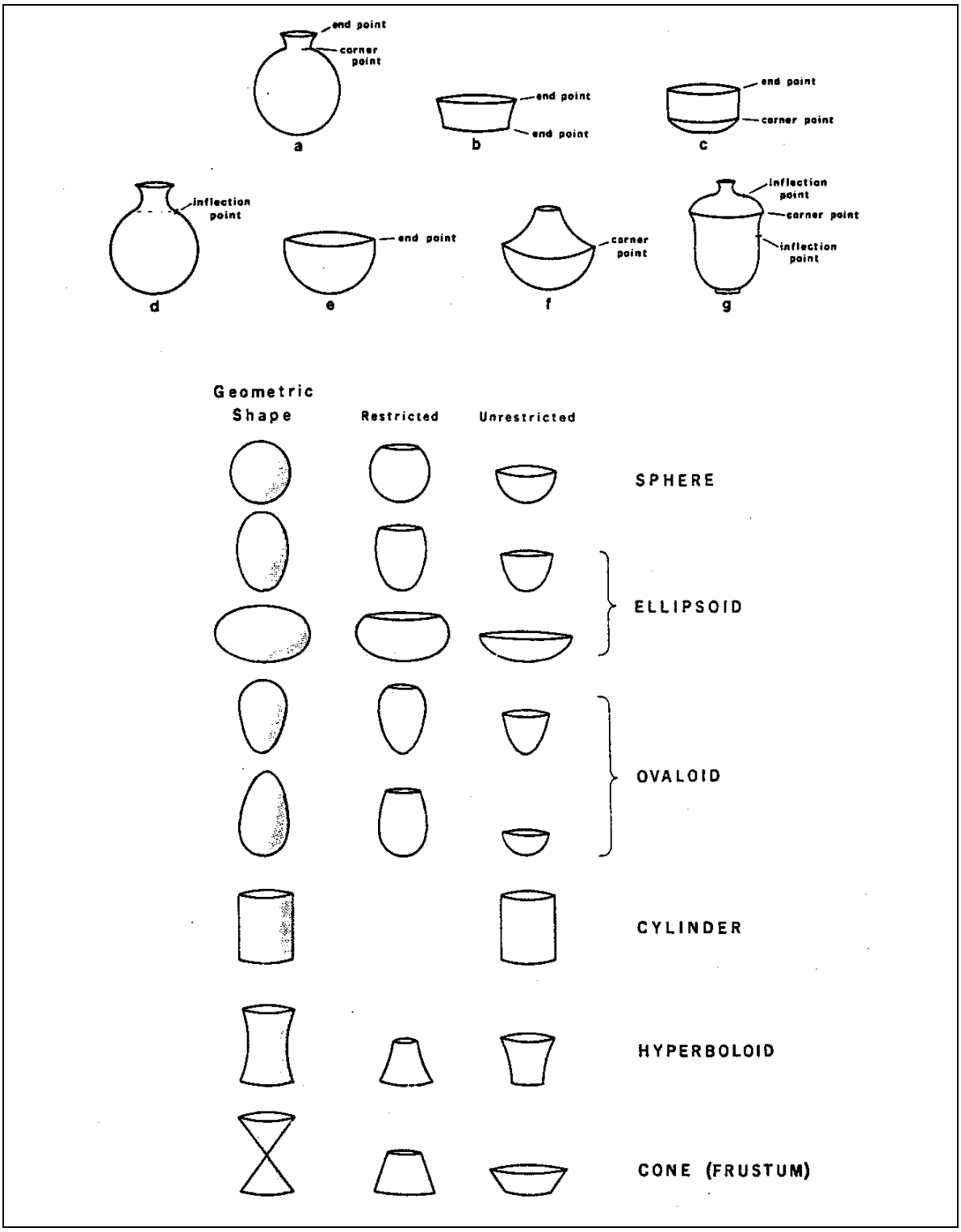

Figure 6.4. Vessel characteristic points (from Shepherd 1976).

points where the tangent of curvature of the wall silhouette is vertical; a corner point is an abrupt change in the orientation of a vessel wall or a distinct angle where vessel parts, as at the vessel's neck and body. An inflection point marks the change of direction of curvature of two parts of the vessel. Rice (1987) defined vessel shape based on three geometric solids (spherical, ellipsoid, and ovaloid) and three surfaces (cylindrical, conical, and hyperboloid) (Figure 6.4).

Concave or convex vessel walls are hyperboloid, while walls that slant in or out are conical. Ovaloid forms are generally egg-shaped; ellipsoid forms usually have greater width than the spherical forms. With low, unrestricted bowl or dish forms, it is often difficult to determine if the vessel is spherical, ellipsoid, or ovaloid (Rice 1987:220).

Surface treatment can occur at several stages during manufacturing altering the size of the vessel, thinning the walls, and finishing the surface while the vessel is still wet. This dimension may reflect functional and stylistic attributes in a manner similar to treatment of a vessel's lip. Paddling, beating the clay with a paddle often wrapped with cord or leather, is usually done to modify a vessel's shape, compact the paste, thin walls, and smooth the surface (Rice 1987). Scraping is used to finish vessels formed from coils, molding, or pinching.

Striations on the vessel surface are often the result of large grains in the clay dragged across the wet surface by a scraper.

A vessel is often smoothed to create a fine, even surface. A variety of tools are used in smoothing but the end result is often a matte finish with fine, shallow and parallel striations (Rice 1987). A burnished surface is similar but the clay particles are compacted and reoriented by rubbing back and forth with a smooth, hard object resulting in a lustrous surface. The vessel surface can be roughened or textured by using a brush, paddle, or comb.

A stylistic element is the smallest component of a design that is manipulated or moved as a single unit. Elements can exist singly or in combination with other elements. These basic units are the most immediately recognizable components of a design and are those that are most likely to be imitated or transmitted from maker to maker.

STYLISTIC ELEMENTS: GENERAL PRINCIPLES

A selectionist perspective in archaeology views any artifact as a nexus of attributes that are measurable. Functional attributes, such as the edge angle on a

tool or temper type in a ceramic, are attributes that are under selection pressure, that is, attributes that will more or less persist based on how well adapted they are to their task or environment (Dunnell 1978). Attributes related to style are selectively neutral, external pressures in no way affect them, and their existence, or persistence, is an arbitrary process determined by artifact makers. Archaeologists are able use style as a chronological marker because they are neutral.

A cultural virus perspective views artifacts as nexus of attributes as well but argues that those elements that one might call stylistic are as functional as edge angles and therefore are under selection pressures as well. Stylistic elements represent expressed memes within the mind of the maker, memes that are competing for space within the mind, memes that seek to replicate as much as memes representing more technological aspects of an artifact. By eliminating the distinction between style and function, one can use methods like seriation to examine the persistence of memes across space and through time as well as observe the "invasion" of new memes. Seriations might allow us to observe how suites of memes interact or how they interact when new persons possessing new memes enter a community.

Consider, for example, a village of non-Romans living at the edge of the Black Forest in the First Century AD. Each individual within this community possesses a suite of memes acquired by being a member of that community as well as new memes produced as innovations by that individual. The persistence, or fitness, of a meme is measured by its fecundity and fidelity and those that are the most fit are those most likely to reside permanently within the mind of the individual. In addition, these memes both most likely to invade new minds encountered as well as resist invasion. An individual's mind might produce a particularly fit meme that is transmitted by some medium of communication, for example speech or included as a set of memes in an artifact. If this meme lodges in enough minds in this community it becomes representative of that community along with any other particularly fit memes produced by that community. When and if, explicit media, for example pottery or burials, express these sets of fecund and transmittable memes then outsiders begin know that community for those meme-sets. Archaeologists identify these memes as expressions of identity in artifacts.

Memes and Meme-sets from one community may invade the minds of another community through direct contact between individuals or acquiring the artifacts

of a community, or communities, through trade. If these memes and meme-sets are more fit than the ones they encounter in the new community they may begin to reside in the minds in the new community and may even replace those that existed previously. When archaeologists observe, using artifact assemblages, a community adopting aspects of another's identity, it is this process of meme invasion that has occurred.

In the hypothetical first century village, let us assume that were particular methods of producing pottery, building houses, burying the dead, and so forth. These methods are a combination of "functional" memes, for example adding a certain kind of temper to clay, and "stylistic" memes. The fittest memes tend to cluster in a community among those individuals are in close contact with one another. When archaeologists identify spatial patterns of stylistic memes to recreate households and kin groups (Rice 1987) they are also identifying sets of memes that are common to a community.

In the following sections, I will examine the interaction of expressed variants within a community and between communities using two lines of material culture, ceramics and burials. In Chapter 1, I outlined my hypothesis: that the

"migration/population replacement" perspective is overstated due to classical accounts of culture contact; that the late Iron Age peoples of southwest Germany were replaced or assimilated by the Romans who were, in turn, replaced by the Alamanni. A replacement of expressed variants should appear in as a break in a series of frequency seriations similar to those shown in Figure 3.4. On the other hand, continuity between the first century inhabitants and those of the fourth century and later should appear as a series of complete seriations.

CERAMIC STYLE ELEMENT SERIATIONS

In Chapter 3, I discussed that frequency seriation is an archaeological technique for constructing and testing whether a temporal sequence is made up of homologous similarities (Dunnell 1970; Lipo et al. 1997; Nieman 1995; Teltser 1995). Homologous types, or in this case style elements, will display certain frequency distributions over time and space; non-homologous types will not display such distributions (Lyman and O'Brien 2000). The types are hypothetically related phylogenetically, given the requirement that seriations represent a single cultural tradition (Dunnell 1970; Ford 1949).

For this set of seriations I used three (element slope, element type, and element frequency) of the 12 dimensions listed in Table 6.2. Most of the remaining nine dimensions describe vessel shape and so I was able to increase the population sample size by including body sherds with partial rims where the shape is undetermined. The resulting paradigmatic classification has three dimensions and 25 modes for a combination of 539 possible style types. The style elements I observed in the 13 artifact assemblages comprised 29 style types and the temporal scale I divided into eight phases corresponding to a century from the 1st century BC to the 7th century AD[92]. I have combined some of these phases in the discussion below and Table 1.1 lists the sites included for each phase. When I reference to a particular stylistic element I will add its classification code (found in Table 6.1) in parentheses, for example (1, 2, 1) refers to a single, horizontal, expressed line.

I grouped the temporal phases into an early (Phases –I and I), middle (Phases II – IV), and late component (V – VII). One of my questions concerns the impact of the historical understanding of modern researchers upon the archaeological record. We know, for example, based on historical sources that the Romans

[92] Only a little more than five percent of the possible stylistic types were identified in the artifact assemblages. This may be indicative of the conservative nature of the ceramic manufacturers or perhaps sample size. Further work in this area may be able to sort this out.

arrived on the upper Rhine and then were pushed back by the Alamanni 300 years later. How do these sources condition our understanding of the culture contact in this area? Ford (1949) viewed time as a continuous "braided stream" divisions of which were created by us and were more apparent than real. Does the historical record impose a "layer cake" view upon us or are there clear divisions of "La Tené", "Roman", and "Alamanni" each replacing the next? I grouped the phases in order to cross-cut at least one of these boundaries that sources tell us occurred in the third century AD.

FIRST CENTURY BC – AD FIRST CENTURY (PHASES –I AND I)

The Romans advanced to the Upper Rhine in the late First Century BC and up to this point, their strategy had been primarily defensive[93]. It was probably between 16 and 13 BC that the legions were first stationed permanently on the Rhine at Xanten. The armies at this time were still highly mobile and the camps that supported them were used as strong points and supply depots. Auxiliary foot and horse operated smaller posts between the forts to maintain supply lines and provide security.

[93] Until 16BC, when the Sugambri defeated a legion under M. Lollius and prompted a revision of Augustus' policy.

The Romans refortified and extended the legionary camps west of the Rhine after the disaster in the Teutoberg Forest in AD9 as well as establishing a number of smaller forts near the project area at Basel and Augst. Throughout this period, a narrow strip of land east of the river up to the edge of the Black Forest lay under military control (Nuber et al. 1990; Schönberger 1969). Within this control zone, the non-Roman inhabitants established farms and cemeteries close to the Roman fortresses at Strasbourg (Argentoratum), Basel (Basilia) and Dangstetten, and probably others, and must have maintained close contact with soldiers. Under Emperor Domitian, in the 80s, the Romans advanced into the Taunus range east of Mainz and began constructing the *limes* system while in the Upper Rhine, the entire Black Forest was occupied and several large *colonia* were established, including modern Rottweil.

The most common stylistic element from Phase –I (55 percent) and Phase I (61 percent) ceramics is a vertical (type 3), combed surface treatment (type 8) repeated across the surface of the vessel (type 5) (typically called *Kammstrich*)[94] (Figure 6.5). In most cases, the vessel is smoothed but not burnished prior to treatment with the comb.

[94] This type of treatment is a common feature of late Iron Age pottery dating in southwest Germany into the fourth century BC (Bücker 2003).

Figure 6.5. Pottery sherd (DA 448.33) with *Kammstrich* (3, 8, 5).

Kammstrich is a very common ceramic stylistic element found on late Iron Age sites throughout central Europe (Fingerlin 1986; Rieckhoff and Biel 2001) and it appears in both of the first century sites examined in this study: Dangstetten and Diersheim. Dangstetten lies approximately half a mile from the Rhine River at the head of the Wutach valley that moves north into the Black Forest. The site is an Augustan Period fort that dates between 15 BC and AD 9 and is probably associated with Tiberius' campaigns in northern Switzerland (Fingerlin 1986).

The excavators recovered over 10,000 ceramic artifacts, a large percentage of which were vessels produced by local craftspeople in their own traditions. The local ceramics are typically hand-formed coarse vessels with rounded shapes probably used for storage or cooking (Figure 6.6).

Figure 6.6. Reconstructed hand-made vessel from Dangstetten (DA 53.34).

Other ceramics include wheel-turned coarse-ware vessels presumably made by Roman potters and imported to the site from Italy or Gaul. The ceramics of this latter category are associated with food service and eating. There is very little terra sigillata found at the site perhaps because the main production centers for this fine-ware at the time of Dangstetten's occupation were in central Italy and the provinces had yet to take up its use (Oswald and Pryce 1920).

Although the fort at Dangstetten was only occupied for 24 years, there accumulated a large assemblage of, predictably, Roman wheel-turned pottery. What is more interesting is that more than half of the total pottery assemblage consists of non-Roman hand-made pottery. The presence of this latter element strongly suggests that the social relationship between the garrison and the native population reached beyond an occupier/occupied dichotomy. I believe that that the fort must have been in close contact with the non-Roman population and that its existence depended upon the cooperation of this group. *Kammstrich* appears on 83 percent of the non-Roman pottery from Dangstetten.

While vertical *Kammstrich* is common across the surface of the vessel, it is usually the only stylistic element present, occurring singly in 56 percent of Phase -I - I

artifacts. When it is in conjunction with another element, it is usually a horizontal combed (1, 8, 5) section or a row of horizontal punctates (1, 7, 1) or horizontal pinches (1, 9, 5) about 25 millimeters from the vessel rim (Figure 6.7).

Figure 6.7. Pottery sherd (DA 373.40) with punctates (1, 7, 1) and *Kammstrich* (3, 8, 5).

