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I am submitting herewith a thesis written by Rebecca Jane Emans entitled "Exploring the Parameters of Style and Function in Lithic Artifacts." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Jan F. Simek, Major Professor

We have read this thesis
and recommend its acceptance:

David Sylvester

Accepted for the Council:

Associate Vice Chancellor and
Dean of the Graduate School

EXPLORING THE PARAMETERS OF STYLE AND FUNCTION IN LITHIC ARTIFACTS

A Thesis
Presented for the
Master of Arts
Degree
The University of Tennessee, Knoxville

Rebecca Jane Emans
August 1998

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To my family, especially my Dad,

Robert Emans,

and, in loving memory of my Mom,

Jeanne Elizabeth (née Faughnan) Emans.

ACKNOWLEDGEMENTS

There are many people who have, in one way or another, enabled me to write and complete this thesis. First, I would like to thank the members of my committee. In particular, my major professor, Jan F. Simek, whose guidance, support, and understanding has been greatly appreciated. It has been wonderful to have a major professor who has encouraged me to pursue my interests, and to seek new ones, even when they are different from his. The other members of my committee, Dr. Jefferson Chapman, and Dr. David Sylwester, contributed helpful suggestions and ideas, and were patient and understanding about last minute changes.

I thank the Frank H. McClung Museum, of the University of Tennessee, Knoxville, for the use of materials for the analysis of this thesis. Dr. Chapman, the Director of the museum, enabled me to use these materials, and to have space there for my work. Also, I greatly appreciate Dr. Susan Frankenberg's help and patience while I was working on the materials there.

There are other people and institutions to whom appreciation for assistance should be recognized. Flemming Kaul, Curator of the National Museum in Copenhagen, Denmark, and the National Museum in general, provided me with information about the collection, started me in the acquisition of relevant literature, and translated the correspondence to and from me. Dr. Janet Levy, of the University of North Carolina, Charlotte, was kind enough to meet with me about this collection, helped me with initial literature sources, and leant me several books. Dr. T. Douglas Price, of the University of Wisconsin, Madison, kindly aided me in literature sources.

I would also like to thank several libraries. The people of the Interlibrary Loan Services of the University of Tennessee, Knoxville, were exceedingly patient and diligent; and, without them, this thesis could not have been written. I also used the libraries at Vanderbilt University; the University at Buffalo, State University of New York; the University College, Dublin; and the National Library of Ireland.

My professional life has been shaped by various professors. My undergraduate Anthropology professors, Larry Zimmerman and Lawrence Bradley, of the University of South Dakota, shaped my early experiences in anthropology and archaeology. Their continued friendship has encouraged me to continue through the rough years of graduate study. Also, over the years, many friends have both helped me and distracted me from graduate work. These friends include Lee-Ann Hartlett-Ensor, Michele Grant, and Nikki Rogers-Garwood.

I also thank my sisters, their husbands, and children: Charlotte, William, and Gideon Moore; and Jennifer, Robert, Cordelia and Ian Hutter. They have given me wonderful support and understanding during a difficult time for all of us.

My parents, Robert and Jeanne Emans, have been kind, caring, and humorous teachers. It is through their active support and nurturing that I am prepared for the life that is before me, wherever it should lead. My father's (professional) emphasis on the enjoyment of reading, has instilled in me an avid interest in reading, and has prepared me well for research. My mother's companionship, sharp mind, and timely wit, have been exceedingly important, even when we were states apart. It is with considerable sadness that I was unable to complete this thesis while she was still alive, for I would love to have known what she thought of it.

ABSTRACT

This thesis explores the parameters of function and style by examining variation in lithic artifacts. It is proposed that variation in functionally equivalent artifacts rests within at least one of four realms: workability; isochrestic variation; derivation; or, stylistic variation. This thesis is attempting to identify the last realm, stylistic variation, by using Polly Wiessner's (1983) predictions to identify when an artifact contains style. These are: the length of time of manufacture; its lifetime, or uselife; and, the variation that exists within the type group.

The artifacts used for analysis are from a collection in the Frank H. McClung Museum, University of Tennessee, Knoxville, and date from the Danish Upper Palaeolithic to the Bronze Age. They are divided into four groups: Unifacial, Bifacial, Multifacial, and Miscellaneous artifacts. Analyses include descriptive and statistical procedures, using qualitative and quantitative data. Both within-group and between-group comparisons are made. Between-group comparisons include chi-square tests of homogeneity between Unifacial, Bifacial, and/or Multifacial artifact groups, and the use of Guttman's Lambdas.

By using Wiessner's prediction for style, the variation within and between the artifact groups is interpreted as evidence for stylistic variation in lithic artifacts. This study illustrates that variation exists in lithic artifacts which can be interpreted as style.

This diachronic study examines the role of style-bearing objects in the Ideotechnic, Sociotechnic, and Technomic spheres of prehistoric Danish societies. The long temporal sequences enable the identification of trends in stylistic variation during Danish prehistory. The styles of these artifacts are discussed in relation to the

degree of activity of style (active vs. passive), the specificity of referent of the style (emblemic and assertive styles), and the level at which stylistic comparison occurs (protocol and panache behaviors). (Wiessner 1990).

Conclusions are made with respect to the concept of style. Style is not viewed as "function writ small" (Sackett 1986b:630). Rather, style has a powerful function in societies, and the ideologies of those societies (Levy 1982). Objects containing style are used by individuals, in rituals which communicate messages about ideology, kin relations, economic conditions, and social tensions. Style is used within action to reinforce group cohesion, social relations, and to signify wealth and power.

PREFACE

This thesis is divided into three sections. Section I presents the theoretical background information and analytical procedures. Chapter I, the Introduction, describes the research goals and summarizes the concepts and paradigms of stylistic and functional variation. Chapter II, Descriptive and Statistical Procedures, presents the procedures, methods, and variables used.

Section II presents within-group analyses. The artifacts are divided into four groups: Unifacial, Bifacial, Multifacial, and Miscellaneous artifacts. Each of these groups is presented in a chapter: Chapter III presents the analyses of Unifacial artifacts; Chapter IV, the analyses of Bifacial artifacts; Chapter V, the analyses of Multifacial artifacts; and Chapter VI, the analyses of Miscellaneous artifacts.

Section III includes the between-group analyses and conclusions of the study. Chapter VII presents between-group comparisons of the Unifacial, Bifacial, and Multifacial artifact groups. Chapter VIII, presents interpretations in relation to four realms of variation: workability, isochrestic, derivative, and style. Stylistic content in lithic artifacts is assessed by three predictions: length of manufacture time, lifetime, and variation within type groups. The overall significance of the concept of style in artifacts is discussed.

Many of the literature sources for this thesis are not listed in the Anthropology indexes; therefore, the Bibliography includes sources cited as well as sources which might be difficult to find. Appendix E summarizes the history of archaeology in Denmark, and Scandinavia in general; and is a survey of the prehistory of Denmark, from Late Palaeolithic times through the Bronze Age.

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SECTION I:

INTRODUCTION AND ANALYTICAL PROCEDURES

CHAPTER I

INTRODUCTION

Function and style are important concepts for the interpretations of culture change and the reconstruction of prehistoric lifeways. While both can be studied in relation to various aspects of the archaeological record, including architecture and art, they are most often studied in relation to artifacts, such as lithics and ceramics. The forms of stone tools and the forms and designs of ceramics have been used to create types. A "type" is a classification of an artifact form into a category that is exclusive to that form (Hill and Evans 1972:233; Clarke 1978; Klejn 1982; Adams 1988). Series of related "types" are called typologies, which, historically, have been used in archaeology to develop relative chronologies and to identify prehistoric cultural groups (Willey and Sabloff 1993). Thus, tool types and pottery types are used to define prehistoric cultural groups; and, therefore, they are both important for culture-historical purposes.

Beyond traditional culture-historical identifications, stone tools and ceramics are used to elucidate behavioral aspects of past human groups, including those which relate to both the function and style of artifacts. The media for the analysis of function are most often stone tools, and the waste products of the manufacturing process (Voss 1977; Meltzer 1981). The goals in functional analysis are to recreate and to identify changes in procurement, processing, manufacturing, subsistence, and

other similar activities. These activities are often viewed as ways that humans have found to adapt to their physical environments. The study of stone tools is most often applied to hunter and gatherer societies.

When archaeologists study style, it is most often in the realm of ceramic design and form (Voss 1977:269). Studies in style in ceramics have been used to expound on the social and ideological aspects of human activities, such as political power or ethnicity (e. g. Deetz 1968; see also Hegmon 1992; Plog 1983), and usually relate less to adaptation and more to social communication and identity. In contrast to studies of stone tools, studies of ceramic styles are more likely to be applied to agricultural societies.

Analysis of style in stone tools for interpretations of social and ideological dimensions of human activities is often viewed as unproductive, usually because the interpretations are subjective, "unsophisticated" (Voss 1977:270), or at least difficult, due to the "simplicity" of most of the artifacts (ibid); and because of the complexity of their attributes (Voss 1977:269; see also Meltzer 1981; Edmonds and Thomas 1987; Close 1978, 1989:852; Hegmon 1992; Plog 1983; Sackett 1990; Weissner 1990; for a recent study of style in lithic artifacts see Rick 1996). However, style is a very important component in artifacts which have largely non-utilitarian functions. These artifacts, as such, are important in the Sociotechnic and Ideotechnic spheres of societies (see below for discussion of Sociotechnic and Ideotechnic functions). Style can also be seen in artifacts which have largely utilitarian functions, as with ceramics.

RESEARCH GOALS

This thesis explores the potential of lithic artifacts for studies of function and style, and their roles in the Sociotechnic and Ideotechnic spheres of societies (Binford 1962). This is done by identifying possible loci for style in lithic artifacts, and then contrasting these loci with information about the functions of the lithics. A museum collection from Denmark, and various literature sources, are used for this purpose.

I propose that, when tools are functionally equivalent, the differences between the forms of these tools lie in four general realms (c.f. Conkey and Hastorf 1990:4). First, the perfection of the workability of the tool (c.f. Olaussen 1983a and b); second, isochrestic variation is the normal range of possible alternatives in the manufacturing process (Sackett 1985a; c.f. Hegmon 1992; Gebauer 1987); third, derivation of attributes from other forms, or invention from independent sources (c.f. Hill 1985:376); and, finally, stylistic variation, where attributes have social and/or ideological meaning (Plog 1990; Wiessner 1990). These realms are further explained and discussed in Chapter VIII.

The problem for archaeology is how to distinguish variation which is stylistic, rather than isochrestic, derivative, or due to workability. The tools in this collection represent an array of possible functions: e.g. chopping (axeheads), levering (picks), cutting (knives, daggers, points), stabbing (daggers, points), and scraping (knives, daggers, points, stemmed scrapers, adzes, chisels). There are more forms than there are functions. In order to resolve this problem this thesis identifies stylistic variation using Polly Wiessner's (1983) predictions for materials which have stylistic content. These predictions relate to: the length of time to manufacture an objects, the lifetime

of the object, and the variation within and between type groups (see Chapter VIII for further discussion). In particular, this study uses these predictions to identify stylistic variation in lithic artifacts, and then contrasts this kind of variation with the other three realms of variation.

METHODS OF ANALYSIS

Analysis includes both descriptive and statistical procedures, using both qualitative and quantitative data derived from the artifacts in this collection. By including descriptive and statistical analyses, this thesis explores the inter-relatedness of style and function in stone tools. Since stone tools are usually interpreted as devoid of style, descriptions lay the foundation for the discussion of style in lithic artifacts. Specific variables and methods of analysis are detailed in Chapter II.

MATERIALS USED

The artifacts used in this study are in the Frank H. McClung Museum of the University of Tennessee, Knoxville. Most of them belong to Accession 45. The artifacts from this accession were donated, in 1949, by Louis Phillip Wulff (formerly of 1948 Harbert Avenue, Memphis, Tennessee, 1949 address). The collection was compiled in Denmark. They were intended to be "duplicates" of specimens in the Danish National Museum, representing the Neolithic and Bronze Age of Denmark, from 3000-2000 BC, (Accession Card No 45, McClung Museum; dates may be prior to modern radiocarbon dating).

Wulff acquired the artifacts in the summer of 1949, apparently some from the Royal Danish Museum in Copenhagen, Denmark, and some from his own travels in Denmark (see letter to Dr. Lewis, June 24, 1953, in McClung Museum). Flemming Kaul (personal communication) states that the only reference that the Danish National Museum has found that might relate to this collection is a note saying "...that some artifacts were given to USA in the year 1949". No specific information about this collection was attainable from the National Museum.

The artifacts lack detailed provenience. What provenience there is, is restricted to the identification of the names of towns near where the artifacts were found (Louis Wulff, letter to Dr. Lewis, June 24, 1953, Flemming Kaul, personal communication). A letter to Dr. Lewis from Wulff (dated June 24, 1953) states that the artifacts were from within a mile of a mound near Køge. The accession cards for this collection identify various towns or regions in Denmark, such as Køge, Eastern Zealand, Sorø, Central Zealand, and Randers, Eastern Zealand, or, simply, Zealand or Jutland. This most likely means that the artifacts were near these towns (Kaul personal communication). Kaul states that, if these artifacts came from the National Museum, then they were most likely originally part of a private or school collection. Two artifacts have numbers written on them, but they could not be used by the National Museum, and, very well may not have been their numbers. Some artifacts are also identified as coming from a cist grave or other grave, but without a site specified.

In addition to the artifacts of Accession 45, three other artifacts in the McClung Museum are used in this analysis. From Accession 51, Number 200 is a dagger. There is another dagger, of unknown Accession. And, finally, there is also a ground stone

axehead, from Accession 2, Number 119. Unless otherwise designated, the artifacts belong to Accession 45, those donated by Louis Wulff.

The collection used in this analysis is an assortment of artifacts which is not comprehensive. The artifacts include various stone tools, spanning from the Late Palaeolithic period to the Bronze Age, in Denmark. There are five Bronze artifacts, as well. Approximately twenty different classes of artifacts are represented in this collection, (e. g. chipped stone axeheads, ground stone axeheads, sickle blades, daggers, chisels, transverse arrowheads). There are considerable gaps in representation of artifacts that could conceivably be found in Denmark for the time periods these artifacts represent. The collection presents only a vague sketch of these periods, but can be used to illustrate the possible loci of stylistic as well as functional attributes.

The justifications for using an unprovenienced, small collection are that this collection was selected specifically for representativeness of the main, central types for these time periods. By using these individual pieces, they are representatives of their classes. For form, they are models for discussion. In relation to function, the odds are that they are representative.

VARIATION IN ARTIFACT ANALYSIS

A basic objective in artifact analysis is to identify and explain variation in artifact forms and attributes. This variation has been usually categorized as functional or stylistic. Dunnell (1978:199) argues that style and function are a "mutually exclusive" dichotomy. However, archaeologists writing about style argue that the two concepts

of function and style are related, and discussion of one necessarily includes some discussion of the other (Sackett 1990:33; Wiessner 1990:107; Sackett 1973:321; Hill 1985:366). It is also appropriate to contrast stylistic and functional variations with isochrestic variation.

Functional Variation

Function relates to the utilitarian aspects of artifacts (Sackett 1986b). It "...deals with those elements of artifact variability relating to processing matter" (Cross 1983:100). Analysis of functional variation can be either artifact oriented or task oriented, relating to the identification of the use and purpose of the artifact within the context of the society being studied (Juel Jensen 1994:162). The purpose of the artifact is the goal of the task or activity being performed; while use is the specific activity [Faulkner in Hayden (1979)].