None of the artifacts from these early sites showed variation from this pattern, either it was only vertical *Kammstrich* or *Kammstrich* with a horizontal element at the bottom of the rim. About 20 percent of the hand-made assemblage was undecorated and of these, five vessels had some type of horizontal, usually

incised lines (1, 1, 2) decoration at the bottom of the lip. The lack of variability is interesting given that non-Roman potters probably had access to or knowledge of imported styles including the highly decorated terra sigillata. The presence of Roman settlements west of the Rhine and access to mass-produced ceramics seems to have had little influence on local production in terms of either manufacturing techniques or stylistic variations from the pre-Roman period.

The cemetery at Diersheim lies on a terrace 7 miles east of the Rhine and eight miles northeast of Strasbourg. A probable Roman road runs north south approximately 50 meters east of the site. The site consists of 39 cremation burials, initially placed into urns; however, most of the ceramic vessels were broken at the time of excavation (Nierhaus 1966). At Diersheim, *Kammstrich* remained in use into the third century (AD 260); in phase 2 it is present on 45 percent of the specimens and on 20 percent of the specimens in phase 3. Combing disappears after the third century AD.

The next most common stylistic element after *Kammstrich* are small patches where the potter has pinched the vessel's fabric between their fingers. The

pinches usually appear horizontally (1, 9, 5) (Figure 6.8) and are present in 14 percent of the assemblage.

Figure 6.8. Pottery sherd (DA 207.14) with pinches (3, 9, 5).

SECOND – FOURTH CENTURIES AD (PHASES II – IV)

In the early Second Century, the Romans had fortified entire length of the *limes* with a ditch and palisade and watchtowers from Mainz on the Rhine to near Regensburg on the Danube. Auxiliary foot and horse were stationed on the *limes*

itself while the heavy infantry remained behind in permanent camps on the Rhine. The region between was given over to civilian management and settlement as part of the province of *Germania Superior*. The Roman settlements within the project area were small towns (Riegel, Bad Krözingen) and country villas connected by the road from Basel to Strasbourg. In the late third century, the Romans withdrew to the east bank of the Rhine while still maintaining a close military presence at the fort of Sponeck (Fingerlin 1990).

For the non-Roman inhabitants of the area this period began in similar circumstances as the previous one ended. The sites at Weil and Diersheim point to a population that maintained many traditional aspects of their culture, for example the practice of placing artifacts in burials, which would have been recognized by any Iron Age La Téne visitor. However, at the same time they did not ignore their Roman neighbors and appeared to have borrowed cultural features that interested them, such as cremation burials. Two facets of second and third century life include the imitation terra sigillata mentioned in Chapter 5 and the persistence of *Kammstrich*. While not the dominant stylistic element, *Kammstrich* appears frequently in the Diersheim cemetery and represents a strong link to the pre-Roman past for the people in the third century AD.

The sites at Biengen, Breisach, Forchheim, and Weil am Rhein all contain ceramics from this component. While nostalgia is evident among the non-Roman assemblages there is a noticeable increase in the number of different stylistic elements appearing on ceramics of the third century. During the first century potters seemed conservative in their stylistic innovations and in a memetic perspective, vertically oriented *Kammstrich* possessed high fidelity and fecundity and resisted invasion even from marketed, mass-produced Roman luxury ceramics. By the fourth century however, *Kammstrich* has disappeared and style variability has increased markedly.

A stylistic element that seems to be characteristic of the fourth century, and later, diagonally oriented grooves called *Schrägkanneluren* (2, 1, 1; 2, 1, 2), that appear across the body of wide variety of vessels (Figure 6.7). This feature first appears on the upper Elbe River associated with the Semnones and are also considered characteristic of Alamannic pottery assemblages (Bücker 1999). Steuer (2003) has used *schrägkanneluren* to argue for the origin of the Alamanni within the Semnones a group of who moved from the Elbe across the *limes* in AD 260 and settled on the upper Rhine.

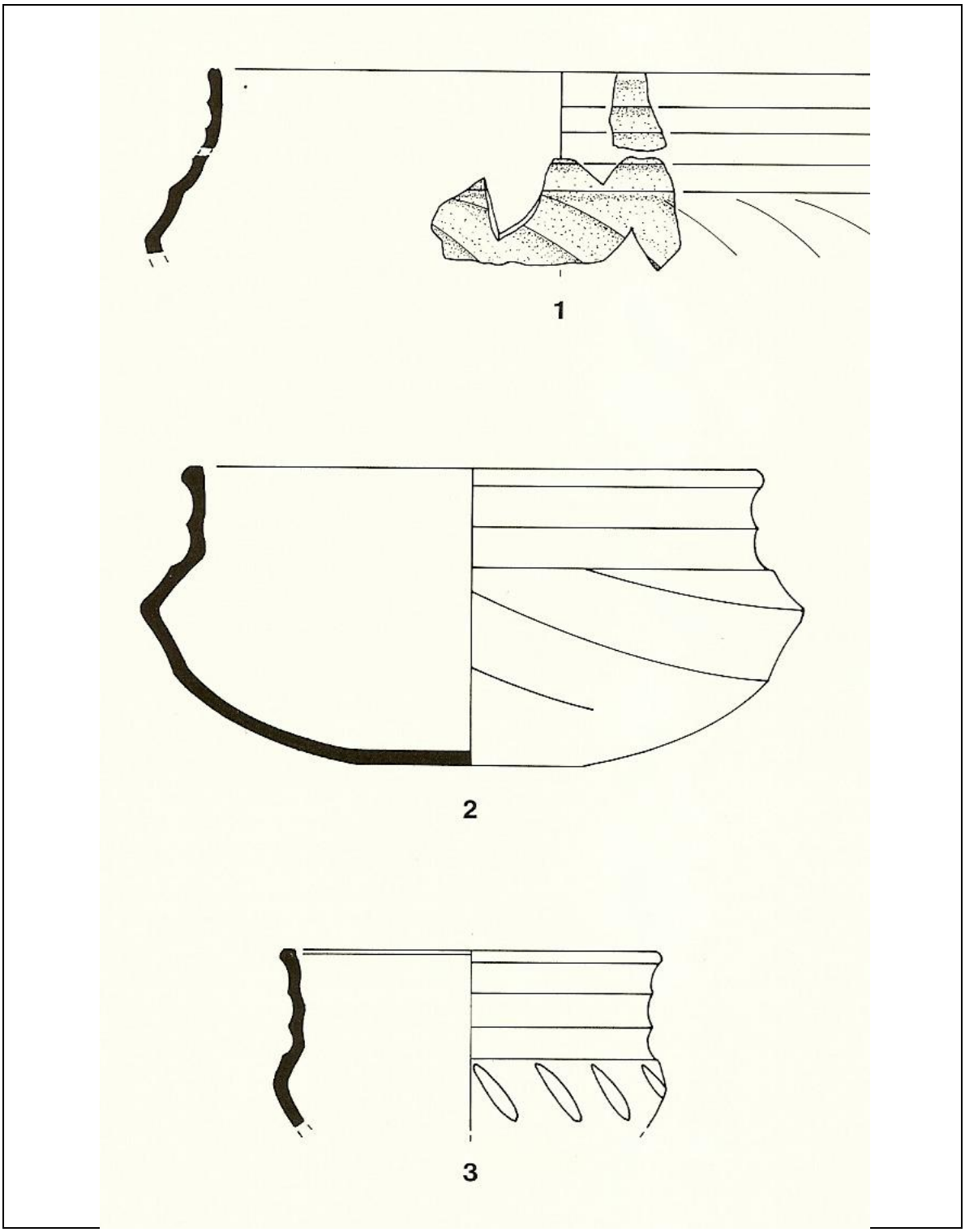

Figure 6.9. Ceramic vessels from Mengen with *Schrägkanneluren* (2, 1, 1) (from Bücker 1997).

Schrägkanneluren are not the only new stylistic elements that come into use during this period, however, and the overall richness of types is interesting. Circular incised (5, 4, 1; 5, 11, 5) features appear as well as expressed "knobs" (7, 9, 1) and appliqué lines (1, 6, 5) (Figures 6.8 and 6.9). In the first century, it was uncommon for a vessel to have more than two style elements. In this latter period, most vessels have more than five elements and the result appears that no one element is dominant, aside perhaps for *schrägkanneluren,* and fitness of all style elements has decreased relative to each other.

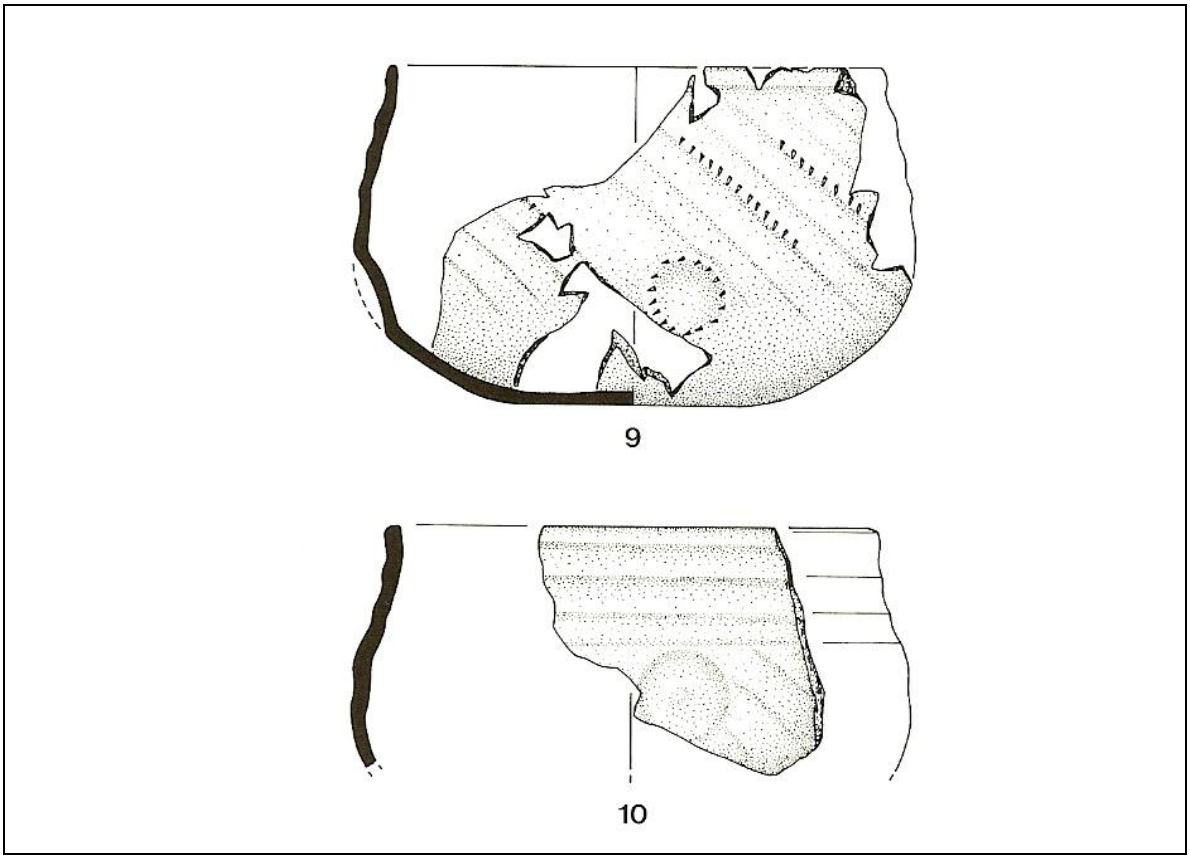

Figure 6.10. Ceramic vessels from Mengen with circular elements (5, 4, 1) and *Schrägkanneluren* (from Bücker 1997).

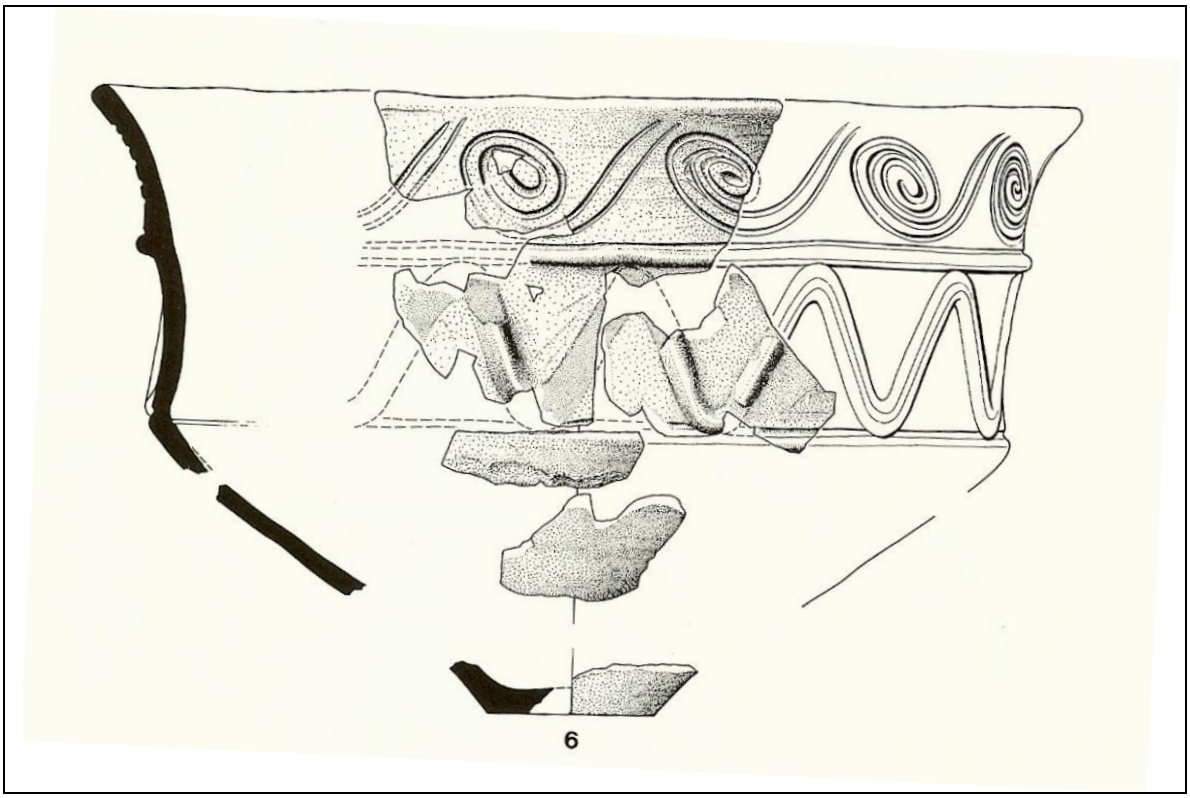

Figure 6.11. Ceramic vessel from Mengen with circumflex appliqué (1, 6, 5) and incised geometric shapes (1, 5, 1) (from Bücker 1997).

FIFTH – SEVENTH CENTURIES AD (PHASES V – VII)

The sites at Bötzingen, Buchheim, and Mengen all contain late component ceramics. The diversity of style elements continues into the fifth and sixth centuries; *Schrägkanneluren* are present as well as circumflex and circular elements. In the seventh century the proliferation of elements becomes so great that in my analysis I created an "other" category (7, 11, 5) to contain it and try to provide a convenient end point. One might argue that the increase in the number and diversity of style during this period is related to the arrival of the

Merovingians from the north who brought with them new meme-sets which were themselves the products of memetic invasions from Roman, British, and northern peoples.

DISCUSSION

The classes created by the paradigmatic classification represent clusters of expressed variants that tend to be transmitted together. The relative frequencies of these expressed variants measure their fitness in the competitive cognitive environment. Seriations for the style element classes are shown in Figures 6.12 - 6.16. They are grouped arbitrarily by element slope. In each figure, the number in the first position refers to a mode of element slope, the second number refers to a mode of element type, and the third number refers to a mode of element association (see Table 6.2 for explanation of the coding system, the style element classes for individual artifacts are given in Appendix 2). The temporal phases (-I through VII) are shown on the x-axis and the relative frequencies of each expressed variant are shown on the y-axis.

Table 6.2. Dimensions and their modes used in style element seriations.

Element Slope	Element Type	Element Association
1: horizontal	1: incised line	1: single element
2: diagonal	2: expressed line	2: two associated elements
3: vertical	3: appliqué line	3: three associated elements
4: undecorated	4: incised geometric	4: four associated elements
5: circular	5: expressed geometric	5: five associated elements
6: circumflex	6: appliqué geometric	6: greater than five associated elements
7: other	7: punctate	7: not applicable
	8: combed	
	9: pinched	
	10: undecorated	
	11: other	

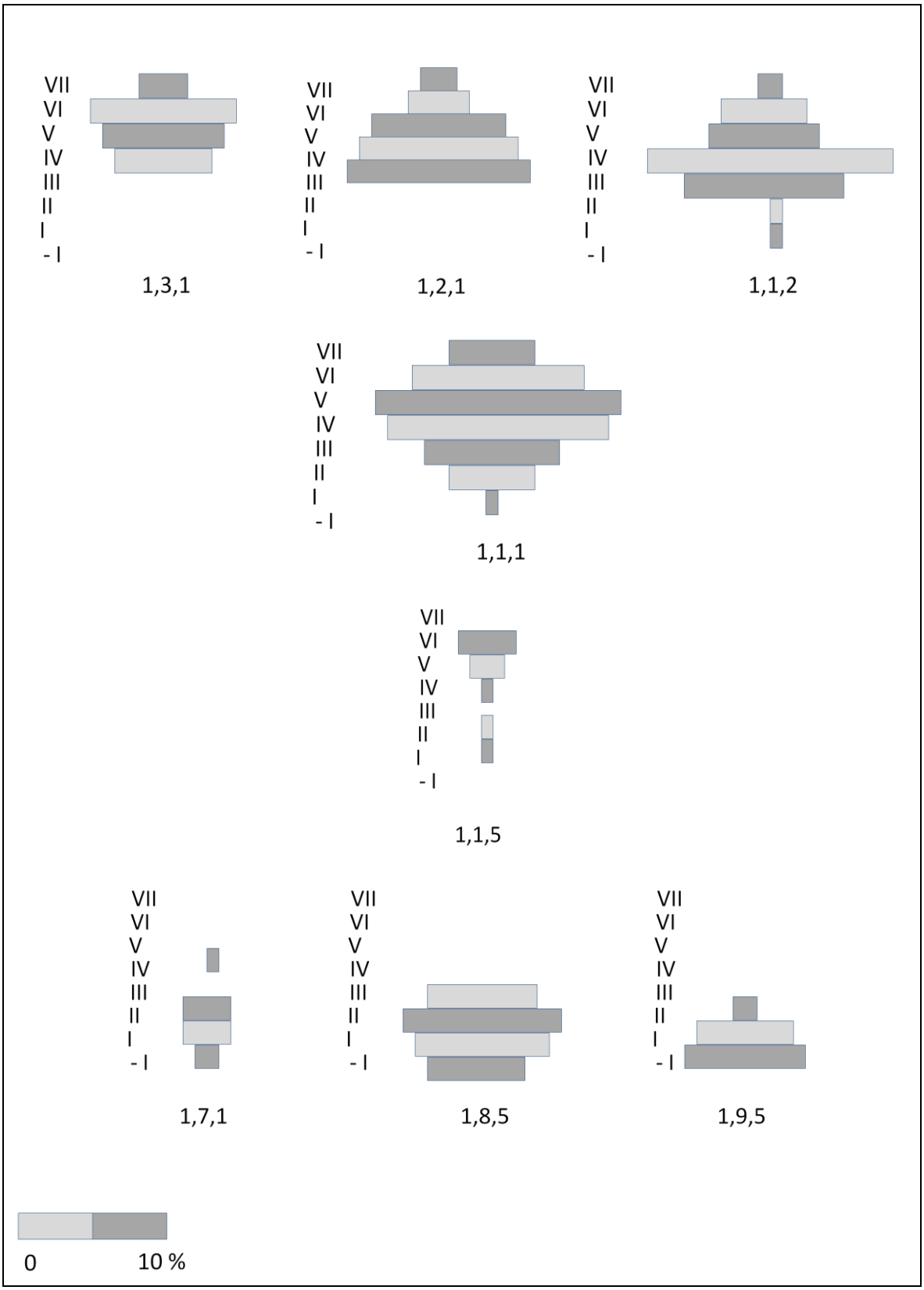

Figure 6.12. Seriations grouped by horizontal element (1, n, n).

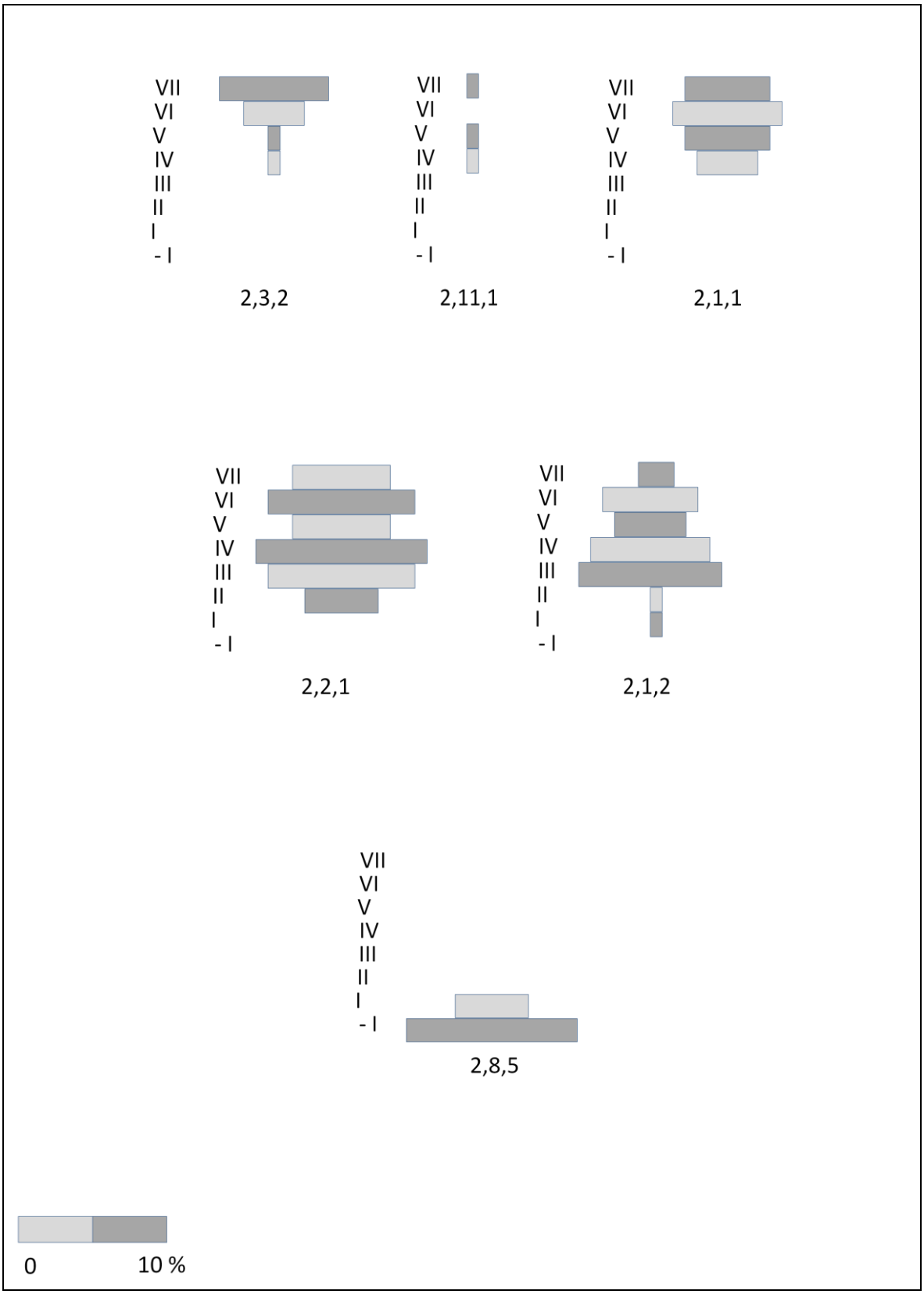

Figure 6.13. Seriations grouped by diagonal element (2, n, n).

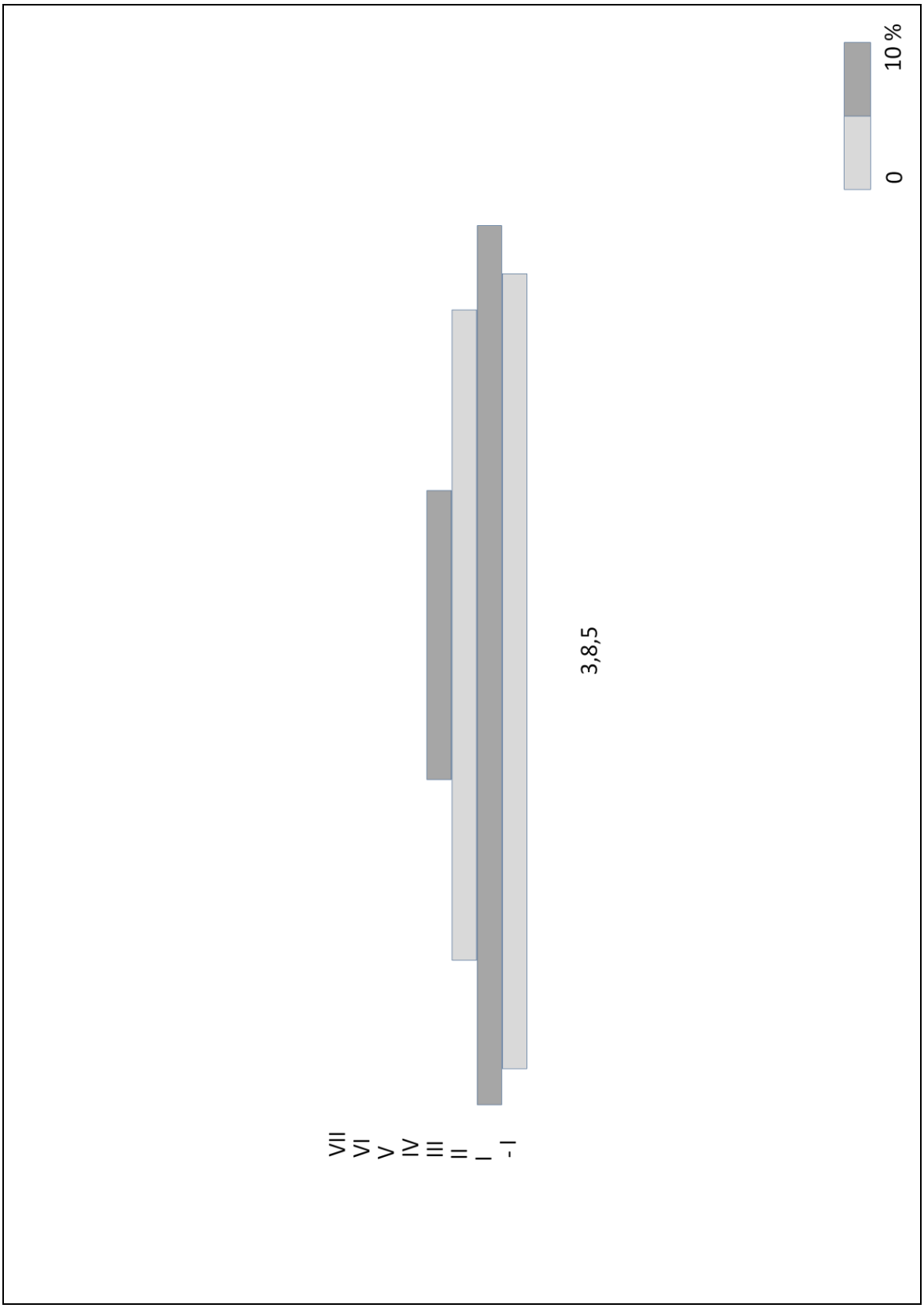

Figure 6.14. Seriation of vertically oriented *Kammstrich* (3, 8, 5).

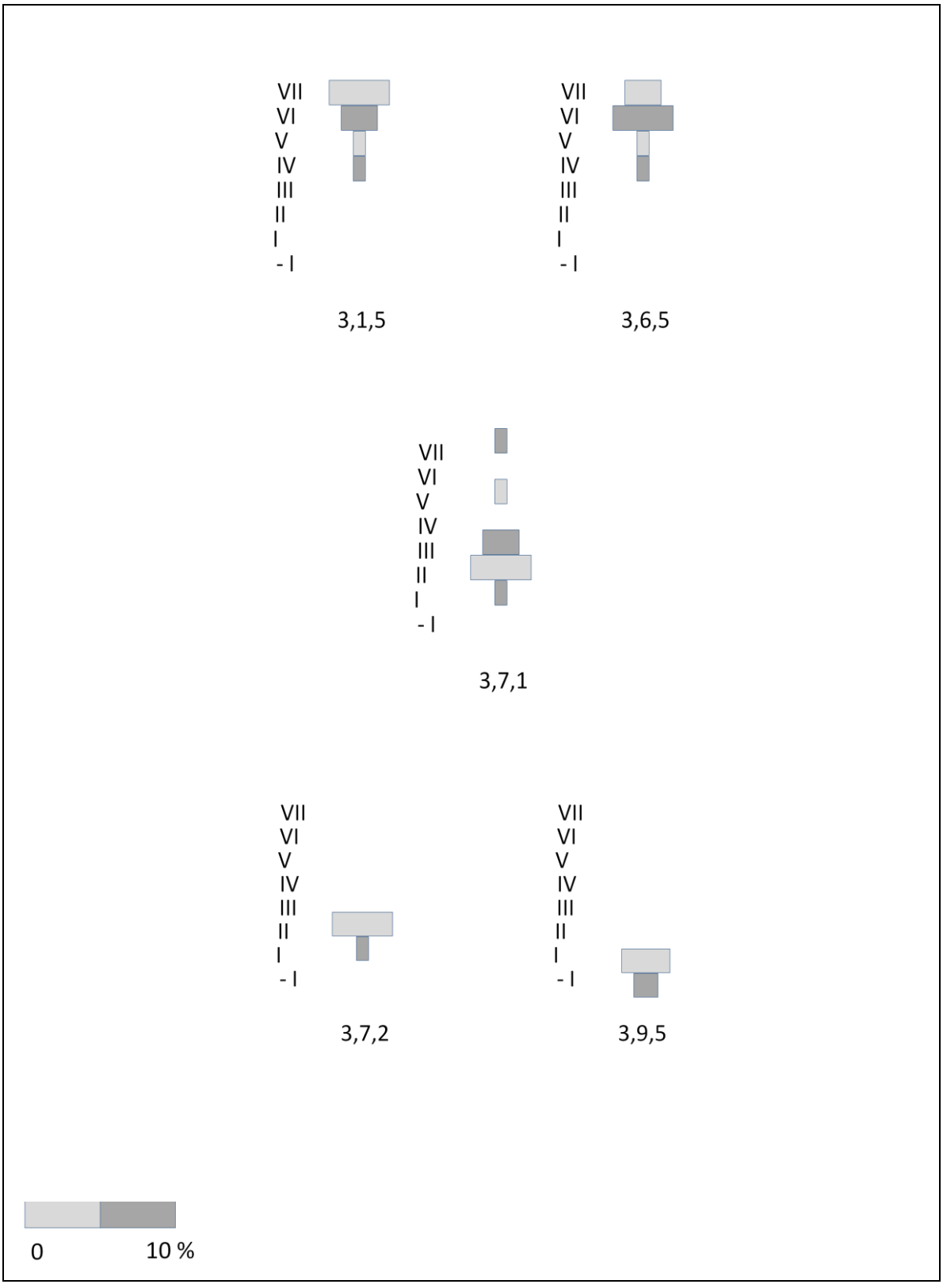

Figure 6.15. Seriations sorted by vertical element (3, n, n).