Dunnell (1978) views function as a trait which affects the Darwinian fitness of populations. Function undergoes natural selection over time, and is influenced by external conditions. Functional elements can be identified and contrasted with one another. Within his evolutionary approach, function must be viewed as separate from style.

According to Binford (1962; also, Schiffer and Skibo 1995:234), artifacts can function within a society as part of technology, which he calls Technomic function. Artifacts can also function in relation to the social aspects of a society, Sociotechnic function; and/or the belief system (ideology) of a society, Ideotechnic function. Methods to identify the Technomic, Sociotechnic, and Ideotechnic functions of an artifact can be based on gross morphology (primary analysis, see Chapter II for

discussion of primary analysis). Interpretations of function use two main forms of analogy: analogy from ethnological studies (ethnoarchaeology); and, analogy from experimental studies (Hole and Heizer 1969). Archaeologists use data from these analyses to make comparisons between archaeological data and analogical data in order to make conclusions about the use and purpose of the artifacts. Archaeologists or anthropologists conduct ethnographic studies of the form and purposes of artifacts by observing the use of material culture in living cultural contexts.

Technomic function can also be based on secondary analyses. A series of microscopic methods have been developed for the utilization of archaeological experiments (e. g. Juel Jensen 1994; Keeley 1980). Archaeologists simulate cutting, scrapping, chopping, and other activities on various materials, such as hide, wood, bone, and grain, usually using flint or other stone. They then make microscopic observations of the "wear" patterns of the stone experimental pieces. These studies, using low and high power microscopes, have been found to be valid and reasonably reliable for the identification of how archaeological materials were used, and thus to make conclusions about the purpose(s) of an artifact.

Conclusions about Sociotechnic and Ideotechnic functions of artifacts tend to be based on primary analysis of style and form. Studies of the styles of artifacts may shed more light on Sociotechnic and Ideotechnic functions, than they relate to Technomic function (Cross 1983). Focus is on the non-utilitarian artifacts or the non-utilitarian context of utilitarian artifacts, such as ritual and burial customs. Within cultures, Sociotechnic and Ideotechnic functions are related to group identity, interaction and cohesion. While assuming artifact purpose and use, conclusions made by archaeologists rely on reconstructions of lifeways and ideologies. These

include comparative studies of prehistoric and ethnographic uses of material culture; graves and grave goods; the exchange of material culture and raw materials; as well as the reconstruction of subsistence patterns, social structures, and settlement patterns.

Stylistic Variation

> "Scholars rarely experience any difficulty in talking about style or in describing its formal elements when we are considering objects, that is, the physical products of certain types of behavior." (Lechtman 1977:5).

Contrary to Heather Lechtman's atypical statement, above, the concept of style has been the focal point of considerable disagreement and discussion (see Hegmon 1992, and various chapters in Conkey and Hastorf, ed. 1990). Most archaeologists recognize that there has been considerable debate involving the definitions of style, and the characterizations, parameters, and use of these concepts in archaeology. Less discussion has focused on paradigms or models of how and why style was used by prehistoric peoples (Conkey 1990; Wiessner 1990).

Recent discussion of artifactual variation has expanded to include different kinds of stylistic variation (see various chapters in Conkey and Hastorf, eds. 1990). Each kind has been defined, interpreted, and used, to some extent, in different ways by different archaeologists. On a basic level, style is the body of non-utilitarian characteristics of artifacts (Sackett 1986b). It is the formal similarities among artifacts which can be found to relate to factors other than availability of raw materials, or mechanical efficiency (Davis 1983:55).

Beyond a general concept of style or stylistic variation, Plog (1990:62) identifies three kinds of stylistic variation. Isochrestic variation has been defined variously by

different archaeologists (cf. Sackett, various sources; Wiessner 1990; Plog 1990). Originally defined by Sackett (1977, 1982, 1985a, 1985b, 1986a, 1986b), isochrestic style or variation "...means literally 'equivalent in use' and refers to the fact that there normally exists an appreciable range of equivalent alternatives, of equally viable options, for attaining any given end in manufacturing craft products" (Sackett 1985a:157). Isochrestic variation can be either stylistic or functional variation. To Sackett, isochrestic style is a latent quality, which all material objects have the potential to contain. Style is "ethnically significant variation unconsciously invested into banal functional items by passive artisans." (Sackett 1986a:274). It is an ethnic style, where the artisan leaves an "ethnic stamp" (Sackett 1986a:270).

Plog's (1990:62) second kind of stylistic variation is symbolic variation. This kind of variation communicates information about social relationships. A form of symbolic variation is Plog's third kind of stylistic variation. This is iconological variation, a term originally coined by Sackett (1986a:270) to differentiate isochrestic style from Wiessner's concept of style (see below). Iconological variation is the product of an active artisan. Wiessner (1983, 1985, 1990) divided her concept of style into emblemic style and assertive style.

Hill (1985) and Wiessner (1983:256) have discussed several paradigms related to the use of style in archaeological and ethnoarchaeological contexts. These are Social Interaction, Information Exchange, Evolutionary, and Social Comparison paradigms. Wiessner (1990:107) uses three criteria to categorize the kinds of style within these paradigms: the degree of activity of style, the specificity of referent of style, and the level at which comparison occurs.

The first two paradigms center around the degree of activity of style. Style can be viewed as a passive element in culture (Sackett 1977, 1985a, 1985b, 1985c, 1986a, 1986b). Passive style is the kind of style which is used within the Social Interaction paradigm (Hill 1985).

In the Social Interaction paradigm, style is a form of "Art for Art's Sake". Style is residual similarities which are considered to be related to the nature and degree of the social interaction between individuals and groups (Hill 1985). Aspects of style are non-adaptive for human groups and populations, and style has no function in maintaining societal interpersonal or inter-group relations: there is no intended message. Diffusion of stylistic traits or attributes depends on the interaction of people: those who interact frequently share many aspects of style; and, conversely, those who interact infrequently share fewer stylistic attributes.

The stability and change of style in artifacts is dependent upon the teaching/communication/learning process: change is a result of accidental random errors in communication or disturbances in the stylistic learning process (Hill 1985:365). When a random error occurs, it diffuses outward and is automatically accepted by anyone who comes into contact with it. Then, it will continue to diffuse until it is stopped by a barrier, or when there is some kind of interruption in interaction. However, Hill (1985:366) asserts that people do not adopt things unless there is some material reason or need to do so, and that social interaction plays only a minimal role in explaining variability and change.

The second paradigm, called Information Exchange (Hill 1985), uses a concept of style as active. Within this paradigm, style plays an active role in mediating cultural information which is exchanged by having a symbolic or communication function

(Wobst 1977). Style is functional to social behavior, and related to the adaptive nature of culture (Wiessner 1983, 1984, 1985; Wobst 1977; Conkey 1989).

Style is "...that part of the formal variability in material culture that can be related to the participation of artifacts in processes of information exchange" (Wobst 1977:321). Style conveys messages which can promote intra-group integration and cohesion; and, also, signifies group identity and affiliation with other groups. Wobst (1977:323) states that it is necessary for stylistic attributes to be visible to the target group(s): the less visible an artifact is, the less it contains messages for the society. Patterns of stylistic variation in material culture can differ in degree of visibility. Style messages must be directed toward a target group that is not socially too close or too far to the sender. They also signify group affiliation and boundaries. If there is a lot of competition, then the markers of group affiliation and boundaries would be highly visible for easy identification of allies and foes.

However, the Information Exchange paradigm does not account for all of the change and variety in style (Hill 1985:382). In this paradigm, formal variability must be part of the process of information exchange. If it is not, then it is not style, but consistent patterns of form without social significance, along the lines of isochrestic variation (Sackett 1986a).

Hill (1985) argues that the Information Exchange and Social Interaction paradigms can be used within an Evolutionary framework. While the Information Exchange paradigm does not explain variability and change in style; and the Social Interaction paradigm does not account for all variability and change, an evolutionary framework would explain and account for variability and change in style. For Hill (1985), a theory of style could come from analogy with biological

evolutionary theory. The questions which evolutionary theory asks are the same kinds of questions which should be answered with respect to style. These include how style originates, what causes style to change, and why does it become extinct.

In his Evolutionary paradigm, Hill (1985) views a community as a breeding population. Its comparable gene pool is the pool of style units available to the community. Change in this pool is the result of invention/innovation (mutation), and diffusion (gene flow). Invention/innovation occurs, either purposely or accidentally, at the individual level. Diffusion is when new style units, external to the community, are introduced in some way (migration, exchange, or idea diffusion). It is a result of interaction, which generates variety. However, diffusion does not cause change in frequencies of spatial variation. Selection processes change the frequencies of style units, and causes spatial variation. The selection of genes in biological populations is analogous to the cultural selection of style units. Unlike biological selection, cultural selection is conscious and purposeful in order to meet an "adaptive need" (Hill 1985:378). This style can be for communication, as well as other needs. Hill equates stochastic processes with genetic drift. Drift of stylistic traits would not be significant at the level of the individual artisan, but might on the level of a group of isolated artisans.

In contrast, Dunnell (1978) views style as a trait which does not affect the Darwinian fitness of populations. Style is adaptively neutral, with no selective value. The frequencies of stylistic traits are not the product of natural selection, and are not affected by external factors. Rather, style traits are part of stochastic, random processes. They are identifiable by their random occurrence. "stylistic similarity is homologous similarity--it is the result of direct cultural transmission once chance similarities in a context of limited possibilities is excluded" (Dunnell 1978:199). Sackett

(1990:43, note 7) argues that the issues which Dunnell discusses are a matter of scale. Meltzer (1981:314) states that "while *particular styles* are not directly accountable by natural selection, *style in general* has a role in the cultural system" because it has a cost with respect to energy, space, and matter.

Another alternative to the Social Interaction and Information Exchange paradigms is the Social Comparison paradigm. Polly Wiessner modified the Social Interaction and Information Exchange paradigms, based on ethnoarchaeological research with the San!. While the Social Comparison paradigm includes social interaction and information exchange, it restricts the information contained in style to that of identity.

Wiessner defines general style as "...formal variation in material culture that transmits information about personal and social identity" (Wiessner 1983:256). This paradigm uses Wiessner's (1990:107) second criterion for categorizing kinds of style: the specificity of to whom or what the style refers. "Specificity of referent can and often does change as styles are used in new contexts and take on new meaning" (Wiessner 1990:108). Based on specificity of referent, Wiessner divides style into two aspects: emblemic and assertive. Both emblemic and assertive styles can be active.

Emblemic style is "...formal variation in material culture that has a distinct referent and transmits a clear message to a defined target population...about conscious affiliation or identity" (Wiessner 1983:257). It symbolizes individual identity and ethnic boundaries.

Assertive style has a more vague association or referent. It is "...formal variation in material culture which is personally based and which carries information supporting

individual identity" (Wiessner 1983:258). Assertive style only supports individual identity, it does not symbolize it. It reflects the degree of contact across boundaries.

These two aspects of style are distinct, and have different patterns of variation, but they can occur on the same artifact (Wiessner 1983). Therefore, they require different methods of analysis in archaeology. These aspects show different patterns through time and space. Since emblemic style has a distinct referent, it is not dependent on innovation and diffusion. In contrast, assertive style depends on innovation and diffusion. It's pattern would reflect socioeconomic change over time. Emblemic style's distribution over space would be distinct, while assertive style's distribution could be random, or clinal, depending on the social, functional, and natural qualities of the artifact carrying the style.

Wiessner's (1990) third criterion for the categorization of style is: the level at which identity refers. MacDonald (1990) applies Wiessner's Social Comparison model to mortuary data. He examines how style was used on group and individual levels. These levels are based on Wiessner's two kinds of style, emblemic and assertive. To MacDonald, Wiessner's assertive and emblemic styles are material products of two separate social processes which MacDonald calls panache and protocol.

Panache ..." refers to those social processes and related behaviors that are aimed at an atomistic emphasis on the individual as a separate, independent, and unique element" (MacDonald 1990:53). It is a form of self-expression and self-definition. Panache results in assertive style in material forms. With panache, MacDonald predicts that there is an increase in stylistic variability in the form of assertive variation as the product of efforts at individuation.

Protocol "...refers to a set of social processes that is aimed at the promotion of group identity and membership at the expense of the individual" (MacDonald 1990:53). Protocols facilitate social interactions and define expectations of behavior. They are dependent on a situation, and are specific to a situation. They relate to age and sex, status and etiquette. Protocol results in emblemic style in material forms. MacDonald sees stylistic variation as communicative and multireferential. Style is a "metaphor" specifying and accounting for the generation of variation.

SUMMARY

From this discussion, it can be seen that function and style in artifact analysis covers a broad spectrum of theories, and methods of analysis. Ethnographic, ethnoarchaeological, and experimental researches all present important information for the interpretation of function and style in artifact analysis. Wiessner (1983, 1985) and others (see Hegmon 1992) view style as transmitting information about identity. Style is a symbol of an idea. It transmits information about identity, as well as symbolizing social and ideological ideas and concepts. These communicate information which enables a society to reinforce its beliefs and social ties.

The development of style and function throughout Danish prehistory may be the only common thread that can be sewn through the museum collection. By examining variation in artifacts it is hoped that an understanding of the parameters of style and function in lithic artifacts will be obtained. In Chapter VIII, there is a further discussion of style and function in lithic artifacts.

CHAPTER II

DESCRIPTIVE AND STATISTICAL PROCEDURES

Artifact analysis can be divided into two areas: primary and secondary analysis (after Redman 1973; and Sharer and Ashmore's divisions of classification; 1987:242). Primary analysis is the examination of the gross morphology of artifacts, and attributes which are directly observable, such as form, length, or proportions, for the purposes of classification and typology. From Primary analysis, the archaeologist can interpret the style and function of artifactual materials. Methods of the analysis can be qualitative descriptions of the materials, and quantitative interpretations utilizing metrical and statistical techniques. Secondary analysis involves the use of microscopic investigation to identify attributes which lead to interpretation of how or what artifacts were used for in prehistoric societies, and thus to interpret the function of the artifacts. These studies are usually qualitative, and based on ethnographic analogies, experimentation, and mechanics.

The methods for this thesis will be restricted to primary analysis. Polish has been placed over the catalogue numbers of the artifacts, so that, especially in the cases of the small unifacial artifacts, such as transverse arrowheads, the small surfaces have been very nearly covered. About one-third of the artifacts in this collection are this small, and may be in this condition. In addition, there is a slight patination of the surfaces, in general. This patination may signify that the materials were collected as surface finds, and/or that the stone tools, at some point in their history, had been

stored so that they connected with one another, or some material, which caused this patination. A non-random sample of various specimens was examined under high power, and it became clear that, at least for the small pieces, it would be difficult to discern use-polish from this polish. More importantly, the methods will be restricted to primary analysis because secondary analysis is restricted to functionalist interpretations. Primary analysis allows for interpretations of style as well as function.

The artifacts are divided into four groups: Unifacial artifacts, Bifacial artifacts, Multifacial artifacts, and Miscellaneous artifacts. The results of the analyses of each of these groups are presented separately in each of four chapters: Unifacial artifacts are covered in Chapter III, and include two-sided artifacts with flake removal on only one side. Bifacial artifacts, in Chapter IV, include two-sided artifacts with flake removal on both of the two sides. Multifacial artifacts, in Chapter V, include artifacts with three or four sides, and flake removal on all sides. Finally, Miscellaneous, in Chapter VI, artifacts are those artifacts in the museum collection which do not fit into any of the three previous categories.