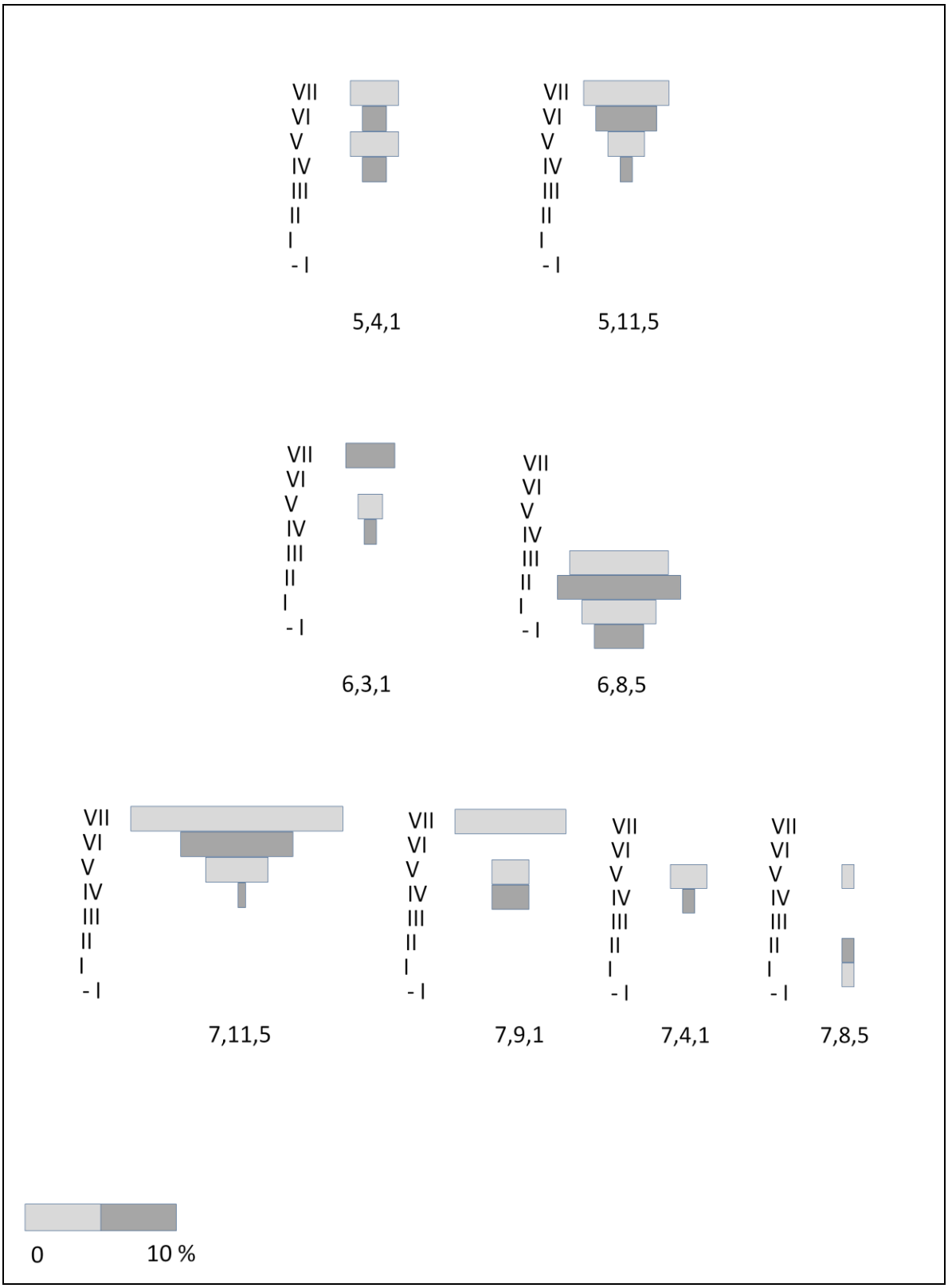

Figure 6.16. Seriations grouped by circular element (5, n, n), circumflex element (6, 8, 5), and other elements (7, n, n).

Style element slope and style element type are among the most cited ceramic features used to argue for cultural change in the project area (Bücker 1999; Fischer 1990; Kuhnen 2005; Nuber et al. 1990). If one assumes a population replacement model where Romans (and their culture) replace La Tené peoples in the first century and Alamanni replace Romans in the third century then seriations based on the material culture in this area should appear disjointed or "tailless" (Figure 3.4) (Dunnell 1970). Discounting the incomplete curves at the end of the seventh century, at which point this dissertation also ends, there does appear to be several instances where seriations are abruptly end. It does not occur in the first century where we might expect it if the Romans and their material culture overwhelmed the non-Roman population. Native stylistic elements persist, such as *Kammstrich* (n, 8, 5), and even flourish throughout the Roman period (Figures 6.12 and 6.14). If Roman forms possessed a high fitness relative to the cost of learning , $(N - 1)/N$, more non-linear, geometric forms appearing on native vessels influenced by imports to which there was access. Non-Romans within the project area did use items such as terra sigillata, and even tried to reproduce it, but it played a different role in identity, in burials, and apparently not in the artifacts of daily use.

The break in the seriations occurs in the third and fourth centuries when *Kammstrich* disappears, there is a reduction in the verticality of elements (Figure 6.13) and an increase in geometric designs, diagonal elements (Figure 6.11) and new forms in general (Figure 6.14). Figure 6.17 illustrates the relative percentages of element slope. A striking feature is the decrease in vertical elements during the fourth century coincident with an increase in diagonal elements.

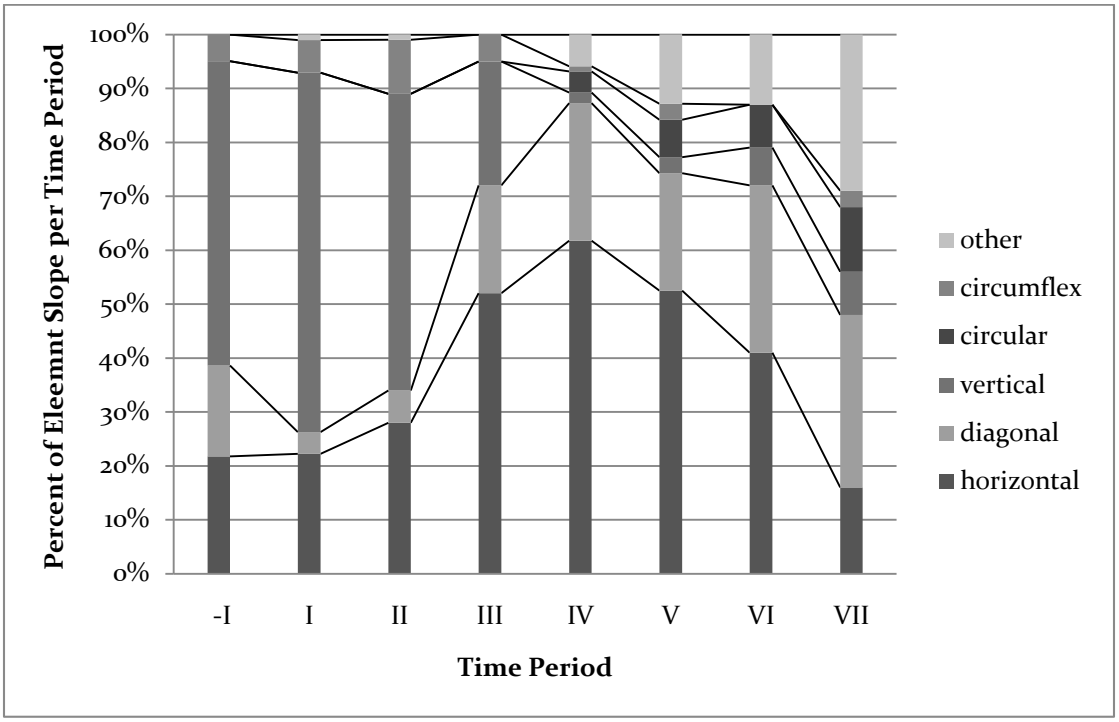

Figure 6.17. Changes in element slope through time.

Figure 6.18 illustrates the changes in element types through time. From the first century BC through the second century AD, potters used a combed finishing

technique for their vessels. In the third century, it is present in the cemetery at Diersheim, but elsewhere it is dropping out of use in favor of incised lines. Again, the important change appears in the fourth century when incised lines (*schrägkanneluren*) are the dominant element but over the next three hundred years this also declined as potters adopted (memetic invasion) new stylistic elements.

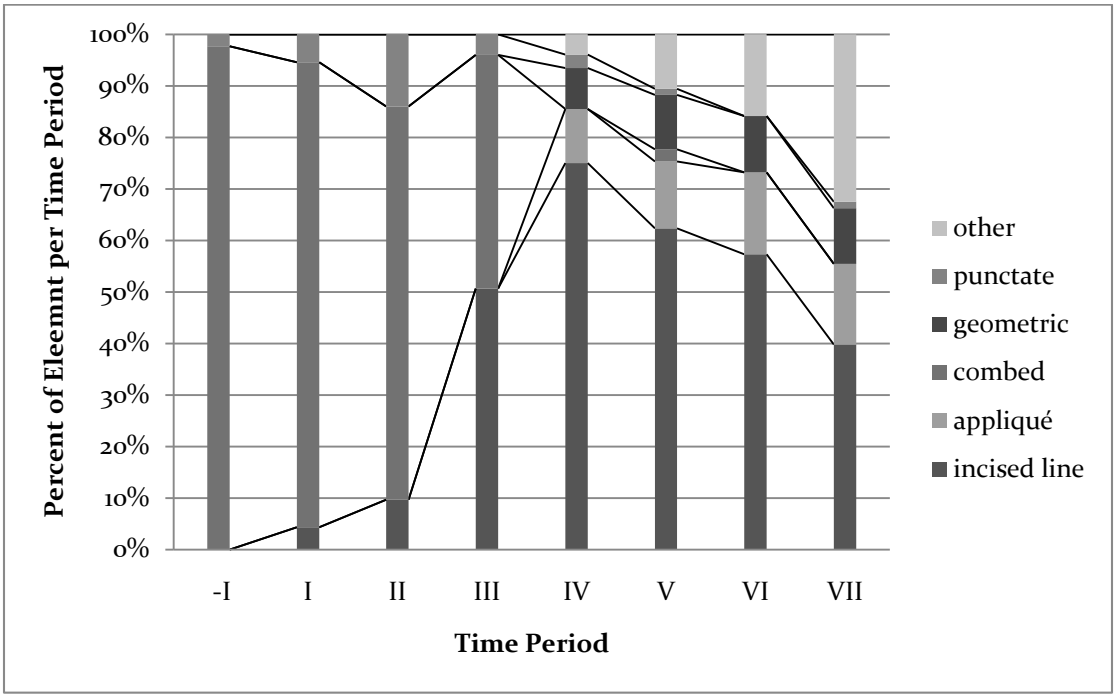

Figure 6.18. Changes in element type through time.

For both element slope (X^2 = 28, df = 3) and element type (X^2 = 22.2, df = 3) there is a statistically significant difference between the frequencies of the Phase -1 through Phase II assemblages and the Phase III assemblage.

Steuer (2003) argues that the arrival of the Alamanni was not so much of a flood of people but a gradual infiltration. There was movement into the project area from the Elbe but there was also movement out of the region as well. On one hand, the new migrants maintained ties to the larger German world beyond the Black Forest including trade in goods and persons. On the other hand, they entered a frontier zone where they were exposed to new cultures and new meme-sets.

Clade-Diversity Diagram

Paleobiologists since Darwin have recognized that morphological similarity among fossil taxa is the result of close phylogenetic relationship. Cladograms are a graphic means to display these phylogenetic relationships between lower level taxa within a higher-level taxon. Gould et al. (1977) used clade-diversity diagrams to display the fluctuating frequency of the number of taxa, which they call richness, within a clade (higher-level taxa) over time. A clade-diversity diagram then comprises a history of the origin and extinction of taxa within a clade. Gould et al. state that

> If the rate of branching exceeds the rate of extinction…the number of coexisting lineages increases. If extinction exceeds the rate of branching, diversity decreases. If the two rates are equal over a period of time, diversity remains constant (1977:528).

Clade-diversity diagrams and seriations are similar in that time passes from the bottom to the top, frequencies of types are illustrated by vertically stacked, horizontally centered bars, and the things graphed are thought to be members of a phylogeny (Lyman and O'Brien 2000). Both also exhibit Markovian diversity where the diversity at any time is dependent in part on the diversity at the previous time. This limits the range of possible diversity and causes the patterns of change through time to appear to be more orderly than under a completely random process. The main difference between clade-diversity diagrams and frequency seriations is that the former displays absolute numbers of taxa and the latter are constructed from relative numbers of types with a period.

Gould et al. (1987) noticed that many of their clade-diversity diagrams appeared bottom-heavy and suggested that there was a direction to biological evolutionary time. A clade's early history appears to be its richest taxonomically and then becomes progressively less rich through time as selection puts pressure on variation. Lyman and O'Brien (2000) suggest that methods of analyzing clade-diversity diagrams can be used to identify "burst of variation" (Schiffer 1996) characteristic of periods of stimulated variation. I would include as a null hypothesis that stimulated variation occurs when a community encounters a new set of individuals and within this context meme-sets have the greatest

opportunity for transference. There were two periods of intense culture contact for the people within the project area: one beginning in the early 1st century AD with the arrival of the Romans and another in the late 3rd century with the arrival of the Alamanni. One might expect an asymmetrical clade-diversity diagram for archaeological data from this period either bottom-heavy (the period when the Romans arrive) or top-heavy (the period when the Alamanni arrive) representing the transference or invasion of new memes causing stimulated variation.

Gould et al. (1987) developed a simple way to determine if a clade-diversity diagram was symmetrical or not. They determined the center of gravity (CG) or the relative position in time of the mean diversity (Gould et al. 1977:26). The duration of the scale is measured from zero (the point immediately before the clade appears) to one (the point at which the clade goes extinct). A diamond-shaped clade has a CG of 0.5. A top-heavy clade has a CG greater than 0.5 and a bottom-heavy clade has a CG less than 0.5. The CG value is calculated with the formula:

$$CG = (\Sigma N_i t_i)/(\Sigma N_i)$$

where *N* is richness per time interval and t is the scaled temporal position of the richness measure (Lyman and O'Brien 2000). Table 6.3 shows the calculations for the CG for the clade-diversity diagram in Figure 6.19.

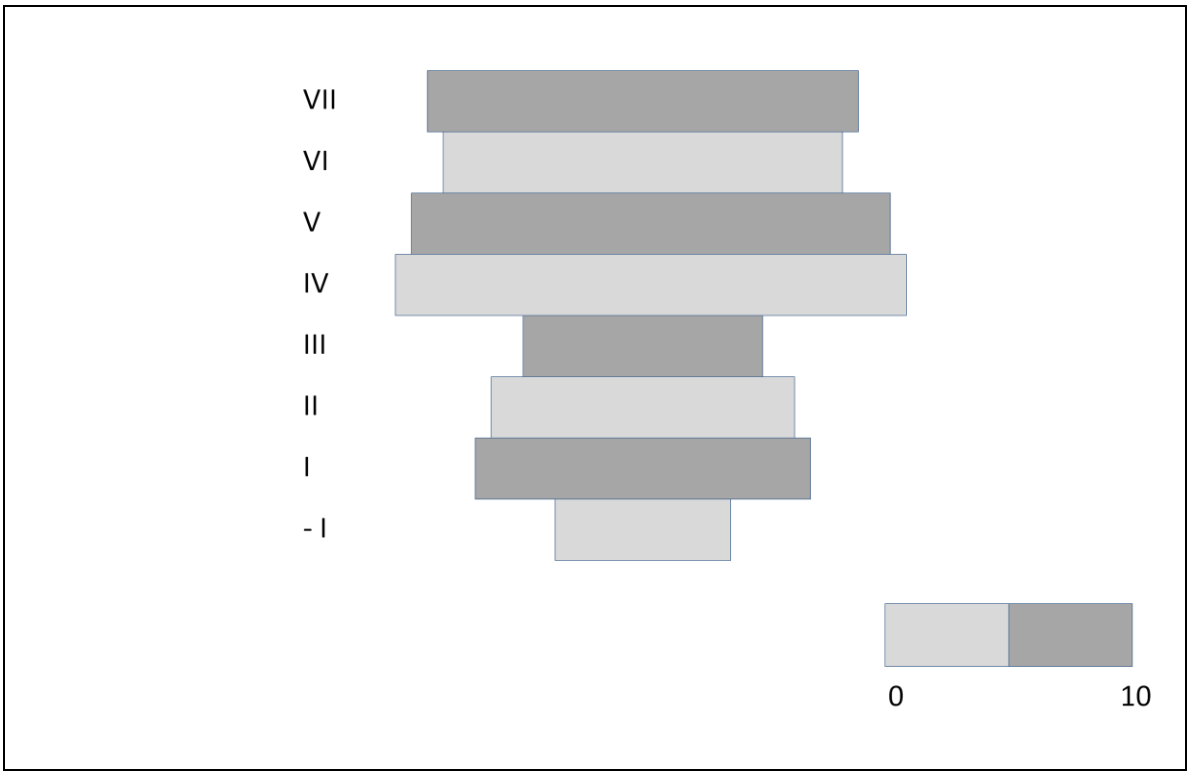

Figure 6.19. Clade-diversity diagram for the frequency of style elements.

Table 6.3. Calculations for the Center of Gravity for the Clade-Diversity Diagram shown in Figure 6.19.

TIME PERIOD	RICHNESS (N)	SCALED TIME (T)	RICHNESS x SCALED TIME
AD 701	0	1.0	0
VII	18	0.9	16.20
VI	16	0.8	12.80
V	22	0.7	15.40
IV	21	0.6	12.60
III	9	0.5	4.50
II	13	0.4	5.20
I	14	0.3	4.20
-I	7	0.2	1.40
50 BC	0	0.1	0.00
TOTAL	120	--	72.30

The period of maximum diversity occurs in occurs in the top half of the clade-diversity diagram. It appears, based on the diagram, that non-Roman potters remained resistant to Roman memes of expressing identity at least through the decorations they placed on their wares. The most significant change occurs when the Roman administration leaves although even then change does not occur rapidly but over 200 years. Is the diversity, however, statistically significant however?

Kitchell and MacLeod (1988) used random simulations and found that a statistically significant ($p < 0.05$) bottom-heavy asymmetry was found in only clades with a CG less than 0.428 and a top-heavy asymmetry was found in clades with a CG greater than 0.578. The CG for the style element clade shown in Figure 6.19 is 0.603 indicating a significant increase in the diversity of style memes beginning in the fourth century AD. I used a t-test to compare the CG value of Kitchell and MacLeod's (1988) simulated sample mean of 0.5 and simulated standard deviation of 0.032 to the CG value from my artifact assemblages and found that the differences are significant ($t = 0.5$, d.f. = 7). From this, it does appear that a "burst" of new variation occurred in the fourth and fifth centuries representing a memetic invasion, if not, a physical one.

CONCLUSION

I argue that people do invest their identity in the material goods that make, purchase, and use and that this identity is composed of particles of information that compete with one another for space in limited memory. Under Kendal and Laland's (2000) model of memetic invasion (Figure 6.20), it appears that the Romans had little influence in the day-to-day production of people's lives in the Upper Rhine.

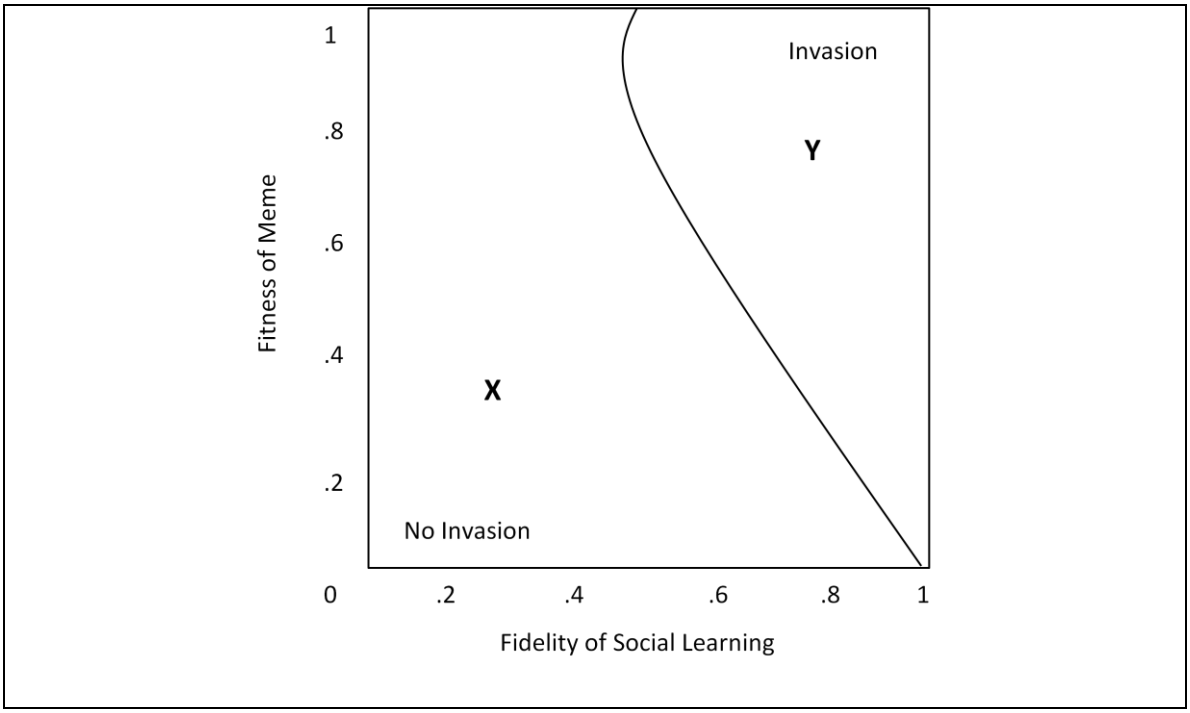

Figure 6.20. The relative position of Roman (X) and Alamannic (Y) memes in the upper Rhine.

The practice of *Kammstrich* had high fitness and the cost of learning was too great for Roman memes to invade completely. The changes that did occur were in

highly charged and ritualized social realms such as burials where non-Romans adopted cremation and the use of terra sigillata but even here, it was not a complete transference from the dominant culture. In the first century AD, there may have been a physical invasion but not a memetic one. The greatest changes occurred in the third and fourth centuries and we see a substantial change in the way in which people expressed themselves in material culture. Not only were the old forms overturned but no single element became dominant and there was an adaptive radiation, to borrow another evolutionary term, of memes as Western Europe itself fractured into small, competing polities at the end of the Empire.

CHAPTER SEVEN

SUMMARY AND CONCLUSIONS

There were two questions addressed by this dissertation. The first, what was the relationship between the people, called Suebi, living in the First Century BC in southwest Germany and those groups, Romans and Alamanni, that appeared later in the archaeological and historical records? Related to this was an examination of how does the fragmentary nature of contemporary accounts influence modern researchers' understanding of the past. Was culture contact in the Upper Rhine a matter of population replacement or more of a creolization? The second question was whether one could develop an archaeological methodology that addressed culture change and at the same time moved away from valuable yet variable textual sources. What do the artifacts themselves tell us about 500 years in a culturally dynamic frontier context?

For the second question, I drew upon a rich body of evolutionary theory developed first for a biological context (Darwin 1859; Dawkins 1976; Mayr 1991) and later for an archaeological one (Cullen 1996; Dunnell 1978; Teltser 1995).

Seriation theory moves the scale of measurement the individual from a person to the artifact and can provide a means to measure culture change.

Using these methods, I believe an interesting picture of culture contact in the Upper Rhine emerged that partially addressed the first question. The non-Roman natives in the first century AD did adopt aspects of Roman culture but only in the realm of emotionally charged ritual. For their day-to-day existence, the artifacts they used appear to have changed little and they maintained an identity adopted centuries before. In evolutionary terms, these practices had a high fitness relative to the cost of learning new ceramic manufacturing techniques. They began to cremate their dead, a Roman practice, yet still they placed artifacts in the burial pits, a non-Roman practice; here they were creolized and items such as coins, glass, and terra sigillata replaced non-Roman artifacts as the means by which to honor their relatives.

In the Third and Fourth Centuries, the Alamanni arrived and in the archaeological record, we see a proliferation of new style elements and forms. Now it appears that peoples readily adopted new means of expressing identity overturning the old forms. However, no one element had fitness great enough to

invade and dominate as *Kammstrich* had in the first century. With the infiltration of people from central Europe and the continued presence of a Mediterranean culture on the Rhine the dynamism of this frontier context increased on a grand scale. Finally, with the arrival of the Merovingians in the Sixth and Seventh centuries, the number of style elements is almost too great to count and, while reflecting a reduction of overall fitness of the memes, the means to express identity expanded.

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APPENDIX 1

VESSEL FORMAL DATA

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Biengen (Bie)	35	2	1	1	3	2	1	3
Biengen (Bie)	38	8	12	8	4	2	1	1
Biengen (Bie)	50	8	12	8	5	3	4	6
Biengen (Bie)	51	8	12	8	1	2	1	3
Biengen (Bie)	52	2	3	2	1	2	1	1
Biengen (Bie)	56	8	12	8	2	2	2	2
Biengen (Bie)	57	2	2	2	2	2	1	2
Biengen (Bie)	58	2	2	2	1	1	1	3
Biengen (Bie)	59	2	2	2	4	2	2	1
Biengen (Bie)	63	2	2	2	1	2	1	1
Biengen (Bie)	69	8	12	8	1	2	2	2
Biengen (Bie)	38:160	8	12	8	3	2	1	4
Bötzingen (Bö)	1.5	8	12	6	5	3	4	6
Bötzingen (Bö)	2.3	2	1	1	3	2	1	3
Bötzingen (Bö)	3.1	2	2	2	2	2	1	2
Bötzingen (Bö)	9.1	1	3	2	2	2	1	1
Bötzingen (Bö)	12.6	2	1	1	1	2	1	2
Bötzingen (Bö)	14.1	2	1	1	2	2	1	1
Bötzingen (Bö)	25.7	2	2	2	1	2	1	4
Bötzingen (Bö)	26.1	2	2	2	1	2	1	4
Bötzingen (Bö)	26.10	2	2	2	1	2	1	4
Bötzingen (Bö)	5,7,8.1	2	2	2	2	2	2	1
Bötzingen (Bö)	5,7,8.4	8	12	6	5	3	4	6
Bötzingen (Bö)	5,7,8.5	8	12	6	5	3	4	6
Breisach (Br)	37:53b 1	8	12	8	5	3	4	6
Breisach (Br)	37:53b 2	8	12	8	5	3	4	6
Breisach (BrFr)	50/24	2	9	1	2	1	1	1
Buchheim (Buhm)	25	8	12	8	5	3	4	6
Buchheim (Buhm)	26	8	12	8	4	2	1	1
Buchheim (Buhm)	27	8	12	8	5	3	4	6
Buchheim (Buhm)	28	2	1	1	1	2	1	3
Buchheim (Buhm)	33	8	12	8	4	2	3	6
Buchheim (Buhm)	50	8	12	8	5	3	4	6
Buchheim (Buhm)	51	8	12	8	5	3	4	6
Buchheim (Buhm)	52	8	12	8	4	2	1	1
Buchheim (Buhm)	56	8	12	8	4	2	1	1
Buchheim (Buhm)	57	8	12	8	1	2	1	3

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Buchheim (Buhm)	58	8	12	8	5	3	4	6
Buchheim (Buhm)	59	8	12	8	5	3	4	6
Buchheim (Buhm)	70	8	12	8	4	2	1	3
Buchheim (Buhm)	71	8	12	8	4	2	2	1
Buchheim (Buhm)	77	8	12	8	5	3	4	6
Dangstetten (Da)	766.35	2	2	2	2	2	1	3
Dangstetten (Da)	766.36	2	2	2	2	2	1	1
Dangstetten (Da)	787.38	2	2	2	2	2	3	2
Dangstetten (Da)	788.60	2	2	2	2	2	1	4
Dangstetten (Da)	821.10	8	12	6	5	3	4	6
Dangstetten (Da)	822.11	1	3	2	2	2	1	1
Dangstetten (Da)	824.12	2	2	2	2	2	1	2
Dangstetten (Da)	827.6	2	2	2	2	2	1	3
Dangstetten (Da)	873.14	2	2	4	2	2	2	3
Dangstetten (Da)	874.25	2	2	2	2	2	2	1
Dangstetten (Da)	875.13	2	2	2	2	2	2	2
Dangstetten (Da)	875.14	2	2	2	2	2	1	3
Dangstetten (Da)	876.38	2	2	4	2	2	1	1
Dangstetten (Da)	876.39	1	3	2	2	2	1	1
Dangstetten (Da)	891.25	2	2	2	2	2	1	4
Dangstetten (Da)	894.19	2	2	2	2	2	1	4
Dangstetten (Da)	895.68	2	2	2	2	2	2	1
Dangstetten (Da)	895.70	1	3	2	2	2	1	1
Dangstetten (Da)	902.30	1	3	2	2	2	1	4
Dangstetten (Da)	906.44	8	12	6	5	3	4	6
Dangstetten (Da)	906.45	2	2	2	2	2	1	3
Dangstetten (Da)	906.46	8	12	6	5	3	4	6
Dangstetten (Da)	914.21	1	3	2	2	2	1	2
Dangstetten (Da)	925.115	2	2	2	5	3	4	6
Dangstetten (Da)	925.121	1	3	2	2	2	1	2
Dangstetten (Da)	925.123	5	1	1	2	2	1	3
Dangstetten (Da)	944.10	2	2	2	2	2	3	2
Dangstetten (Da)	955.19	2	2	2	2	2	1	3
Dangstetten (Da)	956.23	2	2	2	2	2	2	1
Dangstetten (Da)	958.9	2	2	2	2	2	3	2
Dangstetten (Da)	961.8	2	3	2	2	2	2	1
Dangstetten (Da)	972.31	2	2	2	2	2	1	3
Dangstetten (Da)	972.32	1	3	2	2	2	1	3
Dangstetten (Da)	974.18	1	3	2	2	2	1	1
Dangstetten (Da)	975.5	8	12	6	5	3	4	6
Dangstetten (Da)	977.14	8	12	6	5	3	4	6
Dangstetten (Da)	977.15	8	12	6	5	3	4	6
Dangstetten (Da)	978.5	2	5	2	3	2	1	1
Dangstetten (Da)	981.22	2	6	2	3	2	1	3
Dangstetten (Da)	982.11	8	12	6	5	3	4	6
Dangstetten (Da)	986.10	2	2	2	2	2	1	2
Dangstetten (Da)	986.9	8	12	6	5	3	4	6
Dangstetten (Da)	989.18	2	2	2	2	2	1	2