Each chapter contains two sections. The first section of each chapter, Statistical Analysis involves the identification and use of variables as attributes of the artifacts. The identification of variables used for the analysis of the artifacts was based on an analytical scheme developed by Deckers (1985). Deckers' coding system was developed for Neolithic flint materials in the Netherlands. The variables recorded for this thesis are derived, in part, from some variables in Deckers' coding system. Coding systems are used to ensure standardization of terms and definitions related to morphological attributes of artifacts that are not related to time or space, as well as to decrease subjectivity in analysis (Deckers 1985).

The second section, Descriptive Analysis, presents detailed descriptions of the artifacts and includes discussion of information about these types of artifacts, derived from various sources. This information includes interpretations of the methods of manufacture, as well as the significance of the artifacts in archaeology, and the presumed significance of these types in past lifeways. When applicable, provenience is included, although this is restricted to the names of nearby towns (Flemming Kaul, personal communication).

These two sections are not mutually exclusive, however. The sections of Descriptive Analysis and Statistical Analysis overlap in content. This overlapping allows for consistency in interpretation as well as enabling the discussion of style and function.

The position or orientation of each artifact is important for both descriptive and statistical analysis. Orientation of the artifacts is standard for each type of artifact, and follows illustrations in various sources (e. g. Mathiassen 1948; Glob 1952). The orientation of artifacts within similar type groups was consistent. In general, the base or butt of the artifact was laid horizontal and proximally, and the point was placed opposite, or distally. The top was determined by surface features, and kept consistent within type groups. This is true for points, daggers, axes, transverse arrowheads, tanged points, and other forms where the cutting edge(s) was distinct and opposite to a base or butt. Sickles were placed with the convex side as the base. Fish hooks and similar amorphous pieces were oriented with the longest side to the right.

VARIABLES

For this thesis, tools are viewed as clusters of attributes, and "variable" refers to a specific attribute of an artifact (Clarke 1978:206). The variables used in this thesis are divided into three sets: A, B, and C. Abbreviations for each variable are in parentheses after variable names. A 10X magnifying glass was used to cursorily examine the surfaces of the artifacts, and to record some variables (Moss 1983:231).

Set A are Identifying Characteristics, Metric Variables, Indexes, and Surface Features. All four of these categories of variables were recorded for Unifacial, Bifacial, and Multifacial artifacts. Only Identifying Characteristics, Metric Variables, and Indexes were recorded for Miscellaneous artifacts.

Set B are Base Angles and Retouch variables. These were recorded for Unifacial and Bifacial artifacts only, following Deckers' (1985) coding system.

Set C are used for the Multifacial artifacts only, and record features related to surface negatives.

Set A Variables: Identifying Characteristics and Metric Variables

Identifying Characteristics

Characersistic.

NUMBER. (NO). Assigned by the Frank H. McClung Museum.

CLASS. Class of the artifact, e.g. axehead, sickle-blade.

TYPE. Type of artifact, such as thin-butted axehead.

PERIOD. (PER). Chronological period to which the artifact probably dates.

RAW MATERIAL. (RM). Size of grain: fine (F), medium (M), or coarse (C). A 10X magnifying glass was used.

COLOR, PRIMARY. (COL1). The prominent color; was determined using a Munsell Soil Color Chart. Decker used a Rock Color Chart, which was unavailable for use here.

COLOR, SECONDARY. (COL2). Some artifacts had more than one color; the second most common color.

POLISH. (POL). 0-absent, 3-present. Coded for Multifacial artifacts only.

PART. (PRT). Completeness of the artifact: 1-the distal part is present, 2-the medial part is present, 3-the basal (or proximal) part is present, 4-the artifact is complete, 5-the artifact is broken along its length, 6-the distal and medial parts are present, 7-the medial and proximal parts are present, 8-the artifact is nearly complete, with only a fragment missing,

CITATION. (CIT). Type specified in citation, or figure number from citation.

Metric Variables

Variable.

LENGTH. (L) The greatest length. Measured in centimeters with a calipers. See Figure 1.

WIDTH. (W) The greatest width. Measured in centimeters with a calipers. See Figure 1.

THICKNESS. (TH). The greatest thickness. Measured in centimeters with a calipers. See Figure 1.

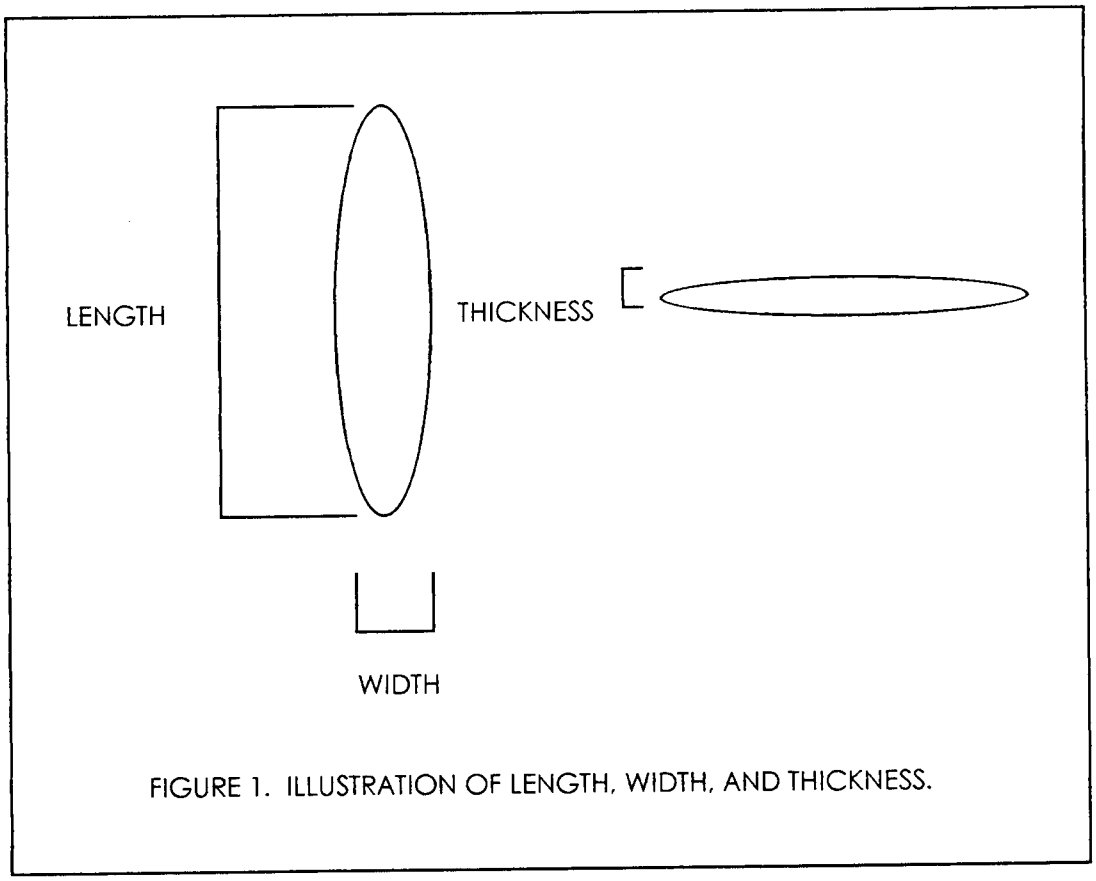


FIGURE 1. ILLUSTRATION OF LENGTH, WIDTH, AND THICKNESS.

WEIGHT. (WT). Measured in grams. Artifacts weighing less than 10 grams were weighed on a digital scale, those weighing more were weighed on a balance scale, and the two largest axeheads were weighed on a mail scale in ounces, which were then converted to grams.

Indexes

Index.

LENGTH TO WIDTH INDEX. (LWINDEX). Generated by the computer. This is the length divided by the width and then multiplied by 10.

WIDTH TO THICKNESS INDEX. (WTINDEX). Generated by the computer. This is the width divided by the thickness and then multiplied by 10.

LENGTH TO THICKNESS INDEX. (LTINDEX). Generated by the computer. This is the length divided by the thickness and then multiplied by 10.

Base Angles

These angles were measured with a protractor and a piece of string put through a hole near the straight edge. The artifact was placed over the protractor, with the base flat along the straight edge, and the angle to be measured at the zero point. The string was then pulled straight along the side.

Base Angle.

RIGHT BASE ANGLE. (RTBA). The right hand corner angle, in degrees.

LEFT BASE ANGLE. (LTBA). The left hand corner angle, in degrees.

Surface Features

Feature.

CORTEX. (COR). The is cortex or patination on the piece. It is coded as follows: 1-the artifact is completely covered with either cortex or patina, 2-the dorsal surface of the artifact is completely covered, 3-the dorsal surface is partially covered, 4-patina or cortex is present on both the dorsal and ventral surfaces, 5-the ventral surface is partially covered, 6-surfaces cannot be distinguished, more than 25 % of the surface is covered, 7-no cortex or patina present, 8-surfaces cannot be distinguished, less than 25% of the surface is covered, 11-not applicable, unknown. Recorded with a 10X magnifying glass.

DIRECTION OF NEGATIVES. (DIRNEG). Direction of the scars left on the artifact as a result of manufacture: 1-the scars are parallel to the length of the artifact, 2-they are oblique to the length, 3-they are irregular, 4-they are parallel to length with the negative of the bulb of percussion near the platform, 5-they are parallel to the length with the negative of the bulb near the distal end of the artifact, 6-the scars are oblique to the length and are bi-directional, 7-they are oblique to the length and are unidirectional, 11-not applicable/unknown. Recorded with a 10X magnifying glass.

PLATFORM KIND. (PLATKIND). The kind of platform used for the initial breaking of the artifact from its core: 1-*Cortical*: the platform is covered by cortex, 2-*Formed*: the platform is formed by a single, complete negative, 3-*Dièdre*: where two negatives meet to create a ridge, 4-*Facetté*: is created by retouching, 5-*Facetté convexe*: is created by perpendicular retouching and results in a ridge, 6-*Edged*: the platform size is less than 2 mm wide, but greater than

2 mm long, 7- *Punctiforme*: the platform is less than 2 mm wide and 2 mm long, 8-none of the above, 9-cannot be coded, 11-not applicable/unknown. Recorded with a 10X magnifying glass.

Set B Variables: Unifacial And Bifacial Artifacts

Retouch Variables

These apply to Unifacial and Bifacial flint artifacts. The following series of variables relate to retouch found on the sides and edges of worked stone. Surfaces were examined with a 10X magnifying glass for the recording of all Retouch Variables. For between-group comparisons, some codes are combined into categories, to increase sample sizes; they will be presented when appropriate in Chapter VII.

Retouch variables are coded for each side of the artifact; up to four sides are used in the analysis, and are designated with Arabic numbers. For amorphous artifacts, the longest side is recorded first, and each subsequent side is recorded counter-clockwise. For artifacts which have consistent patterns of form and functional location, the numbers of the sides are kept uniform and consistent (see Figure 2). For example, the numbering of the sides for the daggers are: right handle is Side 1, right blade is Side 2, left blade is Side 3, and left handle is Side 4. When the dagger or point has a lanceolate form, the right side is Side 2, and the left is Side 3. For tanged points, the right side of the tang is Side 1, the right side of the blade is Side 2, the left side of the blade is Side 3, and the left side of the tang is Side 4. For transverse arrowheads, the functional sides are the distal and proximal end, so that the distal end is Side 2, and the proximal end is Side 3; the right side is Side 1, and the left is Side 4.

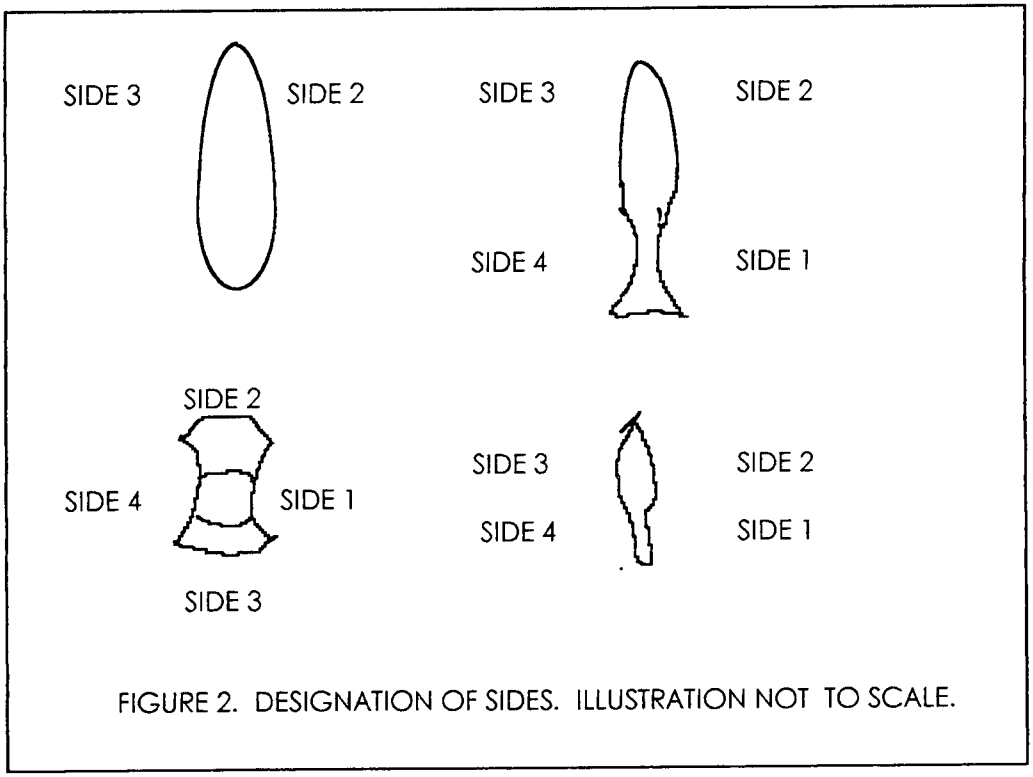


FIGURE 2. DESIGNATION OF SIDES. ILLUSTRATION NOT TO SCALE.

Variable.

FORM OF SIDE. (FORM). This is the form of the side, and each side is designated as FORM1, FORM2, FORM3, AND FORM 4. Form of each side is recorded in three sections, counter-clockwise. The form is coded as follows: 1-convex, 2-straight, 3-concave, 4-notch, shoulder, or hafting, 5-burin spall, 6-bend, 7-very irregular.

EDGE ANGLE. (EDANG). This is the angle of the retouched edges of the sides, and are designated as EDANG1, EDANG2, EDANG3, and EDANG4. Edge Angle is coded as follows: 1-less than or equal to 10°, 2-more than 10°, but less than or equal to 20°, 3-more than 20°, but less than or equal to 30°, 4-more than 30°, but less than or equal to 50°, 5-more than 50°, but less than or equal to 70°, 6-more than 70°, but less than or equal to 85°, 7- more than 85°. This was measured by placing the edge into an area cut out of cardboard.

FORM OF RETOUCH. (RETFRM). RETFRM1, RETFRM2, RETFRM3, RETFRM4. Codes: 1-*retouche sommaire*, 2-*retouche laminaire*, 3-*retouche scaliforme*, 4-rounding of edge due to polishing or grinding, 5-scarring of *retouche scaliforme* and minute nibbling, 6-irregular, 7-gloss and retouch, 8-irregular edge and fracturing, 9-gloss, 10-absent, 11-not applicable/unknown, 12-edges have pinched appearance, 13-scarring creates triangular formation.

LOCATION OF RETOUCH. (RETLOC). RETLOC1, RETLOC2, RETLOC3, and RETLOC4. Codes: 1-on dorsal surface, 2-on ventral surface, 3-on first part of ventral surface and on second part of dorsal surface, 4-on first part of dorsal surface and second part of ventral surface, 5-first on ventral surface, then on dorsal surface, and then on ventral surface, 6-on dorsal and ventral surfaces, 7-first on dorsal surface, then on ventral, then on dorsal, 8-on middle surface, 9-on tip of

edge only, 10-absent, 11-not applicable/unknown, 12-on dorsal surface first, then on both dorsal and ventral surfaces, 13-first on ventral surface, then on both dorsal and ventral surfaces.

LENGTH OF RETOUCH. (RETLNGTH). RETLNGTH1, RETLNGTH2, RETLNGTH3, RETLNGTH4. length, or depth, of retouch for each side, . A code of 9 means that the length is 9 mm or greater. Measured in millimeters with a calipers.

EXTENSION OF RETOUCH. (RETEXT). RETEXT1, RETEXT2, RETEXT3, RETEXT4. There are several possible codes, and only the applicable ones are provided here. For Continuous retouch: 80-whole edge, 1-first part of the edge, 2-first and middle, 3-middle, 4-middle and last, 6-first and last. For Discontinuous retouch: 7-middle and last part, 8-first, 9-first and middle, 10-middle, 11-last, 81-whole edge. For Denticulated, round topped, continuous retouch: 14-middle part, 82-whole edge. Nibbling: 28-whole edge. Strong nibbling, eventually with notches: 29-whole edge. Saw-like edge: 30-whole edge.

DIRECTION OF RETOUCH. (RETDIR). RETDIR1, RETDIR2, RETDIR3, RETDIR4, Codes are: 1-the direction of the retouch is perpendicular to the edge, 2-it is toward the distal end, 3-it is toward the basal end, 4-retouch is centralizing, 5-it is decentralizing, 6-irregular.

SCAR FORM. (SCARFRM). SCARFRM1, SCARFRM2, SCARFRM3, SCARFRM4. The condition of side, kinds of flaking. Codes: 1-the side is a product of a fracture, 2-feathered, 3-hinged, 4-irregular, 5-absent, 6-scalloped, 0-other, 11-not applicable/unknown. Feathered and hinged are kinds of scar terminations, or the ends of scars. For this thesis, a feather scar includes what Crabtree(1972) calls feather and scalar scars, and a hinge scar includes what Crabtree calls

hinged and stepped scars. A feathered scar has a tapered end which is relatively rounded and smooth (see Figure 3). A hinged scar is has an abrupt termination, which forms an approximate ninety degree angle, creating a ridge at the end. These four kinds of scars are grouped into two kinds because they are difficult to identify without microscopic analysis.

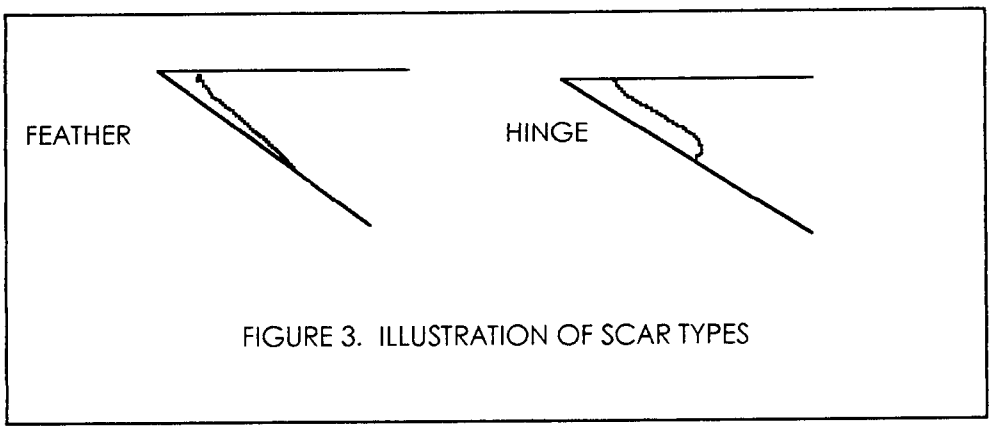


FIGURE 3. ILLUSTRATION OF SCAR TYPES

Set C Variables: Multifacial Artifacts

These variables relate to the scars on the surfaces of celts, such as axeheads, chisels, adzes, and picks. The scars on the surface are the product of removal of flakes and blades. A "flake" is more than half as wide as it is long, and a "blade" is less than half as wide as it is long (Deckers 1985). Intact negatives still have the general form from the original removal. Negatives which are not intact are ones

which have different shapes either because other flakes and blades have been subsequently removed, or grinding and polishing have changed the shape. Surfaces were examined with a 10X magnifying glass.

Negatives Variables

Variable.

NUMBER OF PLATFORMS. (NOPL). Created by the shaping of the artifact.

NUMBER OF FLAKE NEGATIVES. (NOFLNG). A flake scar which has irregular, obtuse, or acute sides, and which the length is less than twice its width.

NUMBER OF BLADE NEGATIVES. (NOBLNG). A blade scar with has parallel sides, and a length which is at least twice its width.

LENGTH OF THE LARGEST INTACT NEGATIVE. (LLNG).

WIDTH OF THE LARGEST INTACT NEGATIVE. (WLNG).

LENGTH OF THE SMALLEST INTACT NEGATIVE. (LSNG).

WIDTH OF THE SMALLEST INTACT NEGATIVE. (WSNG).

SIGNIFICANCE OF VARIABLES

Most of the Identifying Characteristics are for general identification. Raw Material and Color are used, in part, to identify the sources of flint or other raw materials (Deckers 1985:137). (However, it is not possible to source flint materials from Denmark, see Appendix). Metric Variables, Indexes, and Base Angles are used to identify the dimensions of the artifacts, as well as to interpret the minimum size of raw material available.

The Surface Features relate to the manufacturing processes involved in making the artifacts. For Cortex, "the purpose of this variable is to indicate how much of the original surface was removed" (Deckers 1985:138) in the manufacturing process. Direction of Negatives is used to identify characteristics of the original core and about the platforms. The Kind of Platform also aids in understanding the manufacturing process.

For Unifacial and Bifacial artifacts, the Retouch Variables are used to interpret the functions of the artifacts (see Table 1). For this thesis, the most important Retouch Variables for the interpretation of function and use for these two artifact groups are Location of Retouch and Scar Form (based on Hays 1992; see also Odell and Odell-Vereechen 1980; Odell 1977). The Location of Retouch can be used to identify motion of use (Odell and Odell-Vereechen 1980; Tringham et al 1974). Retouch on either the ventral or dorsal surface of an artifact can be interpreted as the product of a scraping motion. Retouch on both the ventral and dorsal surfaces can be interpreted as the product of cutting, graving, or boring. Scar Forms of Feathered and Hinged enable interpretations of the material on which the artifact was used (ibid.; Fischer et al 1984; Cotterell and Kamminga 1977; Crabtree 1972). Feathered scars are interpreted as the product of use on soft to medium materials, e.g. meat, vegetable, hide, or soft wood materials. Hinged scars are interpreted as the product of use on hard materials, e.g. bone, antler, or hard wood.

Also important are Form and Edge Angle. Form is also related to motion (Frison 1968). Straight sides relate to cutting and scraping, and convex and concave sides relate to scraping. For Edge Angle, angles of greater than 85 degrees are indicative of graving or boring, while any edge angle is indicative of cutting and scraping. Scar

TABLE 1. FUNCTIONAL CATEGORIES AND RELATED VARIABLES FOR UNIFACIAL AND BIFACIAL ARTIFACT GROUPS.

Based on Hays 1992 (see also Odell and Odell-Vereechen 1980; Odell 1977).

Scar Form: F: feathered, H: hinged, SCRFRM: Scar Form, RETLOC: Location of Retouch: V: ventral, D: dorsal. EDANG: Edge Angle, code 7: greater than 85 degrees.

FUNCTION	MAT	FORM	SIDE	SCRFRM	RETLOC	EDANG
CUTTING	SOFT	STRAIGHT	2 OR 3	F	V + D	ANY
CUTTING	HARD	STRAIGHT	2 OR 3	H	V + D	ANY
		CONVEX	2 OR 3	H	V + D	ANY
SCRAPING	SOFT	STRAIGHT	2 OR 3	F	V OR D	ANY
		CONVEX	2 OR 3	F	V OR D	ANY
		CONCAVE	2 OR 3	F	V OR D	ANY
SCRAPING	HARD	STRAIGHT	2 OR 3	H	V OR D	ANY
		CONVEX	2 OR 3	H	V OR D	ANY
		CONCAVE	2 OR 3	H	V OR D	ANY
GRAVING	SOFT	STRAIGHT	2 AND 3	F	V + D	7
		CONVEX	2 AND 3	F	V + D	7
GRAVING	HARD	STRAIGHT	2 AND 3	H	V + D	7
		CONVEX	2 AND 3	H	V + D	7
BORING	SOFT	STRAIGHT	2 AND 3	F	V + D	7
		CONVEX	2 AND 3	F	V + D	7
BORING	HARD	STRAIGHT	2 AND 3	H	V + D	7
		CONVEX	2 AND 3	H	V + D	7

Size can also be used to identify function and use. For this analysis, scar sizes are considered large: visible without a microscope (Odell 1988; Moss 1983).

Negative Variables are used for Multifacial artifacts only. They are used to interpret the manufacturing processes. When the artifacts are not in a complete state, e.g. when they have not been polished, these variables are used to make conclusions about where the artifacts are in relation to the sequences of manufacture (Hansen and Madsen 1983).

STATISTICAL ANALYSES

The Statistical Analyses for this thesis are used for within-group and between-group comparisons (group being the artifact group, such as Unifacial artifacts). (Shennan 1988; Weiss and Hassett 1982; Schlotzhauer and Littel 1987; Friedman 1972; SPSS for Windows Student Version 1995; Ott 1988; Fletcher and Lock 1994; Fox 1995; Siegal and Castellan 1988; Thorne 1989; Triola 1995). For within-group comparisons, there are several kinds of statistical analyses which are used: Measures of Central Tendency (all variables), Measures of Dispersion and Distribution (all variables), and Tests of Goodness of Fit (categorical variables). These analyses are intended to identify variation within the groups. The results of the within-group statistical analyses are presented for each group in their respective chapters (Chapters III, IV, and V). Histograms for the integral data are included in Appendixes A, B, C, and D.

Chapter VII summarizes and discusses the results of the within-group comparisons to contrast the degrees of variation within these groups in relation to the degrees of variation within the other groups. Between-group comparisons involve chi-square tests of homogeneity (Weiss and Hassett 1982) between the three groups

of Unifacial, Bifacial, and Multifacial artifacts. Chi-square tests of homogeneity between the three groups of Unifacial, Bifacial, and Multifacial artifacts were performed for each of the Surface Features; and, between the Unifacial and Bifacial artifact groups for the Retouch Variables. Where statistically significant variability exists between groups, these groups are considered not homogenous.

Because of the small sample size in this collection, most of the chi-square tests of homogeneity are questionable. Therefore, Guttman's Lambdas (λ), or the coefficient of predictability (Fox 1995; Fletcher and Lock 1994), were calculated as a measure of association between the variables and the three groups of artifacts. These Lambdas were calculated for the same variables as the chi-square tests of homogeneity.

In most cases, significance levels for this study are 0.1000. For the chi-square tests of homogeneity, two chi-square critical values were acquired from a chi-square table in Weiss and Hassett (1982), for significance at both 0.10, and at 0.05.

Statistics for Within-Group Comparisons

Measures of Central Tendency

Measure.

MEAN: the sum of the values of the observations divided by n (Shennan 1988).

MEDIAN: the middle value of the observations, when arranged from lowest to highest (Thorne 1989).

MODE: is the value (or values) which occurs most frequently. It is commonly used for non-ranked categorical data (Shennan 1988).

n: the number of non-missing observations in the group sample.

Measures of Dispersion and Distribution

Measure.

VARIANCE: (SD^2) measures the variability around the mean. It is "the average of the squared deviations" (Thorne 1989:92).

STANDARD DEVIATION: (SD) measures the variability around the mean. It is the square root of the variance. Unlike the variance, it measures dispersion in the "same units of measurement as the observations" (Schlotzhauer and Littel 1987:72).

STANDARD ERROR: (SE) the standard deviation of the distribution of possible means. It measures possible variation of the mean in relation to the distribution of all possible means (Schlotzhauer and Littel 1987:72).

COEFFICIENT OF VARIATION: (CV) measures the standard deviation in relation to the mean. This is done to compare variability among variables or groups. including those with different measurement units (Triola 1995:89; Fletcher and Lock 1994:46). It is calculated as follows:

$$CV = \frac{SD}{(mean)} \times 100$$

where CV is the coefficient of variation for a variable, and SD is the sample standard deviation.

SKEWNESS: measures "...the tendency for the distribution of values to be more spread out on one side than the other. Positive skewness indicates that values located to the right of the mean are more spread out than are values located to the left of the mean. Negative skewness indicates the opposite." (Schlotzhauer and Littel 1987:72).

For this analysis, slight skewness is less than 1.00, mild skewness is between 1.00 and 3.00, and strong skewness is over 3.00.

KURTOSIS: measures "...the shape of the distribution of values. Large values for kurtosis indicate the distribution has 'heavy tails'. This means the data contain some values that are very distant from the mean, as compared to most of the other values in the data set." (Schlotzhauer and Littel 1987:72).

For this analysis, a slight degree of kurtosis is less than 1.00, a mild degree of kurtosis is between 1.00 and 3.00, and a strong degree of kurtosis is over 3.00.

OUTLIER: an observation which is considerably larger or smaller than other observations. For this analysis, the outliers were obtained from box plots of the data (see Ott 1988). An outlier is considered to be an observation which is less than the lower inner fence (Q1-1.5IQR), or greater than the upper inner fence (Q3+1.5IQR) of the box plot. An extreme is considered to be an observation which is less than the lower outer fence (Q1-3IQR), or greater than the upper outer fence (Q3-3IQR) of the box plot. (Where Q1 is the first quartile, Q3 is the third quartile, and IQR is the interquartile range).

HISTOGRAM: is a graphic display of integral data (Fletcher and Lock 1994). These are included, in the appendixes, for the Metric Variables, Indexes, Base Angles, Retouch Length, and Negatives Variables, for each Artifact group. These aid in the intepretations of dispersions and distributions.

Chi-Square Tests of Goodness-of-Fit

The chi-square tests of goodness of fit were calculated for the frequencies of observations for each category. This chi-square tests that the observed frequencies are different from expected frequencies. The significance is that the sample has attributes which occur in ways which are not just by chance. The hypotheses for the within-group chi-squares are:

Ho: The Observed cell frequencies equal the Expected cell frequencies.

Hr: The Observed cell frequencies do not equal the Expected cell frequencies.