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Dangstetten (Da)	990.6	8	12	6	5	3	4	6
Dangstetten (Da)	994.12	8	12	6	5	3	4	6
Dangstetten (Da)	996.8	8	12	6	5	3	4	6
Dangstetten (Da)	997.5	8	12	6	5	3	4	6
Dangstetten (Da)	1016.12	1	2	2	2	2	1	2
Dangstetten (Da)	1020.8	8	12	6	5	3	4	6
Dangstetten (Da)	1021.16	8	12	6	5	3	4	6
Dangstetten (Da)	1025.13	3	2	2	2	2	1	2
Dangstetten (Da)	1031.6	8	12	6	5	3	4	6
Dangstetten (Da)	1034.6	1	2	2	3	2	2	2
Dangstetten (Da)	1035.14	8	12	6	5	3	4	6
Dangstetten (Da)	1035.15	8	12	6	5	3	4	6
Dangstetten (Da)	1036.22	8	12	6	5	3	4	6
Dangstetten (Da)	1036.23	8	12	6	5	3	4	6
Dangstetten (Da)	1037.31	2	2	2	3	2	1	1
Dangstetten (Da)	1037.32	8	12	6	5	3	4	6
Dangstetten (Da)	1038.21	2	2	2	2	2	1	1
Dangstetten (Da)	1038.22	8	12	6	5	3	4	6
Dangstetten (Da)	1039.21	2	2	2	2	2	1	1
Dangstetten (Da)	1039.22	8	12	6	5	3	4	6
Dangstetten (Da)	1040.16	2	2	2	2	2	1	2
Dangstetten (Da)	1040.17	1	2	2	3	2	2	1
Dangstetten (Da)	1040.18	8	12	6	5	3	4	6
Dangstetten (Da)	1040.19	8	12	6	5	3	4	6
Dangstetten (Da)	1042.14	8	12	6	5	3	4	6
Dangstetten (Da)	1042.15	8	12	6	5	3	4	6
Dangstetten (Da)	1046.14	2	2	2	3	2	3	2
Dangstetten (Da)	1046.15	8	12	6	5	3	4	6
Dangstetten (Da)	1046.16	1	2	2	2	2	1	2
Dangstetten (Da)	1048.13	8	12	6	5	3	4	6
Dangstetten (Da)	1049.17	2	3	2	1	2	1	1
Dangstetten (Da)	1049.18	2	2	2	2	2	1	1
Dangstetten (Da)	1050.7	2	2	2	2	2	2	2
Dangstetten (Da)	1050.8	8	12	6	5	3	4	6
Dangstetten (Da)	1052.10	8	12	6	5	3	4	6
Dangstetten (Da)	1052.9	8	12	6	5	3	4	6
Dangstetten (Da)	1054.29	2	2	2	3	2	2	1
Dangstetten (Da)	1056.9	2	2	2	1	2	1	1
Dangstetten (Da)	1059.23	8	12	6	5	3	4	6
Dangstetten (Da)	1059.24	8	12	6	5	3	4	6
Dangstetten (Da)	1062.11	2	2	2	3	2	1	2
Dangstetten (Da)	1079.7	2	2	2	2	2	1	2
Dangstetten (Da)	1079.8	8	12	6	5	3	4	6
Dangstetten (Da)	1080.17	1	3	2	2	2	1	2
Dangstetten (Da)	1081.20	2	2	2	2	2	1	2
Dangstetten (Da)	1083.20	2	2	2	2	2	1	2
Dangstetten (Da)	1095.9	8	12	6	5	3	4	6
Dangstetten (Da)	1104.3	8	12	6	5	3	4	6

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Dangstetten (Da)	1107.12	2	2	2	1	2	3	2
Dangstetten (Da)	1107.13	8	12	6	5	3	4	6
Dangstetten (Da)	1110.13	8	12	6	5	3	4	6
Dangstetten (Da)	1119.9	2	2	2	1	2	2	1
Dangstetten (Da)	1120.8	1	3	2	1	2	1	1
Dangstetten (Da)	1122.70	1	3	2	1	2	2	1
Dangstetten (Da)	1122.71	2	2	2	1	2	2	2
Dangstetten (Da)	1122.72	8	12	6	5	3	4	6
Dangstetten (Da)	1137.23	8	12	6	5	3	4	6
Dangstetten (Da)	1139.6	8	12	6	5	3	4	6
Dangstetten (Da)	1143.18	2	2	2	1	2	2	2
Dangstetten (Da)	1145.8	8	12	6	5	3	4	6
Dangstetten (Da)	1147.9	8	12	6	5	3	4	6
Dangstetten (Da)	1150.9	8	12	6	5	3	4	6
Dangstetten (Da)	1155.52	2	2	2	3	2	1	2
Dangstetten (Da)	1155.53	2	3	2	3	2	1	2
Dangstetten (Da)	1155.54	8	12	6	5	3	4	6
Dangstetten (Da)	1155.55	8	12	6	5	3	4	6
Dangstetten (Da)	1156.49	2	2	2	3	2	1	2
Dangstetten (Da)	1156.50	8	12	6	5	3	4	6
Dangstetten (Da)	1156.51	8	12	6	5	3	4	6
Dangstetten (Da)	1160.13	8	12	6	5	3	4	6
Dangstetten (Da)	1160.14	8	12	6	5	3	4	6
Dangstetten (Da)	1160.15	8	12	6	5	3	4	6
Dangstetten (Da)	1165.20	8	12	6	5	3	4	6
Dangstetten (Da)	1166.14	1	3	2	2	2	1	1
Dangstetten (Da)	1171.10	2	2	2	3	2	2	2
Dangstetten (Da)	1171.11	8	12	6	5	3	4	6
Dangstetten (Da)	1189.8	8	12	6	5	3	4	6
Dangstetten (Da)	1203.7	2	2	2	3	2	2	2
Dangstetten (Da)	1203.8	8	12	6	5	3	4	6
Dangstetten (Da)	1207.9	8	12	6	5	3	4	6
Dangstetten (Da)	1220.49	8	12	6	5	3	4	6
Dangstetten (Da)	1220.50	1	3	2	3	2	3	2
Dangstetten (Da)	1220.51	8	12	6	5	3	4	6
Dangstetten (Da)	1220.52	2	2	2	2	2	1	2
Dangstetten (Da)	1220.53	8	12	6	5	3	4	6
Dangstetten (Da)	1221.18	2	2	2	2	2	2	2
Dangstetten (Da)	1221.19	8	12	6	5	3	4	6
Dangstetten (Da)	1224.5	2	2	2	2	2	1	1
Dangstetten (Da)	1234.38	8	12	6	5	3	4	6
Dangstetten (Da)	1238.21	2	3	2	2	2	1	2
Dangstetten (Da)	1248.5	1	4	2	3	2	2	2
Dangstetten (Da)	1252.12	8	12	6	5	3	4	6
Dangstetten (Da)	1257.28	8	12	6	5	3	4	6
Dangstetten (Da)	1257.29	8	12	6	5	3	4	6
Dangstetten (Da)	1273.11	8	12	6	5	3	4	6
Dangstetten (Da)	1278.10	2	4	2	2	2	2	2

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Dangstetten (Da)	1278.11	8	12	6	5	3	4	6
Dangstetten (Da)	1278.12	8	12	6	5	3	4	6
Dangstetten (Da)	1285.1	8	12	6	5	3	4	6
Dangstetten (Da)	1288.5	8	12	6	5	3	4	6
Dangstetten (Da)	1292.16	8	12	6	5	3	4	6
Dangstetten (Da)	1295.16	8	12	6	5	3	4	6
Dangstetten (Da)	1296.9	1	3	2	2	2	2	2
Dangstetten (Da)	1297.10	8	12	6	5	3	4	6
Dangstetten (Da)	1302.16	8	12	6	5	3	4	6
Dangstetten (Da)	1308.18	8	12	6	5	3	4	6
Dangstetten (Da)	1311.8	8	12	6	5	3	4	6
Dangstetten (Da)	1311.9	8	12	6	5	3	4	6
Dangstetten (Da)	1322.6	1	3	2	2	2	3	1
Dangstetten (Da)	1337.51	2	2	2	2	2	2	2
Dangstetten (Da)	1337.52	2	2	2	5	2	1	2
Dangstetten (Da)	1337.53	8	12	6	5	3	4	6
Dangstetten (Da)	1341.8	8	12	6	5	3	4	6
Dangstetten (Da)	1350.35	8	12	6	5	3	4	6
Dangstetten (Da)	1351.25	8	12	6	5	3	4	6
Dangstetten (Da)	1351.26	2	2	2	5	3	4	6
Dangstetten (Da)	1354.27	8	12	6	5	3	4	6
Dangstetten (Da)	844 ADE.37	1	2	2	2	2	1	4
Dangstetten (Da)	844A.36	2	2	2	2	2	1	3
Forchheim (Fo)	161	8	12	8	5	3	4	6
Forchheim (Fo)	162	8	12	8	5	3	4	6
Forchheim (Fo)	163	8	12	8	5	3	4	6
Forchheim (Fo)	164.3	8	12	8	4	2	1	2
Forchheim (Fo)	166	2	1	1	4	2	2	2
Forchheim (Fo)	168	8	12	8	4	2	1	2
Forchheim (Fo)	173	1	3	2	4	2	1	1
Forchheim (Fo)	174	2	2	2	1	2	1	2
Forchheim (Fo)	175	2	2	2	4	2	2	3
Forchheim (Fo)	176	8	12	8	4	2	1	1
Forchheim (Fo)	177	8	12	8	1	2	3	2
Forchheim (Fo)	180	2	3	2	1	2	1	3
Forchheim (Fo)	190	2	1	1	3	1	1	2
Jechtingen (Jech)	848	8	12	8	5	3	4	6
Jechtingen (Jech)	849	2	3	2	1	1	1	1
Jechtingen (Jech)	850	8	12	8	4	2	1	1
Jechtingen (Jech)	851	2	3	2	3	2	1	1
Jechtingen (Jech)	852	2	2	2	3	2	1	3
Jechtingen (Jech)	853	2	2	2	1	1	1	3
Jechtingen (Jech)	854	2	2	2	4	2	1	1
Jechtingen (Jech)	855	8	12	8	3	2	1	1
Jechtingen (Jech)	857	2	2	2	4	2	1	1
Jechtingen (Jech)	858	2	1	1	1	2	1	1
Jechtingen (Jech)	859	8	12	8	1	2	1	3
Jechtingen (Jech)	1510	2	6	8	5	3	4	6

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Mengen (Me)	429	2	1	1	1	1	1	1
Mengen (Me)	430	2	6	2	4	2	1	3
Mengen (Me)	431	2	1	1	1	1	1	1
Mengen (Me)	432	2	1	1	1	1	1	1
Mengen (Me)	434	2	6	2	2	1	1	1
Mengen (Me)	441	2	3	1	4	2	1	1
Mengen (Me)	446	2	2	2	1	1	1	1
Mengen (Me)	449.1	2	6	1	4	2	1	1
Mengen (Me)	449.2	3	4	3	5	3	4	6
Mengen (Me)	450	2	1	1	1	2	1	1
Mengen (Me)	451	2	1	1	4	2	1	2
Mengen (Me)	457	2	2	1	1	2	1	1
Mengen (Me)	459.1	2	12	2	2	1	1	3
Mengen (Me)	460.1	2	1	1	4	2	1	3
Mengen (Me)	460.2	2	6	3	3	1	1	1
Mengen (Me)	461.1	2	8	4	4	2	1	1
Mengen (Me)	461.2	2	1	1	1	2	1	3
Mengen (Me)	461.3	2	12	2	2	2	1	1
Mengen (Me)	464.1	2	1	1	1	2	1	1
Mengen (Me)	502	2	4	2	3	1	1	1
Mengen (Me)	503	8	12	8	2	2	1	1
Mengen (Me)	504	2	1	1	4	2	1	1
Mengen (Me)	505	8	12	8	5	3	4	6
Mengen (Me)	506	8	12	8	4	2	1	1
Mengen (Me)	507.1	2	1	1	4	2	1	1
Mengen (Me)	507.2	2	1	1	4	2	1	3
Mengen (Me)	507.3	2	2	2	2	2	1	1
Mengen (Me)	508	8	12	8	5	3	4	6
Mengen (Me)	509	2	2	2	1	1	1	1
Mengen (Me)	531	6	1	1	4	2	1	3
Mengen (Me)	532.1	8	1	1	1	2	2	1
Mengen (Me)	532.2	8	1	1	1	2	2	1
Mengen (Me)	535	2	12	8	5	3	4	6
Mengen (Me)	543	1	3	3	3	2	1	1
Mengen (Me)	544	8	12	8	5	3	4	6
Mengen (Me)	556	2	8	2	2	1	1	1
Mengen (Me)	565.2	8	12	8	5	3	4	6
Mengen (Me)	565.3	8	12	1	4	2	1	2
Mengen (Me)	565.4	8	12	8	5	3	4	6
Mengen (Me)	566	8	12	8	1	2	1	1
Mengen (Me)	571	2	2	8	5	3	4	6
Mengen (Me)	572.1	2	2	2	4	2	1	1
Mengen (Me)	572.2	8	12	8	5	3	4	6
Mengen (Me)	573.1	2	12	8	5	3	4	6
Mengen (Me)	585.1	2	3	2	2	2	1	1
Mengen (Me)	585.2	8	12	8	2	2	1	1
Mengen (Me)	585.3	2	3	8	5	3	4	6
Mengen (Me)	586.1	2	2	2	4	2	1	1