Where the Expected cell frequencies are calculated as follows:

$$\text{Expected} = \frac{r \times c}{N}$$

Statistics for Between-Group Comparisons

Chi-Square Tests of Homogeneity

Chi-square tests of homogeneity were conducted for the three groups for the Surface Features: Cortex, Direction of Negatives, and Platform Kind; and for the Unifacial and Bifacial artifact groups for the Retouch Variables. The general hypotheses for the between-group chi-square test of homogeneity are:

Ho: The groups are homogenous

Hr: The groups are not homogenous

The chi-square tests of homogeneity (Weiss and Hassett 1982) were calculated by hand, using the formula:

$$X^2 = \sum \frac{(O-E)^2}{E}$$

Where: X^2: Chi-Square Value

$\sum$: sum

O: Observed Frequency

E: Expected Frequency = $\frac{\text{Column Total x Row Total}}{n}$

n: total number in relevant group samples.

Guttman's Lambdas

Because of the small sample sizes in this collection, most of the chi-square tests of homogeneity are questionable. Therefore, Guttman's Lambda (λ), also known as the coefficient of predictability (Fox 1995; Fletcher and Lock 1994; c.f. Goodman and Kruskal's Lambda, in Siegal and Castellan 1988), is calculated as a measure of association between the variables and the three groups of artifacts. Guttman's Lambdas were calculated by hand, based on the contingency tables used for the chi-square tests of homogeneity.

Lambda is a "proportional reduction in error" (Fox 1995). It "is a measure of the asymmetric relation between the variables" (Siegal and Castellan 1988). In this case, between each Retouch variable, or Surface Feature variable, and the artifact Groups (Unifacial, Bifacial, Multifacial).

For each contingency table, three Lambdas were calculated. One with a Surface Feature variable or Retouch variable as the dependent variable. One with the Groups as the dependent variable. And a third, Symmetric Lambda where the dependency of the variables is not taken into account. The Lambdas are calculated as follows:

LAMBDA-C. The Surface Feature or Retouch variable is the dependent variable.

$$\lambda C = \frac{\sum (\text{mode of each column}) - (\text{mode of column total})}{N - (\text{mode of column total})}$$

Where: C = column variable is dependent.

LAMBDA-R. The Artifact group is the dependent variable:

$$\lambda R = \frac{\sum (\text{mode of each row}) - (\text{mode of row total})}{N - (\text{mode of row total})}$$

Where: R = row variable is dependent.

LAMBDA-S. Dependent-neutral.

$$\lambda S = \frac{[\sum (\text{column mode}) - (\text{mode of column total})] + [\sum (\text{row mode}) - (\text{mode of row total})]}{(\text{N-mode column total}) + (\text{N-mode of row total})}$$

Where: S = symmetric

Fox (1995) presents the following guidelines for interpreting measures of association: more than 0.30, there is a Strong relationship; from 0.10 to 0.30, there is a Moderate relationship; and less than 0.10, there is a Weak relationship.

SECTION II:

WITHIN-GROUP ANALYSES

CHAPTER III

UNIFACIAL ARTIFACTS

Unifacial artifacts have two sides, with flake removal only on one side. There are twenty-nine (29) artifacts classified as unifacial that are used in this analysis. These include thirteen (13) transverse arrowheads, numbers 45-37-1 through 37-13; two (2) triangular points, numbers 45-38-5 and 45-39-4; two (2) burins or burin spalls, numbers 45-38-7 and 45-39-9; five (5) microblades, numbers 45-39-1 through 39-3, 39-7 and 39-8; two (2) fish hooks, numbers 45-39-5 and 39-6; and five (5) tanged points, numbers 45-38-1 through 38-4, and 38-6.

Unifacial artifacts will be discussed in reference to microlithics since, as "types", most of the unifacial artifacts in this collection are discussed in the literature as microliths. Microlithic artifacts are usually longer than 2 cm and smaller than 5 cm; and wider than a half centimeter to narrower than 1 centimeter (Mathiassen 1948:58-60; Bordaz 1970:90-93). By definition, most of the unifacial pieces in the collection are larger than these dimensions.

Microliths are important indicators of continuity and change (Clarke 1975:108). Manufacture of these small artifacts originated during the Upper Palaeolithic, in Europe, Asia, and Africa (Semenov 1964:63). In Europe, they developed most especially in the Magdalenian, and are the culmination of a trend towards smaller

chipped stone tools that occurred in the Palaeolithic (Bordaz 1970:92). These artifacts became more common in the Mesolithic. Different forms characterize different periods of the Mesolithic. If a particular form occurs as a proportion of greater than 50 percent of the microlithic tool kit in an assemblage, than that assemblage is classified into a particular period of the Mesolithic. Microlithic points and triangles typify the Maglemose, rhombic arrowheads the Kongemose, and transverse arrowheads the Ertebolle (Jensen 1982:66, and see Figure 21, p. 65).

These artifacts were used as the cutting edge of composite tools of spear heads, arrows, and knives of microlithic blades and bone or antler hafts. Later, the transverse arrowpoints were used singly as tips for arrows of wooden handles. They are interpreted as a development in response to small, hard to find nodules of raw material. They allowed prehistoric peoples to create straight and sharp edged tools of variable lengths, and to replace broken or missing pieces relatively easily, without having to manufacture another whole tool (Semenov 1964:63; Bordaz 1970:93).

The earliest forms of microliths, narrow flakes and microblades, were made by punch, hammer, or pressure flaking of a small nuclei about one inch in height (Callahan 1985; Bordaz 1970; Semenov 1964; and Mathiassen 1948). These flakes were then blunted at one side. Later forms are made from prismatic blades, and the technique is called the micro-buring technique. The blades were notched by fine retouch, in order to divide the blade into segments of trapeze, triangle, lunate, or other shapes. The blades may have been snapped into fragments by hand, or held in a piece of bone as a leverage, and each piece would then have been broken into

equal parts, or through indirect percussion. The first of the blade methods would not have left a bulb, and there would be a fracture through the body of the fragment. The last method would have left a bulb with a facet (Semenov 1964:63-66). These fragments were then retouched to form geometric patterns (Bordaz 1970:92-93, see Figure 42, p.94). Andre Leroi-Gourhan concluded that the prismatic blade technique would create 300 feet of cutting edge from two pounds of flint (Bordaz).

STATISTICAL ANALYSIS

The following are the statistical results for Unifacial artifacts. These include Identifying Characteristics, Metric Variables, Indexes, Base Angles, Surface Features, and Retouch Variables. Histograms, for Unifacial Artifacts, of the Metric Variables, Indexes, Base Angles, and Retouch Length, are in Appendix A.

Set A Variables

Identifying Characteristics

The Identifying Characteristics are listed in Table 2. All of the artifacts in the Unifacial group are made of fine-grained flint. The Primary Color is predominantly around the 10YR5/4 or 4/2 range, with many also around the 2.5YR7/2 or 6/4 range. None of these artifacts had an obvious secondary color. All of the Unifacial artifacts appear complete.

TABLE 2. IDENTIFYING CHARACTERISTICS FOR UNIFACIAL ARTIFACTS.

PER=Period, LP=Late Palaeolithic, TM=Terminal Mesolithic, EN=Early Neolithic, MN-PITT=Middle Neolithic Pitted Ware, LN=Late Neolithic, EBA=Early Bronze Age. RM=Raw Material, F=Fine Grained. COL1=Primary Color. PRT=Part, 4=Complete. CIT=Citation, from Mathiassen 1948 and Callahan 1985. See qualitative analysis section below for specific references.

NO.	TYPE	PER	RM	COL1	PRT	CIT
37-1	TRANSVERSE ARROWHEAD	TM	F	10YR5/2	4	106
37-2	TRANSVERSE ARROWHEAD	TM	F	10YR4/4	4	100
37-3	TRANSVERSE ARROWHEAD	TM	F	10YR5/4	4	100
37-4	TRANSVERSE ARROWHEAD	TM	F	10YR3/1	4	102
37-5	TRANSVERSE ARROWHEAD	TM	F	10YR5/4	4	99
37-6	TRANSVERSE ARROWHEAD	TM	F	10YR5/1	4	101
37-7	TRANSVERSE ARROWHEAD	TM	F	10YR4/2	4	100
37-8	TRANSVERSE ARROWHEAD	TM	F	10YR3/2	4	100
37-9	TRANSVERSE ARROWHEAD	TM	F	2.5YR2.5/4	4	100
37-10	TRANSVERSE ARROWHEAD	TM	F	7.5YR3/2	4	100
37-11	TRANSVERSE ARROWHEAD	TM	F	10YR4/3	4	100
37-12	TRANSVERSE ARROWHEAD	TM	F	2.5YR3/2	4	100
37-13	TRANSVERSE ARROWHEAD	TM	F	10YR3/3	4	102
38-5	TRIANGULAR POINT	LP	F	2.5Y6/4	4	
39-4	TRIANGULAR POINT	LN-EBA	F	2.5Y4/2	4	4b
38-7	BURIN	LP-EN	F	10YR4/2	4	
39-9	BURIN	LP-EN	F	2.5Y5/2	4	
39-1	MICRO BLADE	LP	F	10YR7/2	4	1
39-2	MICRO BLADE	LP	F	2.5Y7/2	4	1e
39-3	MICRO BLADE	LP	F	10YR6/3	4	1h
39-7	MICRO BLADE	LP	F	10YR8/1	4	1h
39-8	MICRO BLADE	LP	F	10YR5/2	4	1e
39-5	FISH HOOK	TM	F	10YR6/3	4	
39-6	FISH HOOK	TM	F	10YR6/2	4	
38-1	TANGED POINT	MN-PITT	F	10YR5/2	4	310
38-2	TANGED POINT	MN-PITT	F	10YR5/1	4	310
38-3	TANGED POINT	LP	F	10YR5/2	4	74
38-4	TANGED POINT	MN-PITT	F	10YR6/1	4	310
38-6	TANGED POINT	LP	F	10YR6/2	4	74

Metric Variables

Table 3 presents the summary statistics for the Unifacial Artifact group. These include Metric Variables, Indexes, Base Angles, and Surface Features. Table 4 presents the coefficients of variation, skewness and kurtosis.

Variable.

LENGTH. The average for all unifacial artifacts is 2.826, with a variance of 2.31, and a standard deviation of 1.518. The median is 2.160, and the mode is 1.850. The coefficient of variation is 53.72 percent. The distribution is mildly positively skewed (1.434), and there is a mild positive degree of kurtosis (1.042). Numbers 38-6, 38-1, 38-4, 38-2, all tanged points, are outliers.

WIDTH. The average for all unifacial artifacts is 1.2666, with a variance of 0.22, and a standard deviation of 0.466. The median is 1.330, and there are multiple modes. The coefficient of variation is 36.78 percent. The distribution is slightly negatively skewed (-0.332), and there is a slight negative degree of kurtosis (-0.451). There are no outliers or extremes.

THICKNESS. The average for all unifacial artifacts is 0.327, with a variance of 0.009, and a standard deviation of 0.097. The median is 0.310, and there are multiple modes. The coefficient of variation is 29.66 percent. The distribution is slightly positively skewed (0.752), and there is a very slight positive degree of kurtosis (0.090). Number 38-2, a tanged point, is an outlier case.

WEIGHT. The average for all unifacial artifacts is 1.071, with a variance of 1.41, and a standard deviation of 1.188. The median is 0.600, and the mode is 0.50. The coefficient of variation is 110.92 percent. The distribution is mildly positively

TABLE 3. SUMMARY STATISTICS FOR UNIFACIAL ARTIFACTS, INCLUDING METRIC VARIABLES, INDEXES, BASE ANGLES, AND SURFACE FEATURES.

SD^2: variance, SD: Standard Deviation, SE: Standard Error of the Mean. MODE: MUL-MULTIPLE. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MEDIAN	MODE
LENGTH	2.83	2.31	1.52	0.28	2.16	1.85
WIDTH	1.27	0.22	0.47	0.09	1.33	MULT
THICKNESS	0.33	0.01	0.097	0.08	0.31	MULT
WEIGHT	1.07	1.41	1.19	0.22	0.60	0.60
LWINDEX	28.23	464.42	21.55	4.00	18.50	MULT
WTINDEX	40.59	232.19	15.24	2.83	41.56	35.71
LTINDEX	88.55	1743.75	41.76	7.75	71.11	MULT
RTBA	87.00	272.93	16.52	3.07	91.00	65.00
LTBA	96.52	363.76	19.07	3.54	92.00	MULT
CORTEX	6.52	2.97	1.72	0.32	7.00	7
DIRNEG	1.66	1.02	1.01	0.19	1.00	1
PLTKIND	3.75	5.66	2.38	0.69	3.00	2

TABLE 4. COEFFICIENTS OF VARIATION, SKEWNESS, AND KURTOSIS FOR UNIFACIAL ARTIFACTS, INCLUDING METRIC VARIABLES, INDEXES, BASE ANGLES, AND SURFACE FEATURES.

CV: coefficient of variation, in percentages. See Chapter II for abbreviations for Variables.

VARIABLE	CV	SKEWNESS	KURTOSIS
LENGTH	53.72	1.434	1.042
WIDTH	36.78	-0.332	-0.451
THICKNESS	29.66	0.752	0.090
WEIGHT	110.92	2.459	6.864
LWINDEX	76.34	1.379	1.819
WTINDEX	37.54	-0.342	-0.326
LTINDEX	47.16	1.121	0.623
RTBA	18.99	-1.167	1.743
LTBA	19.76	1.184	1.048
CORTEX	26.45	-2.770	6.752
DIRNEG	61.03	3.007	12.083
PLTKIND	63.44	1.571	1.544

skewed (2.459), and there is a strong positive degree of kurtosis (6.864). Number 38-2, a tanged point, is an outlier case.

Indexes

Index.

LENGTH/WIDTH INDEX. (LWINDEX). The average for all unifacial artifacts is 28.229, with a variance of 464.42, and a standard deviation of 21.55. The median is 18.504, and there are multiple modes. The coefficient of variation is 76.34 percent. The distribution is mildly positively skewed (1.379), and there is a mild positive degree of kurtosis (1.819). Number 39-9, a burin, is an outlier.

WIDTH/THICKNESS INDEX. (WTINDEX). The average for all unifacial artifacts is 40.588, with a variance of 232.19, and a standard deviation of 15.238. The median is 41.563, and the mode is 35.714. The coefficient of variation is 37.54 percent. The distribution is slightly negatively skewed (-0.342), and there is a slight negative degree of kurtosis (-0.326). There are no outliers or extremes.

LENGTH/THICKNESS INDEX. (LTINDEX). The average for all unifacial artifacts is 88.545, with a variance of 1743.75, and a standard deviation of 41.758. The median is 71.111, and there are multiple modes. The coefficient of variation is 47.16 percent. The distribution is mildly positively skewed (1.121), and there is a slight positive degree of kurtosis (0.623). Numbers 39-2, a microblade, and 38-4, a tanged point, are outliers.

Base Angles

Base Angle.

RIGHT BASE ANGLE. (RTBA). The average for all unifacial artifacts is 87.000, with a variance of 272.93, and a standard deviation of 16.52. The median is 91.00, and the mode is 65.00. The coefficient of variation is 18.99 percent. The distribution is mildly negatively skewed (-1.167), and there is a mild positive degree of kurtosis (1.743). Number 39-6, a fishhook, is an outlier, and number 39-2, a microblade, is an extreme case.

LEFT BASE ANGLE. (LTBA). The average for all unifacial artifacts is 96.517, with a variance 363.76, and a standard deviation of 19.072. The median is 92.00, and there are multiple modes. The coefficient of variation is 19.76 percent. The distribution is mildly positively skewed (1.184), and there is a mild positive degree of kurtosis (1.048). Numbers 37-3, a transverse arrowhead , and 39-5, a fishhook, are outliers.

Surface Features

Feature.