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Mengen (Me)	604.3	8	12	8	5	3	4	6
Mengen (Me)	604.4	8	12	8	5	3	4	6
Mengen (Me)	606	4	1	1	4	2	1	1
Mengen (Me)	606	4	1	1	4	2	1	3
Mengen (Me)	607.1	8	12	8	5	3	4	6
Mengen (Me)	607.1	2	1	1	3	2	1	1
Mengen (Me)	650.1	2	1	1	1	1	1	1
Mengen (Me)	650.3	8	12	8	5	3	4	6
Mengen (Me)	652	4	12	8	5	3	4	6
Mengen (Me)	653	2	12	2	4	2	1	2
Mengen (Me)	696	2	6	3	2	2	1	1
Mengen (Me)	697.1	2	6	3	2	5	1	1
Mengen (Me)	698.2	2	6	2	4	2	1	1
Mengen (Me)	699	2	6	2	2	1	1	3
Mengen (Me)	702.1	2	1	1	4	2	2	2
Mengen (Me)	703	2	1	1	1	1	1	1
Mengen (Me)	705.1	8	12	8	4	5	1	1
Mengen (Me)	705.2	8	12	8	5	3	4	6
Mengen (Me)	714	8	12	8	1	1	1	3
Mengen (Me)	716.1	2	2	2	4	2	1	3
Mengen (Me)	718	8	12	8	4	2	1	1
Mengen (Me)	540/541.6	2	7	1	4	2	1	1
Sponeck (Sp)	3252	2	3	2	1	2	1	3
Sponeck (Sp)	3106/5	8	12	8	4	2	1	1
Sponeck (Sp)	3112/10	8	12	8	5	3	4	6
Sponeck (Sp)	3112/6-31	2	3	2	1	1	1	1
Sponeck (Sp)	3128/43	2	3	2	4	2	1	1
Sponeck (Sp)	3129/13	2	3	2	1	2	1	3
Sponeck (Sp)	3143/6	8	12	8	5	3	4	6
Sponeck (Sp)	3152/14	8	12	4	4	2	1	3
Sponeck (Sp)	3152/16	8	12	8	5	3	4	6
Sponeck (Sp)	3168/38	8	12	8	2	2	1	3
Sponeck (Sp)	3186/26	8	12	8	5	3	4	6
Sponeck (Sp)	3186/27	8	12	2	4	2	1	1
Sponeck (Sp)	3192/5	8	12	8	5	3	4	6
Sponeck (Sp)	3228/10	2	1	1	1	1	1	3
Sponeck (Sp)	3269/4	2	2	2	4	2	2	1
Sponeck (Sp)	3269/5	2	2	2	3	2	1	1
Sponeck (Sp)	3274/10	8	12	8	5	3	4	6
Sponeck (Sp)	3280/14	2	6	2	2	1	1	1
Sponeck (Sp)	3327/4	8	12	8	2	1	1	1
Sponeck (Sp)	3346/10	2	6	2	1	2	3	2
Sponeck (Sp)	3374/39,40	2	6	2	4	2	1	1
Sponeck (Sp)	3395/3	8	12	8	1	2	2	2
Sponeck (Sp)	3397/15-21	3	7	3	2	2	1	1
Sponeck (Sp)	3397/3	8	12	8	5	3	4	6
Sponeck (Sp)	3397/59	8	12	8	4	2	2	1
Sponeck (Sp)	3397/60	8	12	8	5	3	5	6

Site	Catalog Number	Vessel Shape		Mouth Shape	Rim Characteristics			
		Vessel Shape	Characteristic Point		Position of Rim Thickness	Junction of Thickened Part with Wall	Point of Greatest Thickness	Rim Shape
Sponeck (Sp)	3397/71	8	12	8	4	2	1	1
Sponeck (Sp)	3402/14	2	3	2	4	2	1	1
Sponeck (Sp)	3402/3	2	2	2	1	1	1	1
Sponeck (Sp)	3402/71	8	12	8	5	3	4	6
Sponeck (Sp)	3410/23	2	12	4	4	2	2	1
Sponeck (Sp)	3410/23a	8	12	8	5	3	4	6
Sponeck (Sp)	3416/4	2	6	2	5	3	4	6
Sponeck (Sp)	3462/4	2	3	2	4	2	1	1
Sponeck (Sp)	3463/1	8	12	8	2	1	3	2
Sponeck (Sp)	3468/41	8	12	8	5	3	4	6
Vörstetten (Vor)	35	2	5	2	4	2	1	1
Vörstetten (Vor)	37	8	12	8	5	3	4	6
Vörstetten (Vor)	40	2	6	2	2	2	1	1
Vörstetten (Vor)	41	8	12	8	5	3	4	6
Vörstetten (Vor)	48	8	12	8	2	1	2	4
Vörstetten (Vor)	50	2	2	2	4	2	1	3
Vörstetten (Vor)	55	8	12	8	5	3	4	6
Vörstetten (Vor)	94	2	6	2	2	2	1	1
Weil (Wei)	6.1	2	2	2	2	2	1	1
Weil (Wei)	47.1	2	2	2	5	6	4	6
Weil (Wei)	55.1	2	2	2	2	2	1	1
Weil (Wei)	59.26	3	3	2	3	2	3	2
Weil (Wei)	80.1	1	2	2	2	2	1	3
Weil (Wei)	83.1	3	3	2	2	2	1	3
Weil (Wei)	85.3	3	3	2	2	2	1	3
Weisweil (We)	100	8	12	8	4	3	4	6

APPENDIX 2

ASSEMBLAGE STYLE ELEMENTS

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Biengen (Bie)	35	4															
Biengen (Bie)	38	5	1	1	1												
Biengen (Bie)	50	5	2	2	1												
Biengen (Bie)	51	5															
Biengen (Bie)	52	4															
Biengen (Bie)	56	4															
Biengen (Bie)	57	5	1	1	2												
Biengen (Bie)	58	4															
Biengen (Bie)	59	4															
Biengen (Bie)	63	4															
Biengen (Bie)	69	5															
Biengen (Bie)	38:160	5															
Bötzingen (Bö)	1.5	4	3	8	5												
Bötzingen (Bö)	2.3	4	3	8	5												
Bötzingen (Bö)	3.1	4	3	8	5												
Bötzingen (Bö)	9.1	4	1	8	5	3	8	5									
Bötzingen (Bö)	12.6	4	1	12	1	3	8	5									
Bötzingen (Bö)	14.1	4	3	8	5												
Bötzingen (Bö)	25.7	4	3	8	5												
Bötzingen (Bö)	26.1	4	3	8	5												
Bötzingen (Bö)	26.10	4	3	8	5												
Bötzingen (Bö)	5,7,8.1	4	3	8	5												
Bötzingen (Bö)	5,7,8.4	4	2	8	5	3	8	5									
Bötzingen (Bö)	5,7,8.5	4	3	8	5												
Breisach (Br)	4753.1		1	1	1												
Breisach (Br)	5518.38		1	1	1	2	1	5	2	1	5						
Breisach (Br)	8514.5		5	4	1	2	1	3									
Breisach (Br)	37:53b 1	5	1	1	2	2	1	3									
Breisach (Br)	37:53b 2	5	1	1	2	2	1	3									
Breisach (Br)	8666/8956		2	11	1	2	2	1	2	1	2						
Breisach (BrFr)	50/24	4	1	2	1	1	1	2	1	1	2						
Buchheim (Buhm)	25	5	1	1	1	1	1	1									

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Buchheim (Buhm)	26	4															
Buchheim (Buhm)	27	5	2	1	1	1	3	1	2	1	1	1	3	1	2	1	1
Buchheim (Buhm)	28	4															
Buchheim (Buhm)	33	4	1	1	1	1	7	2									
Buchheim (Buhm)	50	5	1	1	3	1	1	3									
Buchheim (Buhm)	51	5	7	11	5												
Buchheim (Buhm)	52	4															
Buchheim (Buhm)	56	5															
Buchheim (Buhm)	57	4															
Buchheim (Buhm)	58	4															
Buchheim (Buhm)	59	4															
Buchheim (Buhm)	70	4															
Buchheim (Buhm)	71	4															
Buchheim (Buhm)	77	5	1	1	1	2	1	1	1	1	1	1	1	1			
Dangstetten (Da)	3.9		2	8	5												
Dangstetten (Da)	4.16		2	8	5	3	8	5									
Dangstetten (Da)	28.13		1	7	1	1	1	5	3	8	5						
Dangstetten (Da)	28.14		1	7	1	1	1	5	3	8	5						
Dangstetten (Da)	31.23		1	1	1	3	8	5									
Dangstetten (Da)	42.37		3	7	4	3	8	5									
Dangstetten (Da)	42.38		1	9	5												
Dangstetten (Da)	42.39		6	8	5	3	8	5									
Dangstetten (Da)	42.41		1	1	3												
Dangstetten (Da)	44.10		7	8	5												
Dangstetten (Da)	48.6		2	8	5	3	8	5									

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	48.7		3	7	4	3	8	5									
Dangstetten (Da)	50.8		6	8	5	3	8	5									
Dangstetten (Da)	52.34		1	1	5												
Dangstetten (Da)	56.31		2	1	4												
Dangstetten (Da)	62.20		1	8	5	3	8	5									
Dangstetten (Da)	67.12		6	8	5	3	8	5									
Dangstetten (Da)	85.15		2	1	4												
Dangstetten (Da)	104.24		7	8	5												
Dangstetten (Da)	110.18		3	8	5												
Dangstetten (Da)	124.21		1	1	4	3	8	5									
Dangstetten (Da)	142.24		3	8	5												
Dangstetten (Da)	150.10		1	8	5	3	8	5									
Dangstetten (Da)	159.10		2	7	4	3	8	5									
Dangstetten (Da)	164.50		3	8	5												
Dangstetten (Da)	164.52		1	8	5	3	8	5									
Dangstetten (Da)	176.117		3	8	5												
Dangstetten (Da)	192.8		3	8	5												
Dangstetten (Da)	196.17		1	8	5	3	8	5									
Dangstetten (Da)	206.12		3	8	5												
Dangstetten (Da)	206.13		1	7	1	3	7	4	3	8	5						
Dangstetten (Da)	207.14		3	9	5	3	8	5									
Dangstetten (Da)	207.15		6	8	5	3	8	5									
Dangstetten (Da)	211.74		3	8	5												
Dangstetten (Da)	221.21		2	7	5												
Dangstetten (Da)	225.11		3	8	5												

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	226.15		2	8	5	3	8	5									
Dangstetten (Da)	244.39		1	1	3												
Dangstetten (Da)	272.6		1	8	5	3	8	5									
Dangstetten (Da)	291.10		3	8	5												
Dangstetten (Da)	312.39		6	8	5	3	8	5									
Dangstetten (Da)	313.27		3	8	5												
Dangstetten (Da)	334.11		1	7	1	1	1	4	3	8	5						
Dangstetten (Da)	335.5		3	8	5												
Dangstetten (Da)	344.43		1	8	5	3	8	5									
Dangstetten (Da)	348.7		3	8	5												
Dangstetten (Da)	356.41		3	8	5												
Dangstetten (Da)	363.84		1	8	5	3	8	5									
Dangstetten (Da)	363.85		3	7	1	1	9	5									
Dangstetten (Da)	367.33		6	8	5	3	8	5									
Dangstetten (Da)	373.40																
Dangstetten (Da)	374.19																
Dangstetten (Da)	386.5		1	7	1	3	1	1									
Dangstetten (Da)	397.35		2	1	4	3	8	5									
Dangstetten (Da)	413.6		3	8	5												
Dangstetten (Da)	419.6		3	8	5												
Dangstetten (Da)	427.32		1	8	5	3	8	5									
Dangstetten (Da)	443.7		1	8	5	3	8	5									
Dangstetten (Da)	448.33		6	8	5	3	8	5									
Dangstetten (Da)	450.43		3	8	5												
Dangstetten (Da)	468.11		3	8	5												

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	481.6		1	1	1	3	8	5									
Dangstetten (Da)	484.43		2	8	5												
Dangstetten (Da)	488.29		3	8	5												
Dangstetten (Da)	519.54		1	8	5	3	8	5									
Dangstetten (Da)	542.18		3	8	5												
Dangstetten (Da)	544.110		6	8	5	3	8	5									
Dangstetten (Da)	544.111		3	8	5												
Dangstetten (Da)	575.25		6	8	5	3	8	5									
Dangstetten (Da)	591.7		3	9	5	3	8	5									
Dangstetten (Da)	594.25		2	1	4	3	8	5									
Dangstetten (Da)	594.26		1	7	1	3	8	5									
Dangstetten (Da)	766.35	4	1	8	5	3	8	5									
Dangstetten (Da)	766.36	4	1	8	5												
Dangstetten (Da)	787.38	4	1	7	1	1	1	5	3	8	5						
Dangstetten (Da)	788.60	4	1	8	5	3	8	5									
Dangstetten (Da)	821.10	4	3	8	5												
Dangstetten (Da)	822.11	4	1	7	2	1	1	4	3	8	5						
Dangstetten (Da)	824.12	4	1	8	5	3	8	5									
Dangstetten (Da)	827.6	4	1	1	5	3	8	5									
Dangstetten (Da)	873.14	4	3	8	5												
Dangstetten (Da)	874.25	4	1	7	1												
Dangstetten (Da)	875.13	4	3	8	5												
Dangstetten (Da)	875.14	4	3	9	5	3	8	5									
Dangstetten (Da)	876.38	4	3	8	5												
Dangstetten (Da)	876.39	4	7	8	5												

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	891.25	4	3	8	5												
Dangstetten (Da)	894.19	4	1	8	5	3	8	5									
Dangstetten (Da)	895.68	4	2	1	4	6	8	5	3	8	5						
Dangstetten (Da)	895.70	4	3	8	5												
Dangstetten (Da)	902.30	4	1	8	5	3	8	5									
Dangstetten (Da)	906.44	4	3	9	5	3	8	5									
Dangstetten (Da)	906.45	4	3	8	5												
Dangstetten (Da)	906.46	4	6	8	5	3	8	5									
Dangstetten (Da)	914.21	4	3	8	5												
Dangstetten (Da)	925.115	4	3	9	5	3	8	5									
Dangstetten (Da)	925.121	4	1	8	5	3	8	5									
Dangstetten (Da)	925.123	4	6	8	5	3	8	5									
Dangstetten (Da)	944.10	4	3	8	5												
Dangstetten (Da)	955.19	4	1	8	5	3	8	5									
Dangstetten (Da)	956.23	4	3	8	5												
Dangstetten (Da)	958.9	4	3	8	5												
Dangstetten (Da)	961.8	4	3	8	5												
Dangstetten (Da)	972.31	4	1	8	5	3	8	5									
Dangstetten (Da)	972.32	4	3	8	5												
Dangstetten (Da)	974.18	4	1	7	1	1	7	1	1	7	1						
Dangstetten (Da)	975.5	4	3	8	4												
Dangstetten (Da)	977.14	4	7	8	4												
Dangstetten (Da)	977.15	4	3	8	5												
Dangstetten (Da)	978.5	4	6	8	5												
Dangstetten (Da)	981.22	4	2	8	5												

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	982.11	4	3	8	5												
Dangstetten (Da)	986.10	4	3	8	5												
Dangstetten (Da)	986.9	4	6	8	5	3	8	5									
Dangstetten (Da)	989.18	8	1	8	5	3	8	5									
Dangstetten (Da)	990.6	4	3	8	5												
Dangstetten (Da)	994.12	8	3	8	5												
Dangstetten (Da)	996.8	8	3	7	1												
Dangstetten (Da)	997.5	8	3	8	5												
Dangstetten (Da)	1016.12	4	3	7	1	3	8	5									
Dangstetten (Da)	1020.8	8	3	8	5												
Dangstetten (Da)	1021.16	8	3	8	5												
Dangstetten (Da)	1025.13	8	1	8	5	3	8	5									
Dangstetten (Da)	1031.6	4	1	8	5	3	8	5									
Dangstetten (Da)	1034.6	8	2	8	5												
Dangstetten (Da)	1035.14	4	3	8	5												
Dangstetten (Da)	1035.15	8	3	8	5												
Dangstetten (Da)	1036.22	8	3	9	5	3	8	5									
Dangstetten (Da)	1036.23	8	1	8	5	3	8	5									
Dangstetten (Da)	1037.31	8	3	8	5												
Dangstetten (Da)	1037.32	4	1	8	5	3	8	5									
Dangstetten (Da)	1038.21	4	3	8	5												
Dangstetten (Da)	1038.22	4	1	8	5	3	8	5									
Dangstetten (Da)	1039.21	4	1	9	5	3	8	5									
Dangstetten (Da)	1039.22	4	1	9	5	3	8	5									
Dangstetten (Da)	1040.16	4	1	8	5	3	8	5									