CORTEX. The average for all unifacial artifacts is 6.517, with a variance of 2.97, and a standard deviation of 1.724. The median is 7.00, and the mode is 7. The coefficient of variation is 26.45 percent. The distribution is mildly negatively skewed (-2.770), and there is a very strong positive degree of kurtosis (6.752). Numbers 37-7, a transverse arrowhead, 39-7, a microblade, 38-2, a tanged point, and 39-4, a triangular point, are extreme cases.

The chi-square value is 15.6897, df=3, with a significance at 0.000. One artifact, (3.4%), is coded 3, the dorsal surface is partially covered. Two, (6.9%), are coded 1, completely covered. Two, (6.9%), are coded 8, less than 25% of the surface is covered. And twenty-four, (82.8%), are coded 7, no cortex or patination.

DIRECTION OF NEGATIVES. (DIRNEG). The average for all unifacial artifacts is 1.655, with a variance of 1.02, and a standard deviation of 1.010. The median is 1.00, and the mode is 1. The coefficient of variation is 61.03 percent. The distribution is strongly positively skewed (3.007), and there is a very strong positive degree of kurtosis (12.083). Number 39-9, a burin, is an extreme case.

The chi-square value is 22.1724, df=3, with a significance at 0.0001. One artifact, (3.4%), is coded 3, negatives are irregular. One, (3.4%), is coded 6, the negatives are oblique and bi-directional. Twelve, (41.4%), are coded 2, they are oblique. And fifteen, (51.7%), are coded 1, they are parallel to the length of the artifact.

PLATFORM KIND. (PLTKND). The average for all unifacial artifacts is 3.750, with a variance of 5.66, and a standard deviation of 2.379. The median is 3.00, and the mode is 2. The coefficient of variation is 63.44 percent. The distribution is mildly positively skewed (1.571), and there is a mild positive degree of kurtosis (1.544). Numbers 39-9, a burin, and 38-4, a tanged point, are outliers.

The chi-square value is 4.6667, df=4, is not significance at 0.3232. Two artifacts, (6.9%), are coded 3, *Dièdre*. Three, (10.3%), are coded 4, *Facetté*. Five, (17.2%), are coded 2, *Formed*. One artifact, (3.4%), is coded 8, none of the

above, and one, (3.4%), is coded 9, cannot be coded. There are seventeen, (58.6%), which do not have apparent platforms.

Set B Variables

Retouch Variables

Table 5 presents summary statistics for the Unifacial Retouch Variables. These include Form of Side, Edge Angle, Form of Retouch, Location of Retouch, Length of Retouch, Extension of Retouch, Direction of Retouch, and Scar Form. Table 6 presents the coefficients of variation, skewness and kurtosis. The histograms for Retouch Length are in Appendix A. The results are presented by Retouch Variable, by Side.

Form of Side.

FORM1. The average for unifacial artifacts is 273.650, with a variance of 13917.157, and a standard deviation of 117.971. The median is 234.5, and there are multiple modes. The coefficient of variation is 43.11 percent. The distribution is mildly positively skewed (1.362), and there is a strong positive degree of kurtosis (3.368). Number 37-13, a transverse arrowhead, is an outlier.

The chi-square value is 2.4000, df=15, and is not significant at 0.9999. The chi-square statistic is questionable due to the small sample size. One (5.0%) is coded for each of the following codes: 122, 124, 131, 161, 221, 223, 224, 233, 236, 331, 424, 631. Two (10.0%) are coded for each of the following codes: 226, 323, 324, 333. N=20, nine are not coded.

FORM2. The average for unifacial artifacts is 248.448, with a variance of 21627.526, and a standard deviation of 147.063. The median is 222, and the modal code is 222. The coefficient of variation is 59.19 percent. The distribution is mildly

TABLE 5. RETOUCH VARIABLES FOR UNIFACIAL ARTIFACTS, BY SIDE.

SD^2: Variance; SD: Standard Deviation, SE: Standard Error of the Mean.
MODE - MUL=Multiple Modes. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MEDIAN	MODE
FORM1	273.65	13917.16	117.97	26.38	234.5	MUL
FORM2	248.45	21627.53	147.06	27.31	222	222
FORM3	249.93	39726.07	199.31	37.01	167	222
FORM4	315.67	17023.99	130.48	25.11	323	333
EDANG1	5.84	0.47	0.69	0.16	6	6
EDANG2	4.65	7.51	2.74	0.54	3	3
EDANG3	4.35	7.42	2.72	0.57	3	3
EDANG4	5.74	1.86	1.36	0.28	6	7
RETFRM1	4.21	3.18	1.78	0.41	5	5
RETFRM2	6.77	3.87	1.97	0.39	8	8
RETFRM3	6.52	3.26	1.81	0.38	8	8
RETFRM4	4.22	3.73	1.93	0.40	5	5
RETLOC1	2.63	6.14	2.48	0.57	1	1
RETLOC2	7.42	10.73	3.28	0.64	9	9
RETLOC3	7.13	10.84	3.29	0.69	9	9
RETLOC4	3.36	8.05	2.84	0.59	1	1
RETLNGTH1	0.246	0.009	0.097	0.022	0.24	MUL
RETLNGTH2	0.145	0.017	0.130	0.026	0.08	0.04
RETLNGTH3	0.129	0.008	0.090	0.019	0.10	0.04
RETLNGTH4	0.203	0.011	0.103	0.021	0.19	0.13
RETEXT1	50.16	1351.22	36.76	8.43	80	81
RETEXT2	60.89	1121.25	33.49	6.57	81	81
RETEXT3	51.78	1386.74	37.24	7.77	81	81
RETEXT4	55.61	123.05	35.13	7.33	80	81
RETDIR1						1
RETDIR2						1
RETDIR3						1
RETDIR4						1
SCARFRM1	18.63	200.90	14.174	3.25	23.00	32
SCARFRM2	7.85	182.68	13.516	2.65	0.00	0
SCARFRM3	8.57	181.36	13.467	2.81	2.00	0
SCARFRM4	14.30	204.49	14.300	2.98	3.00	MUL

TABLE 6. COEFFICIENTS OF VARIATION, SKEWNESS, AND KURTOSIS OF RETOUCH VARIABLES FOR UNIFACIAL ARTIFACTS, BY SIDE.

CV: coefficient of variation. See Chapter II for abbreviations for Variables.

VARIABLE	CV	SKEW	KURT
FORM1	43.11	1.362	3.368
FORM2	59.19	2.234	6.109
FORM3	79.75	1.582	1.060
FORM4	41.33	0.570	0.669
EDANG1	11.82	0.212	-0.662
EDANG2	58.92	1.050	-0.130
EDANG3	62.53	1.120	0.271
EDANG4	23.69	-1.278	1.542
RETFRM1	42.28	-0.486	0.553
RETFRM2	29.099	-1.157	-0.373
RETFRM3	27.76	-0.622	-1.139
RETFRM4	45.73	-0.088	-0.050
RETLOC1	94.297	0.891	-1.305
RETLOC2	44.20	-1.111	0.210
RETLOC3	46.14	-0.745	-0.367
RETLOC4	84.52	0.697	-0.959
RETLNGTH1	39.43	0.280	-0.718
RETLNGTH2	89.66	1.005	-0.284
RETLNGTH3	69.77	0.458	-1.309
RETLNGTH4	50.74	0.695	0.501
RETEXT1	73.29	-0.355	-2.096
RETEXT2	55.00	-1.114	-0.814
RETEXT3	71.92	-0.490	-1.917
RETEXT4	63.17	-0.693	-1.657
RETDIR1			
RETDIR2			
RETDIR3			
RETDIR4			
SCARFRM1	76.06	-0.213	-2.069
SCARFRM2	172.23	1.344	-0.193
SCARFRM3	157.18	1.205	-0.517
SCARFRM4	100.00	0.377	-1.922

positively skewed (2.234), and there is a very strong positive degree of kurtosis (6.109). Numbers 37-1, a transverse arrowhead, and 38-7, a burin, are outliers.

The chi-square value is 8.3448, df=18, and is not significant at 0.9730. The chi-square statistic is questionable due to the small sample size. One (3.4%) is coded for each of the following codes: 116, 122, 131, 147, 211, 213, 232, 312, 321, 336, 622, 777. Two (6.9%) are coded for each of the following codes: 141, 212, 223, 313, 333. Three (10.3%), are coded 111. Four (13.8%), are coded 222. N=29.

FORM3. The average for unifacial artifacts is 249.931, with a variance of 39726.071, and a standard deviation of 199.314. The median is 167, and the modal code is 222. The coefficient of variation is 79.75 percent. The distribution is mildly positively skewed (1.582), and there is a mild positive degree of kurtosis (1.060). Numbers 37-9, 37-7, 37-12, transverse arrowheads, 39-9, a microblade, and 39-6, a fishhook, are extremes.

The chi-square value is 37.7241, df=14, and is significant at 0.0006. The chi-square statistic is questionable due to the small sample size. One (3.4%) is coded for each of the following codes: 121, 123, 136, 141, 146, 167, 333, 612, 622, 632, 712, 722. Two (6.9%) are coded 114. Seven (24.1%) are coded 111. Eight (27.6%) are coded 222. N=29.

FORM4. The average for unifacial artifacts is 315.667, with a variance of 17023.987, and a standard deviation of 130.476. The median is 323, and the modal code is 333. The coefficient of variation is 41.33 percent. The distribution is slightly positively skewed (0.570), and there is a slight positive degree of kurtosis (0.669). Numbers 37-10, and 37-5, transverse arrowheads, are outliers.

The chi-square value is 5.5926, df=15, and is not significant at 0.9858. The chi-square statistic is questionable due to the small sample size. One (3.7%) is coded for each of the following codes: 132, 162, 166, 221, 332, 343, 421. Two (7.4%) is coded for each of the following codes: 111, 222, 262, 322, 323, 422, 423, 622. Four (14.8%) are coded 333. N=27, two are not coded.

Edge Angle.

EDANG1. The average for unifacial artifacts is 5.842, with a variance of 0.473, and a standard deviation of 0.688. The median is 6, and the modal code is 6. The coefficient of variation is 11.82 percent. The distribution is slightly positively skewed (0.212), and there is a slight negative degree of kurtosis (-0.662). There are no outliers or extremes.

The chi-square value of 3.8947, df=2, is not significant at 0.1426. Six (31.6%) are coded 5, between 50 and 70 degrees. Ten (52.6%) are coded 6, between 70 and 85 degrees. Three (15.8%) are coded 7, greater than 85 degrees. N=19, ten are not coded.

EDANG2. The average for unifacial artifacts is 4.654, with a variance of 7.513, and a standard deviation of 2.741. The median is 3, and the modal code is 3. The coefficient of variation is 58.92 percent. The distribution is mildly positively skewed (1.050), and there is a very slight negative degree of kurtosis (-0.130). There are no outliers or extremes.

The chi-square value of 12.7692, df=6, is significant at 0.0469 The chi-square statistic is questionable due to the small sample size. Five (19.2%) are coded 2, between 10 and 20 degrees. Nine (34.6%) are coded 3, between 20 and 30 degrees. Two (7.7%) are coded 4, between 30 and 50 degrees. One

(3.8%) is coded 5, between 50 and 70 degrees. Four (15.4%) are coded 6, between 70 and 85 degrees. One (3.8%) is coded 7, greater than 85 degrees. Four (15.4%) are coded 10, could not be coded. N=26, three are not coded.

EDANG3. The average for unifacial artifacts is 4.348, with a variance of 7.42, and a standard deviation of 2.724. The median is 3, and the modal code is 3. The coefficient of variation is 62.53 percent. The distribution is mildly positively skewed (1.120), and there is a very slight positive degree of kurtosis (0.271). There are no outliers or extremes.

The chi-square value of 11.4348, df=7, is not significant at 0.1207. The chi-square statistic is questionable due to the small sample size. Seven, (30.4%), are coded 3, between 20 and 30 degrees. Five,, (21.7%), are coded 2, between 10 and 20 degrees. Three, (13.0%), are coded 6, between 70 and 85 degrees. Three, (13.0%), is coded 10, could not be coded. Two, (8.7%), are coded 4, between 30 and 50 degrees. One, (4.3%), is coded 1, less than or equal to 10 degrees. One, (4.3%), are coded 5, between 50 and 70 degrees. One, (4.3%), is coded 7, greater than 85 degrees. N=23, six are not coded.

EDANG4. The average for unifacial artifacts is 5.739, with a variance of 1.863, and a standard deviation of 1.356. The median is 6, and the modal code is 7. The coefficient of variation is 23.69 percent. The distribution is mildly negatively skewed (-1.278), and there is a mild positive degree of kurtosis (1.542). Number 37-13, a transverse arrowhead, is an outlier.

The chi-square value of 13.7826, df=5, is significant at 0.0171. The chi-square statistic is questionable due to the small sample size. One (4.3%) is coded for each of the following codes: 2, between 10 and 20 degrees, 3,

between 20 and 30 degrees, and 4, between 30 and 50 degrees. Five (21.7%) are coded 5, between 50 and 70 degrees. Seven (30.4%) are coded 6, between 70 and 85 degrees. Eight (34.8%) are coded 7, greater than 85 degrees. N=23, six are not coded.

Form of Retouch.

RETFRM1. The average for unifacial artifacts is 4.211, with a variance of 3.176, and a standard deviation of 1.782. The median is 5, and the modal code is 5. The coefficient of variation is 42.28 percent. The distribution is slightly negatively skewed (-0.486), and there is a slight positive degree of kurtosis (0.553). Number 38-7, a burin, is an outlier.

The chi-square value of 15.3158, df=3, is significant at 0.0016. The chi-square statistic is questionable due to the small sample size. Three (15.8%) are coded 1, *retouch sommaire*. Three (15.8%) are coded 3, *retouche scaliforme*. Twelve (63.2%) are coded 5, scarring of *retouch scaliforme* and minute nibbling. One (5.3%) is coded 8, irregular edge and fracturing. N=19, ten are not coded.

RETFRM2. The average for unifacial artifacts is 6.769, with a variance of 3.865, and a standard deviation of 1.966. The median is 8, and the modal code is 8. The coefficient of variation is 29.099 percent. The distribution is mildly negatively skewed (-1.157), and there is a slight negative degree of kurtosis (-0.373). There are no outliers or extremes.

The chi-square value of 15.0769, df=2, is significant at 0.0005. Four (15.4%) are coded 3, *retouche scaliforme*. Four (15.4%) are coded 5, scarring

of *retouche scaliforme* and minute nibbling. Eighteen (69.2%) are coded 8, irregular edge and fracturing. N=26, three are not coded.

RETFRM3. The average for unifacial artifacts is 6.522, with a variance of 3.262, and a standard deviation of 1.806. The median is 8, and the modal code is 8. The coefficient of variation is 27.76 percent. The distribution is slightly negatively skewed (-0.622), and there is a mild negative degree of kurtosis (-1.139). There are no outliers or extremes.

The chi-square value of 7.9130, df=2, is significant at 0.0191. Two (8.7%) are coded 3, *retouche scaliforme*. Eight (34.8%) are coded 5, scarring of *retouche scaliforme* and minute nibbling. Thirteen (56.5%) are coded 8, irregular edge and fracturing. N=23, six are not coded.

RETFRM4. The average for unifacial artifacts is 4.217, with a variance of 3.725, and a standard deviation of 1.930. The median is 5, and the modal code is 5. The coefficient of variation is 45.73 percent. The distribution is very slightly negatively skewed (-0.088), and there is a very slight negative degree of kurtosis (-0.050). Numbers 39-6, fishhooks, and 39-5, fishhooks, are outliers.

The chi-square value of 19.3913, df=4, is significant at 0.0007. The chi-square statistic is questionable due to the small sample size. Three, (13.0%), are coded 1, *retouche sommaire*. Two, (8.7%), are coded 2, *retouche laminaire*. Three, (13.0), are coded 3, *retouche scaliforme*. Thirteen, (56.5%), are coded 5, scarring of *retouch scaliforme* and minute nibbling. Two, (8.7%), are coded 8, irregular edge and fracturing. N=23, six are not coded.

Location of Retouch.

RETLOC1. The average for unifacial artifacts is 2.632, with a variance of 6.136, and a standard deviation of 2.477. The median is 1, and the modal code is 1. The coefficient of variation is 94.297 percent. The distribution is slightly positively skewed (0.891), and there is a mild negative degree of kurtosis (-1.305). There are no outliers or extremes.

The chi-square value of 11.7895, df=2, is significant at 0.0028. Thirteen, (68.4%), are coded 1, on dorsal surface. Five, (26.3%), are coded 6, on dorsal and ventral surfaces. One, (5.3%), is coded 7, first on dorsal surface, then on ventral, then on dorsal. N=19, ten are not coded.

RETLOC2. The average for unifacial artifacts is 7.423, with a variance of 10.732, and a standard deviation of 3.276. The median is 9, and the modal code is 9. The coefficient of variation is 44.20 percent. The distribution is mildly negatively skewed (-1.111), and there is a very slight positive degree of kurtosis (0.210). Numbers 39-2, , 39-1, 39-3, and 39-9, all microblades, are outliers.

The chi-square value of 41.8462, df=6, is significant at 0.0000. The chi-square statistic is questionable due to the small sample size. Four, (15.4%), are coded 1, on dorsal surface. One, (3.8%), is coded 3, on first part of ventral surface and on second part of dorsal surface. Two, (7.7%), are coded 6, on dorsal and ventral surfaces. One, (3.8%), is coded 7, first on dorsal surface, then on central, then on dorsal. One, (3.8%), is coded 8, on middle surface. Fifteen, (57.5%), are coded 9, on tip of edge only. Two, (7.7%), are coded 12, on dorsal surface first, then on both dorsal and ventral surfaces. N=26, three are not coded.

RETLOC3. The average for unifacial artifacts is 7.130, with a variance of 10.844, and a standard deviation of 3.293. The median is 9, and the modal code is 9. The coefficient of variation is 46.14 percent. The distribution is slightly negatively skewed (-0.745), and there is a slight negative degree of kurtosis (-0.367). Numbers 39-2, 38-3, and 39-1, all microblades, are outliers.

The chi-square value of 17.4348, df=5, is significant at 0.0037. The chi-square statistic is questionable due to the small sample size. Three (13.0%) are coded 1, on dorsal surface. Two (8.7%) are coded 3, on first part of ventral surface and on second part of dorsal surface. Four (17.4%) are coded 6, on dorsal and ventral surface. One (4.3%) is coded 8, on middle surface. Eleven (47.8%) are coded 9, on tip of edge only. Two (8.7%) are coded 12, on dorsal surface first, then on both dorsal and ventral surfaces. N=23, six are not coded.

RETLOC4. The average for unifacial artifacts is 3.348, with a variance of 8.054, and a standard deviation of 2.838. The median is 1, and the modal code is 1. The coefficient of variation is 84.52 percent. The distribution is slightly positively skewed (0.697), and there is a slight negative degree of kurtosis (-0.959). There are no outliers or extremes.

The chi-square value of 25.7826, df=5, is significant at 0.0001. The chi-square statistic is questionable due to the small sample size. Twelve (52.2%) are coded 1, on dorsal surface. One (4.3%) is coded 2, on ventral surface. One (4.3%) is coded 4, on first part of dorsal surface and second part of ventral surface. One (4.3%) is coded 5, first on ventral surface, then on dorsal surface,

and then on ventral surface. Six (26.1%) are coded 6, on dorsal and ventral surfaces. Two (8.7%) are coded 9, on tip of edge only. N=23, six are not coded.

Length of Retouch.

RETLNGTH1. The average for unifacial artifacts is 0.246, with a variance of 0.009, and a standard deviation of 0.097. The median is 0.240, and there are multiple modes. The coefficient of variation is 39.43 percent. The distribution is slightly positively skewed (0.280), and there is a slight negative degree of kurtosis (-0.718). There are no outliers or extremes. N=19, ten were not coded.

RETLNGTH2. The average for unifacial artifacts is 0.145, with variance of 0.017, and a standard deviation of 0.130. The median is 0.080, and the mode is 0.040. The coefficient of variation is 89.66 percent. The distribution is very mildly positively skewed (1.005), and there is a slight negative degree of kurtosis (-0.284). There are no outliers or extremes. N=26, three are not coded.

RETLNGTH3. The average for unifacial artifacts is 0.129, with a variance of 0.008, and a standard deviation of 0.090. The median is 0.100, and the mode is 0.040. The coefficient of variation is 69.77 percent. The distribution is slightly positively skewed (0.458), and there is a mild negative degree of kurtosis (-1.309). There are no outliers or extremes. N=23, six are not coded.

RETLNGTH4. The average for unifacial artifacts is 0.203, with a variance of 0.011, and a standard deviation of 0.103. The median is 0.190, and the mode is 0.13. The coefficient of variation is 50.74 percent. The distribution is slightly positively skewed (0.695), and there is a slight positive degree of kurtosis (0.501). Number 38-5, a triangular point, is an outlier. N=23, six are not coded.

Extension of Retouch.

RETEXT1. The average for unifacial artifacts is 50.158, with a variance of 1351.224, and a standard deviation of 36.759. The median is 80, and the modal code is 81. The coefficient of variation is 73.29 percent. The distribution is slightly negatively skewed (-0.355), and there is a mild negative degree of kurtosis (-2.096). There are no outliers or extremes.

The chi-square value of 7.8421, df=5, is not significant at 0.1652. The chi-square statistic is questionable due to the small sample size. One (5.3%) is coded 2, continuous retouch on the first and middle part of the edge. One (5.3%) is coded 7, discontinuous retouch on the middle and last part of the edge. Three (15.8%) are coded 9, discontinuous retouch on the first and middle part of the edge. Three (15.8%) are coded 10, discontinuous retouch on the middle part of the edge. Four (21.1%) are coded 80, continuous retouch on the whole edge. Seven (36.8%) are coded 81, discontinuous retouch on the whole edge. N=19, ten are not coded.

RETEXT2. The average for unifacial artifacts is 60.885, with a variance of 1121.245, and a standard deviation of 33.485. The median is 81, and the modal code is 81. The coefficient of variation is 55.00 percent. The distribution is mildly negatively skewed (-1.114), and there is a slight negative degree of kurtosis (-0.814). There are no outliers or extremes.

The chi-square value of 41.8462, df=6, is significant at 0.0000. The chi-square statistic is questionable due to the small sample size. One, (3.8%), is coded 1, continuous retouch on the first part of the edge. One, (3.8%), is coded 4, continuous retouch on the middle and last part. Two, (7.7%), are

coded 7, discontinuous retouch on the middle and last part. One, (3.8%), is coded 9, discontinuous retouch on the first and middle part. Two, (7.7%), are coded 10, discontinuous retouch on the middle part. Four, (15.4%), are coded 80, continuous retouch on the whole edge. Fifteen, (57.7%), are coded 81, discontinuous retouch on the whole edge. N=26, three are not coded.

RETEXT3. The average for unifacial artifacts is 51.783, with a variance of 1386.743, and a standard deviation of 37.239. The median is 81, and the modal code is 81. The coefficient of variation is 71.92 percent. The distribution is slightly negatively skewed (-0.490), and there is a mild negative degree of kurtosis (-1.917). There are no outliers or extremes.

The chi-square value of 48.6087, df=8, is significant at 0.0000. The chi-square statistic is questionable due to the small sample size. One (4.3%) is coded for each of the following codes: 1, continuous retouch on whole edge; 7, discontinuous retouch on the middle and last part of the edge; 9, discontinuous retouch on the first and middle part of the edge; 10, discontinuous on the middle part; 11, discontinuous retouch on the last part; and 80, continuous retouch on the whole edge. Two (8.7%) are coded 2, continuous retouch on the first and middle part. Two (8.7%) are coded 8, discontinuous retouch on the first part. Thirteen (56.5%) are coded 81, discontinuous retouch on the whole edge. N=23, six are not coded.

RETEXT4. The average for unifacial artifacts is 55.609, with a variance of 1234.07, and a standard deviation of 35.129. The median is 80, and the modal code is 81. The coefficient of variation is 63.17 percent. The distribution is slightly

negatively skewed (-0.693), and there is a mild negative degree of kurtosis (-1.657). There are no outliers or extremes.

The chi-square value of 10.6957, df=4, is significant at 0.0302. The chi-square statistic is questionable due to the small sample size. One (4.3%) is coded 1, continuous retouch on the first part of the edge. Two (8.7%) are coded 9, discontinuous retouch on the first and middle part of the edge. Five (21.7%) are coded 10, discontinuous retouch on the middle part. Five (21.7%) are coded 80, continuous on the whole edge. Ten (43.5%) are coded 81, discontinuous on the whole edge. N=23, six are not coded.

Direction of Retouch.

RETDIR1. All but one are coded 1. N=29. Number 37-7 is not coded.

RETDIR2. All but three are coded 1. N=29. Numbers 37-1, 37-7 and 39-7 are not coded.

RETDIR3. All but 5 are coded 1. N=29. Numbers 37-1, 37-2, 37-6, 37-7, and 37-10, are not coded.

RETDIR4. All but two are coded 1. N=29. Numbers 37-7, and 38-7, are not coded.

Code 1 is the Direction of Retouch is perpendicular to the edge.

Scar Form.

SCARFRM1. The average for unifacial artifacts is 18.632, with a variance of 200.902, and a standard deviation of 14.174. The median is 23, and the modal code is 32. The coefficient of variation is 76.06 percent. The distribution is very slightly negatively skewed (-0.213), and there is a mild negative degree of kurtosis (-2.069). There are no outliers or extremes.

The chi-square value of 16.0000, df=4, is significant at 0.0030. The chi-square statistic is questionable due to the small sample size. One (5.3%) is

coded 2, feathered. Seven (36.8%) is coded 3, hinged. One (5.3%) is coded 20, feathered and other. One (5.3%) is coded 23, feathered and hinged. Nine (47.4%) is coded 32, hinged and feathered. N=19, ten are not coded.

SCARFRM2. The average for unifacial artifacts is 7.846, with a variance of 182.682, and a standard deviation of 13.516. The median is 0, and the modal code is 0. The coefficient of variation is 172.23 percent. The distribution is mildly positively skewed (1.344), and there is a very slight negative degree of kurtosis (-0.193). Numbers 39-9, a burin, 38-1, tanged points, 39-4, triangular point, 38-3, tanged point, 39-6, fishhook, and 38-7, microblade, are extremes.

The chi-square value of 4.9231, df=2, is significant at 0.0853. Fourteen (53.8%) are coded 0, other. Six (23.1%) are coded 2, feathered. Six (23.1%) are coded 32, hinged and feathered. N=26, three are not coded.

SCARFRM3. The average for unifacial artifacts is 8.565, with a variance of 181.360, and a standard deviation of 13.467. The median is 2, and the modal code is 0. The coefficient of variation is 157.18 percent. The distribution is mildly positively skewed (1.205), and there is a slight negative degree of kurtosis (-0.517). Numbers 38-1, microblade, 39-4, triangular point, 38-3, tanged point, 39-7, burin, and 38-7, burin, are outliers.

The chi-square value of 7.4348, df=3, is significant at 0.0593. Ten (43.5%) are coded 0, other. Seven (30.4%) are coded 2, feathered. One (4.3%) is coded 23, feathered and hinged . Five (21.7%) are coded 32, hinged and feathered. N=23, six are not coded.

SCARFRM4. The average for unifacial artifacts is 14.304, with a variance of 204.49, and a standard deviation of 14.300. The median is 3, and there are multiple modal codes. The coefficient of variation is 100.00 percent. The distribution is slightly positively skewed (0.377), and there is a mild negative degree of kurtosis (-1.922). There are no outliers or extremes.

The chi-square value of 14.3043, df=5, is significant at 0.0138. The chi-square statistic is questionable due to the small sample size. Two (8.7%) are coded 0, other. Three (13.0%) are coded 2, feathered. Eight (34.8%) are coded 3, hinged. One (4.3%) is coded 20, feathered and other. One (4.3%) is coded 23, feathered and hinged. Eight (34.8%) are coded 32, hinged and feathered. N=23, six are not coded.

DESCRIPTIVE ANALYSIS

Descriptions of Unifacial Artifacts

Transverse Arrowheads

An important product of the prismatic blade technique is the transverse arrowhead or point. These were manufactured largely in the Late Mesolithic, Ertebolle phase, and the Early Neolithic TRB (Mathiassen 1948). They can be found in settlements, graves, and other sites (Anderson 1990) There are thirteen transverse points in this collection. Ten (Numbers 37-2-4, and 7-13) are like number 100 of Mathiassen (1948:60). These have very concave sides with edges that turn outward, and a straight cutting edge. One (Numbers 37-6) is like number 102 of Mathiassen,

with one edge oblique, and the other concave. One (Number 37-5) is like number 99 of Mathiassen; it is narrow, with slightly diverging parallel sides. They are frequently found in "Gudenaa" and Ertebolle, and the Late Stone Age. Number 37-1 is like Mathiassen's number 105, it is long and blunted on one side. This is interpreted as an unfinished form, from the early stages of manufacture, before the retouch to create the more usual forms.

Number 37-1. Transverse Arrowhead.

Similar to Numbers 105 and 106 of Mathiassen (1948:60). Terminal Mesolithic. Number 37-1 is an outlier for Form 1. From Jutland. Made of fine-grained flint, gray (10YR5/2). Length 1.44 cm.

Overall form is a wide truncated V-shape, with slightly flaring sides. The sides diverge from base, and curve outward to ends. The right side is more concave than the other. The cutting edge is straight, but slightly concave. One surface is made of two scars, the other is from one scar. The base is straight, but slightly concave. This is interpreted as an unfinished form, from the early stages of manufacture, before the retouch to create the more usual forms.

Number 37-2. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark brown (10YR4/4). Length 1.78 cm.

Overall form is an asymmetrical T-shape. Sides run parallel from base, then curve outward to ends. The right side is more concave than the other. Cutting edge is straight except for a small scar. One surface is made of two scars, the other is from one scar. The base is straight, but at an angle, and is about one-third as wide as the cutting edge.

Numbers 37-3. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, medium yellow brown (10YR5/4). Length 1.75 cm.

Overall form is a symmetrical T-shape. Sides run parallel from base, then curve outward to ends. Cutting edge is irregular, but generally straight. Surfaces are rough. Both surfaces are made of one scar, each, and the cross-section is a squat triangle. The base is convex, and is about one-third as wide as the cutting edge.

Number 37-4. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark gray/black (10YR3/1). Length 1.85 cm.

Overall form is a symmetrical T-shape. The sides diverge, and the left side is slightly convex. The sides then run parallel from base, and curve outward to ends. Cutting edge is straight. One surface is made of three scars, the other is from one scar. The base is straight, but at an angle.

Number 37-5. Transverse Arrowhead.

Similar to Number 99 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, medium brown gray (10YR5/4). Length 1.63 cm.