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	1040.17	4	1	9	5	3	8	5									
Dangstetten (Da)	1040.18	4	3	8	5												
Dangstetten (Da)	1040.19	4	3	8	5												
Dangstetten (Da)	1042.14	4	1	9	5												
Dangstetten (Da)	1042.15	4	3	8	5												
Dangstetten (Da)	1046.14	4	1	8	5	3	8	5									
Dangstetten (Da)	1046.15	4	3	8	5												
Dangstetten (Da)	1046.16	4	1	8	5	3	8	5									
Dangstetten (Da)	1048.13	4	3	8	5												
Dangstetten (Da)	1049.17	4	3	8	5												
Dangstetten (Da)	1049.18	4	3	8	5												
Dangstetten (Da)	1050.7	4	6	8	5	3	8	5									
Dangstetten (Da)	1050.8	4	3	9	5												
Dangstetten (Da)	1052.10	4	3	8	5												
Dangstetten (Da)	1052.9	4	3	8	5												
Dangstetten (Da)	1054.29	4	1	9	5	3	8	5									
Dangstetten (Da)	1056.9	4	1	9	5	3	8	5									
Dangstetten (Da)	1059.23	4	1	9	5	3	8	5									
Dangstetten (Da)	1059.24	4	3	8	5												
Dangstetten (Da)	1062.11	4	3	8	5												
Dangstetten (Da)	1079.7	4	1	8	5	3	8	5									
Dangstetten (Da)	1079.8	4	3	9	5												
Dangstetten (Da)	1080.17	4	6	8	5												
Dangstetten (Da)	1081.20	4	3	8	5												
Dangstetten (Da)	1083.20	4	3	8	5												

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	1095.9	4	3	8	5												
Dangstetten (Da)	1104.3	4	3	8	5												
Dangstetten (Da)	1107.12	4	1	9	5	3	8	5									
Dangstetten (Da)	1107.13	4	3	8	5												
Dangstetten (Da)	1110.13	4	3	8	5												
Dangstetten (Da)	1119.9	4	3	8	5												
Dangstetten (Da)	1120.8	4	6	8	5												
Dangstetten (Da)	1122.70	4	3	8	5												
Dangstetten (Da)	1122.71	4	3	8	5												
Dangstetten (Da)	1122.72	4	3	8	5												
Dangstetten (Da)	1137.23	4	6	8	5												
Dangstetten (Da)	1139.6	4	3	8	5												
Dangstetten (Da)	1143.18	4	1	9	5	3	8	5									
Dangstetten (Da)	1145.8	4	3	8	5												
Dangstetten (Da)	1147.9	4	3	8	5												
Dangstetten (Da)	1150.9	4	3	8	5												
Dangstetten (Da)	1155.52	4	3	8	5												
Dangstetten (Da)	1155.53	8	3	8	5												
Dangstetten (Da)	1155.54	8	1	8	5	3	8	5									
Dangstetten (Da)	1155.55	8	3	8	5												
Dangstetten (Da)	1156.49	4	3	8	5												
Dangstetten (Da)	1156.50	4	1	8	5												
Dangstetten (Da)	1156.51	4	1	6	5	3	8	5									
Dangstetten (Da)	1160.13	4	1	8	5	3	8	5									
Dangstetten (Da)	1160.14	4	3	8	5												

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	1160.15	4	3	8	5												
Dangstetten (Da)	1165.20	4	3	8	5												
Dangstetten (Da)	1166.14	4	1	8	5	3	8	5									
Dangstetten (Da)	1171.10	4	3	8	5												
Dangstetten (Da)	1171.11	4	1	8	5	3	8	5									
Dangstetten (Da)	1189.8	4	3	8	5												
Dangstetten (Da)	1203.7	4	3	8	5												
Dangstetten (Da)	1203.8	4	3	8	5												
Dangstetten (Da)	1207.9	4	1	8	5	3	8	5									
Dangstetten (Da)	1220.49	4	1	7	5												
Dangstetten (Da)	1220.50	4	1	9	5	3	8	5									
Dangstetten (Da)	1220.51	8	1	8	5	3	8	5									
Dangstetten (Da)	1220.52	4	3	8	5												
Dangstetten (Da)	1220.53	8	1	8	5	3	8	5									
Dangstetten (Da)	1221.18	4	3	8	5												
Dangstetten (Da)	1221.19	4	3	8	5												
Dangstetten (Da)	1224.5	4	6	8	5	3	8	5									
Dangstetten (Da)	1234.38	4	3	8	5												
Dangstetten (Da)	1238.21	8	3	8	5												
Dangstetten (Da)	1248.5	4	3	8	5												
Dangstetten (Da)	1252.12	8	3	8	5												
Dangstetten (Da)	1257.28	4	1	8	5	3	8	5									
Dangstetten (Da)	1257.29	4	3	8	5												
Dangstetten (Da)	1273.11	4	3	8	5												
Dangstetten (Da)	1278.10	4	1	9	5	3	8	5									

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Dangstetten (Da)	1278.11	4	1	8	5	3	8	5									
Dangstetten (Da)	1278.12	8	3	8	5												
Dangstetten (Da)	1285.1	4	3	8	5												
Dangstetten (Da)	1288.5	4	3	8	5												
Dangstetten (Da)	1292.16	8	3	8	5												
Dangstetten (Da)	1295.16	4	6	8	5	3	8	5									
Dangstetten (Da)	1296.9	4	3	8	5												
Dangstetten (Da)	1297.10	8	3	8	5												
Dangstetten (Da)	1302.16	8	3	8	5												
Dangstetten (Da)	1308.18	4	1	9	5	3	8	5									
Dangstetten (Da)	1311.8	8	3	8	5												
Dangstetten (Da)	1311.9	4	3	8	5												
Dangstetten (Da)	1322.6	4	3	8	5												
Dangstetten (Da)	1337.51	4	3	8	5												
Dangstetten (Da)	1337.52	4	3	8	5												
Dangstetten (Da)	1337.53	8	3	8	5												
Dangstetten (Da)	1341.8	8	3	8	5												
Dangstetten (Da)	1350.35	8	3	8	5												
Dangstetten (Da)	1351.25	8	3	8	5												
Dangstetten (Da)	1351.26	4	3	8	5												
Dangstetten (Da)	1354.27	4	3	8	5												
Dangstetten (Da)	352 A/B.28		3	9	5	3	8	5									
Dangstetten (Da)	455-457.31		1	8	5	3	8	5									
Dangstetten (Da)	844 ADE.37	4	1	8	5	3	8	5									
Dangstetten (Da)	844A.36	4	1	8	5	3	8	5									
Forchheim (Fo)	161	5	1	1	2	1	1	2	2	2	1						

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Forchheim (Fo)	162	5	1	1	2	1	1	2	2	2	1						
Forchheim (Fo)	163	5	2	2	1												
Forchheim (Fo)	164.3	5	1	1	2	1	1	2									
Forchheim (Fo)	166	5															
Forchheim (Fo)	168	5															
Forchheim (Fo)	173	5	1	1	2	1	1	2									
Forchheim (Fo)	174	4															
Forchheim (Fo)	175	4															
Forchheim (Fo)	176	4															
Forchheim (Fo)	177	4															
Forchheim (Fo)	180	4															
Forchheim (Fo)	190	5															
Jechtingen (Jech)	848	5	1	3	1												
Jechtingen (Jech)	849	5															
Jechtingen (Jech)	850	4															
Jechtingen (Jech)	851	4															
Jechtingen (Jech)	852	4															
Jechtingen (Jech)	853	4															
Jechtingen (Jech)	854	4															
Jechtingen (Jech)	855	4															
Jechtingen (Jech)	857	4															
Jechtingen (Jech)	858	4															
Jechtingen (Jech)	859	4															
Jechtingen (Jech)	1510	5	1	1	2	1	2	1	1	1	2	2	2	1			
Mengen (Me)	429	5	1	2	1												
Mengen (Me)	430	5	1	1	2	2	1	2	1	1	2	7	9	1			
Mengen (Me)	431	5	1	2	1												
Mengen (Me)	432	4															
Mengen (Me)	434	5	1	1	2	2	2	1	1	1	2						
Mengen (Me)	441	5	1	1	1	1	1	1	1	1	2	7	9	1			
Mengen (Me)	446	4	1	2	1												
Mengen (Me)	449.1	5	1	3	1	1	1	3									
Mengen (Me)	449.2	5	1	3	1												
Mengen (Me)	450	5															

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Mengen (Me)	451	5															
Mengen (Me)	457	4															
Mengen (Me)	459.1	5	1	2	1												
Mengen (Me)	460.1	4															
Mengen (Me)	460.2	4	1	2	1												
Mengen (Me)	461.1	5															
Mengen (Me)	461.2	5															
Mengen (Me)	461.3	4															
Mengen (Me)	464.1	4	1	2	1												
Mengen (Me)	502	5	1	1	2												
Mengen (Me)	503	5	1	1	1	1	1	1									
Mengen (Me)	504	5	5	11	5												
Mengen (Me)	505	5	2	1	3												
Mengen (Me)	506	5															
Mengen (Me)	507.1	4															
Mengen (Me)	507.2	4															
Mengen (Me)	507.3	4															
Mengen (Me)	508	5	1	1	1												
Mengen (Me)	509	5	1	2	1												
Mengen (Me)	531	4															
Mengen (Me)	532.1	5															
Mengen (Me)	532.2	5															
Mengen (Me)	535	4															
Mengen (Me)	543	5	1	1	1												
Mengen (Me)	544	5															
Mengen (Me)	556	5															
Mengen (Me)	565.2	5	1	1	1												
Mengen (Me)	565.3	4															
Mengen (Me)	565.4	4															
Mengen (Me)	566	4															
Mengen (Me)	571	4	1	1	2												
Mengen (Me)	572.1	4															
Mengen (Me)	572.2	4															
Mengen (Me)	573.1	4															
Mengen (Me)	585.1	5	1	2	1												
Mengen (Me)	585.2	5															
Mengen (Me)	585.3	5	7	9	1	1	1	1	2	1	1						
Mengen (Me)	586.1	5															
Mengen (Me)	604.3	4	1	1	1	1	3	1	1	1	1						
Mengen (Me)	604.4	4															
Mengen (Me)	606	4															

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Mengen (Me)	606	4															
Mengen (Me)	607.1	4	2	1	4												
Mengen (Me)	607.1	5															
Mengen (Me)	650.1	4															
Mengen (Me)	650.3	4															
Mengen (Me)	652	4															
Mengen (Me)	653	5	1	1	2												
Mengen (Me)	696	5	1	1	2	1	1	2	1	1	2	2	2	1			
Mengen (Me)	697.1	5	1	1	2	2	2	1									
Mengen (Me)	698.2	5	1	1	2	1	7	1	1	1	1	2	11	1			
Mengen (Me)	699	5	1	1	3	2	1	3	7	4	1						
Mengen (Me)	702.1	5	7	9	1												
Mengen (Me)	703	5	1	2	1												
Mengen (Me)	705.1	5															
Mengen (Me)	705.2	5	2	2	1	5	4	1									
Mengen (Me)	714	4															
Mengen (Me)	716.1	4															
Mengen (Me)	718	4															
Mengen (Me)	540/541.6	5	7	4	1	1	3	1	6	3	1						
Riegel	29306.1																
Riegel	29306.2																
Riegel	29308.1																
Riegel	29356.1																
Sponeck (Sp)	3252	5															
Sponeck (Sp)	3106/5	5															
Sponeck (Sp)	3112/10	5	1	1	2	1	1	3									
Sponeck (Sp)	3112/6-31	4															
Sponeck (Sp)	3128/43	5															
Sponeck (Sp)	3129/13	5															
Sponeck (Sp)	3143/6	5	1	1	3	2	2	1									
Sponeck (Sp)	3152/14	5															
Sponeck (Sp)	3152/16	5	2	2	1												
Sponeck (Sp)	3168/38	5	1	2	1												
Sponeck (Sp)	3186/26	5	5	4	1												
Sponeck (Sp)	3186/27	5															
Sponeck (Sp)	3192/5	5	2	2	1												
Sponeck (Sp)	3228/10	4	1	2	1												
Sponeck (Sp)	3269/4	4															
Sponeck (Sp)	3269/5	4															
Sponeck (Sp)	3274/10	5	1	1	1	1	7	1	1	1	1						
Sponeck (Sp)	3280/14	5	1	2	1	1	3	1									

Site	Catalog Number	Surface Treatment	Design Element														
			Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element	Slope Element	Type Element	Frequency Element
Sponeck (Sp)	3327/4	5	1	2	1												
Sponeck (Sp)	3346/10	4	2	2	1												
Sponeck (Sp)	3374/39,40	5															
Sponeck (Sp)	3395/3	4															
Sponeck (Sp)	3397/15-21	5	1	1	5	7	11	5	3	6	5	3	1	5			
Sponeck (Sp)	3397/3	5	2	2	1												
Sponeck (Sp)	3397/59	5															
Sponeck (Sp)	3397/60	5	1	1	1	2	2	1									
Sponeck (Sp)	3397/71	4	1	1	4	2	1	1									
Sponeck (Sp)	3402/14	5	2	2	1												
Sponeck (Sp)	3402/3	5															
Sponeck (Sp)	3402/71	5	1	1	1	1	3	1	1	1	1						
Sponeck (Sp)	3410/23	5	1	1	1	2	3	2									
Sponeck (Sp)	3410/23a	5	1	1	1	2	2	1									
Sponeck (Sp)	3416/4	5	1	3	1												
Sponeck (Sp)	3462/4	5															
Sponeck (Sp)	3463/1	4	1	1	1												
Sponeck (Sp)	3468/41	5	2	1	2	1	1	1									
Vörstetten (Vor)	35	5	1	1	2	2	2	1	1	2	1	7	4	1			
Vörstetten (Vor)	37	4															
Vörstetten (Vor)	40	5	1	1	2	1	1	2	1	1	2	2	2	1	5	4	1
Vörstetten (Vor)	41	5	2	2	1												
Vörstetten (Vor)	48	4															
Vörstetten (Vor)	50	4															
Vörstetten (Vor)	55	4	7	9	1												
Vörstetten (Vor)	94	5	1	1	2	1	1	2	1	1	2	2	2	1	5	4	1
Weil (Wei)	6.1	4	3	8	5												
Weil (Wei)	47.1	4	6	8	5												
Weil (Wei)	55.1	4	2	8	5												
Weil (Wei)	59.26	4	2	8	5												
Weil (Wei)	80.1	4	3	8	5												
Weil (Wei)	83.1	4															
Weil (Wei)	85.3	4	3	8	5												
Weisweil (We)	100	5	1	1	1	6	1	1	1	1	1						