Overall form is a narrow truncated V-shape. Sides diverge very slightly from base. The right side flairs slightly at cutting edge. The cutting edge is slightly concave. One surface is made of two scars, the other is from one scar. The base is straight, but at a slight angle. Number 37-5 is an outlier for Form 1.

Number 37- 6. Transverse Arrowhead.

Similar to Numbers 101 and 102 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark gray (10YR5/1). Length 1.85 cm.

Overall form is an asymmetrical triangle. The sides diverge from base; the left side is concave, and the right is straight. The cutting edge is slightly convex. One surface is made of two scars, the other is from one scar. The base is straight and very narrow, and about one-sixth as wide as the cutting edge.

Numbers 37- 7. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, medium gray (10YR4/2). Length 1.16 cm.

Overall form is a wide truncated symmetrical V-shape with concave sides. Sides run parallel from base, then curve outward to ends. The left side is more concave than the other. Cutting edge is generally straight. One surface is made of three scars, the other is from one scar. The base is straight, but at an angle, and is about half as wide as the cutting edge. Number 37-7 is an extreme for Form 3.

Numbers 37-8. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark gray/black (10YR3/2). Length 1.91 cm.

Overall form is a symmetrical truncated V-shape with wide upper ends. Sides diverge from base, then curve sharply outward to ends. The right side is slightly longer than the other. Cutting edge is very straight. One surface is made of three scars, the other is from one scar. The base is straight, and about one-fifth as wide as the cutting edge.

Numbers 37-9. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark reddish brown (2.5YR2.5/4). Length 1.92 cm.

Overall form is a wide asymmetrical T-shape, with a flaring base. Sides converge from base, then curve to diverge outward to ends. The left side is more concave than the other. Cutting edge is slightly concave. One surface is made of three scars, the other is from one scar. The base is straight, but at an angle, and is about one-half as wide as the cutting edge. Number 37-9 is an extreme for Form 3.

Numbers 37-10. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark gray (7.5YR3/2). Length 1.82 cm.

Overall form is an asymmetrical T-shape. Sides run parallel from base, then curve outward to ends. The left side is more concave than the other. The cutting edge is slightly convex. One surface is made of three scars, the other is from one scar. The base is straight, but at an angle, about one-third as wide as the cutting edge. Number 37-10 is an outlier for Form 4.

Number 37-11. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, yellow gray brown (10YR4/3). Length 1.67 cm.

Overall form is an asymmetrical truncated V-shape with wide upper ends. Sides diverge from base, then curve outward to ends. The left side is slightly longer than the other. Cutting edge is very straight. One surface is made of two scars, the other is from one scar. The base is straight, at an angle, and about one-fifth as wide as the cutting edge.

Number 37-12. Transverse Arrowhead.

Similar to Number 100 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark gray (2.5YR3/2). Length 1.95 cm.

Overall form is a wide asymmetrical T-shape, with a flaring base. Sides converge from base, then curve to diverge outward to ends. The right side is more concave than the other. Cutting edge is straight. One surface is made of two scars, the other is from one scar. The base is an asymmetrical V-shape, and is about one-half as wide as the cutting edge. Number 37-12 is for extreme for Form 3.

Number 37- 13. Transverse Arrowhead.

Similar to Numbers 100 and 102 of Mathiassen (1948:60). Terminal Mesolithic. From Jutland. Made of fine-grained flint, dark gray-brown (10YR3/3). Length 1.85 cm.

Overall form is a narrow based asymmetrical T-shape. The sides converge from base, are very concave to the midpoint, and then diverge to form wide ends. The right side is more concave than the other. The cutting edge is S-shaped. One surface is made of three scars, the other is from one scar. The base is straight, but at an angle. Number 37-13 is an outlier for Form 1, and Edge Angle 4.

Triangular Points

Number 38-5. Triangular Point.

Late Palaeolithic. From Jutland. Made of fine-grained flint, mottled light brown and dark grey (2.5Y6/4, 2.5Y4/2). Length 2.35 cm.

Overall form is an asymmetrical triangle with a slightly concave base. The body is short and wide. The surfaces are smooth and flat. The left side runs acutely

from base and then bends slightly to form a slight concavity. It then bends outward to form a convexivity, and then converges to the point. The right side runs straight from base, and then bends to form a large concavity; it runs straight, and then converges to the point. About three-fourths of the length from the base the sides converge to a dull point. The cross-section is a very narrow oval. The base is concave. The greatest width is at the base. Number 38-5 is an outlier for Retouch Length 4.

Number 39-4. Triangular Point, Flat Flaked.

Also called barbed or hollow-based arrowhead (Boas 1983, 1991; Johansen 1985). Similar to Figure 4b, (Lomborg 1973:23; Liversage and Singh 1985:78). Flat-flaked implements include these triangular points, as well as daggers and sickles (Liversage and Singh 1985:72). Late Neolithic to Early Bronze Age. From Jutland. Made of fine-grained flint, very dark grey/black (2.5Y4/2). Length 3.04 cm.

Overall form is an asymmetrical triangle with a very concave base. The body is long and wide, and is well developed. The back surface is smooth and flat. The top surface is also smooth, it tapers to the edges, and there is evidence of retouch on the edges. The left side runs convexly from base. The right side runs straight from base, at an acute angle to the base. About three-fourths of the length from the base the sides converge to a sharp point. The cross-section is a thin rectangle with the top surface narrower than the bottom surface. The base is very concave and curved. The greatest width is at the base. Number 39-4 is an outlier for Retouch Location 2, and an extreme for Scar Form 2.

Burin/Burin-Spall

Number 38-7. Burin.

Late Palaeolithic to Early Neolithic. From Jutland. Made of fine-grained flint, dark reddish brown (10YR4/2). Length 3.19 cm.

Overall form is a very oblong, narrow triangle. The body is very long and very narrow. Surfaces have small scars. The sides are straight, but rough. They converge very gradually from base, so that the base is wider than the tip. The tip is a sharp point. The cross-section is a triangle. The base is very flat. The greatest width is at the base. Number 38-7 is an outlier for Form 2 and Scar Form 3, and an extreme for Scar Form 2 and Retouch Form 1.

Number 39-9. Burin Spall.

Late Palaeolithic to Early Neolithic. This artifact was not assigned a museum number, but was with the other Accession 45, Number 39 artifacts. From Jutland. Made of fine-grained flint, dark grey (2.5Y5/2). Length 2.75 cm.

Overall form is a narrow, oblong S-shape. The body is long and very narrow. Surfaces have small scars. The sides are rough. The sides runs parallel in an S-form. The cross-section is a square. The greatest width is at the middle. Number 39-9 is an outlier for Retouch Location 2, and an extreme for Form 3 and Scar Form 2.

Microblades

Microblades are slim blades usually between two and five centimeters (Mathiassen 1948:51) removed from a small core (Callahan 1985). They have scarring that are longitudinal, parallel to the edge of the blade. These blades were used in compound tools as inserts along the shaft of arrows, and were used to hunt land

animals They are devoid of retouch, as a contrast to earlier microlith inserts. Callahan (1985:37), in his experimental reconstruction of microblade manufacture, has suggested that the blades may have been removed by holding a small core in the hand, and using antler, or an antler-like material, to pressure-flake the blades from the core. The core would have been prepared by hard hammer percussion.

In Denmark, there are several schools of thought in relation to microblades (Callahan 1985). One view is that microblades belong to the Kongemose culture, while another proposes that microblades, and their cores, are intrusive into the Kongemose, and actually belong to the Maglemose or the transition from the Maglemose to the Kongemose. It is also suggested that microblades decreased in occurrence more quickly in the Jutland area of Denmark, than the Zealand area.

This collection has five microblades from Jutland, numbers: 39-1, -2, -3, -7, -8. They are devoid of retouch. Due to their apparent location, one can propose that they are from the transition from the Maglemose to the Kongemose.

Number 39-1. Microblade.

Similar to Figure 1, Callahan (1985:24). Late Palaeolithic Maglemose and Kongemose. From Jutland. Made of fine-grained flint, light grey brown (10YR7/2). Length 3.11 cm.

The body is long, and very thin. Sides diverge slightly from base, run parallel, and then converge to a sharp point. The surfaces are smooth. The cross-section is a squat triangle. The base is rounded. Maximum width is at the middle. Number 39-1 is an outlier for Retouch Location 2 and Retouch Location 3.

Number 39-2. Microblade.

Similar to Figure 1e, Callahan (1985:24). Late Palaeolithic Maglemose and Kongemose. From Jutland. Made of fine-grained flint, light reddish brown (2.5YR7/2). Length 3.59 cm.

The body is very long, narrow, and thin. Sides converge from base to form a notch, and then diverge. The sides then run parallel, the left side is convex, and the right side is concave. The sides converge to a sharp point. The surfaces are smooth. The cross-section is a very narrow and thin oval. The base is rounded. Maximum width is at the base. Number 39-2 is an outlier for Retouch Location 2 and Retouch Location 3.

Number 39-3. Microblade.

Similar to Figure 1h, Callahan (1985:24). Late Palaeolithic Maglemose and Kongemose. From Jutland. Made of fine-grained flint, light brown (10YR6/3). Length 3.15 cm.

The body is very long, narrow, and thin. The sides run parallel from base, and then converge about two-thirds of the length from the butt to form a dull point. The surfaces are smooth. The cross-section is a very narrow and thin oval. The base is flat. Maximum width is at the middle.

Number 39-7. Microblade.

Similar to Figure 1h, Callahan (1985:24). Late Palaeolithic Maglemose and Kongemose. From Jutland. Made of fine-grained flint, light brown (10YR8/1). Length 2.55 cm.

The body is very long, and narrow. Sides converge from base, and then diverge, so that the sides are slightly convex. The sides then converge to a sharp point.

The surfaces are smooth. The cross-section is a very narrow and thin oval. The base is flat and very narrow. Maximum width is towards the tip. Number 39-7 is an outlier for Scar Form 3.

Number 39-8. Microblade.

Similar to Figure 1e, Callahan (1985:24). Late Palaeolithic Maglemose and Kongemose. From Jutland. Made of fine-grained flint, medium brown (10YR5/2). Length 2.49 cm.

The body is squat and very thin. Sides diverge slightly from base, run parallel, and then curve so that the left side is concave, and the right side is convex. The sides converge to a sharp point. The surfaces are smooth. The cross-section is a very narrow and thin oval. The base is rounded. Maximum width is at the middle.

Fishhooks

Number 39-5. Fishhook.

Terminal Mesolithic to Early Neolithic. From Jutland. Made of fine-grained flint, light yellow brown (10YR6/3). Length 2.16 cm.

Overall form is very irregular. The base is a very asymmetrical, sharp V-shape. Longest side runs straight, then bends outward. The next side runs at an acute angle to the longest, forming a sharp point. This side is convex. It then meets the smallest side, forming a very asymmetrical V-shape. The smallest side is short and straight, and projects from previous side. The last side runs, slightly concave, at an acute angle to the shortest side, and forming a sharp point, meets the longest side. The surfaces are smooth and flat. The cross-section is very thin. The greatest width is at about one-fourth of the length from the base. Number 39-5 is an outlier for Retouch Form 4.

Number 39-6. Fishhook.

Terminal Mesolithic to Early Neolithic. From Jutland. Made of fine-grained flint, light yellow brown (10YR6/2). Length 2.07 cm.

Overall form is an irregular asymmetrical shape. The body is squat and wide. The surfaces are smooth and flat. Longest side is very concave. It meets the next side at an acute angle. The second side is slightly convex, and meets the third side at an obtuse angle. The third side has cortex on the edge. It is straight and short. The third side meets the fourth at an obtuse angle. The fourth side is very straight. It runs to an irregular area that is a general pointed-circle shape, that meets the first side. The cross-section is very thin. The base is very rounded. The greatest width is at the base. Number 39-6 is an extreme for Form 3, Scar Form 2, and Retouch Form 4.

Tanged Points

Tanged points occurred, in similar form, in the Upper Palaeolithic and the Middle Neolithic of Denmark (Mathiassen 1948; Glob 1952). These are made from a narrow, pointed blade. The tang, at the base, is formed by retouch, which is generally restricted to one side, and therefore, they are unifacial. For the Upper Palaeolithic, especially the Bromme and Ahrensburg phases, the blade of these points can also be retouched on one side. They are usually between four and six centimeters (Mathiassen 1948). The Neolithic forms, called Blade Arrowheads, have some retouching of the blade, tangs with a triangular cross-section, and a bulb at the base of the tang. There are five tanged points in this collection. Based on form, tang cross-section, and presence of bulb, Numbers 38-1, 2, and 4 are classified as Middle

Neolithic Pitted Ware (Glob 1952; Rasmussen 1993, photograph, p. 115); and numbers 38-3 and 6 are classified as Late Palaeolithic Ahrensburg, or, perhaps, Bromme.

Number 38-1. Tanged Point.

Similar to #310 (Glob 1952:102). Middle Neolithic Pitted Ware Culture. From Jutland. Made of fine-grained flint, light gray (10YR5/2). Length 5.93 cm.

The body is very long and very narrow. Surfaces are smooth, with some retouching of the blade. Sides run parallel from butt to about one-third of the length of the body, and then diverge to form shoulders. From the shoulders, the sides gradually converge to a sharp point. The sides are slightly concave. The tang is narrow, and has a triangular cross-section. The base is flat, and is about one-half as wide as the greatest width. The greatest width is at the shoulders. There is a small bulb projecting from the surface of the back of the butt. Number 38-1 is an outlier for Scar Form 3, and an extreme for Scar Form 2.

Number 38-2. Tanged Point.

Similar to #310 (Glob 1952:102). Middle Neolithic Pitted Ware Culture. From Jutland. Made of fine-grained flint, dark gray/black (10YR5/1). Length 6.60 cm.

The body is long and wide. Surfaces are smooth, with some retouching of the blade. Sides run parallel from butt to about one-third of the length of the body, and then diverge to form shoulders. From the shoulders, the sides gradually converge to a sharp point. The sides are convex. The tang is wide, and has a triangular cross-section. The base is V-shaped, and is about one-half as wide as the greatest width. The greatest width is at the shoulders. There is a small bulb projecting from the surface of the back of the butt.

Number 38-3. Tanged Point.

Similar to #74 (Mathiassen 1948:58). Late Palaeolithic Ahrensburg/Bromme. From Jutland. Made of fine-grained flint, light gray (10YR5/2). Length 4.68 cm.

The body is short and wide. Surfaces are smooth, with some retouching of one side of the blade. Sides run parallel from butt to about one-third of the length of the body, and then diverge to form rounded shoulders. From the shoulders, the sides gradually converge, to form a sharp point. The left side is slightly convex, and the right side is slightly concave. The tang has a narrow oval cross-section. The base is flat, and narrow, about one-third as wide as the greatest width. The greatest width is at the shoulders. Number 38-3 is an outlier for Retouch Location 3 and Scar Form 3, and an extreme for Scar Form 2.

Number 38-4. Tanged Point.

Similar to #313 (Glob 1952:102). Middle Neolithic Pitted Ware Culture. From Jutland. Made of fine-grained flint, light gray (10YR6/1). Length 6.35 cm.

The body is long and narrow. Surfaces are smooth, with some retouching of the blade. Sides run parallel, in a slight S-shape, from butt to more than one-third of the length of the body, and then diverge to form shoulders. The shoulders are asymmetrical, the left shoulder is slightly wider than the right. From the shoulders, the left side is concave, and the right side is straight to about two-thirds of the length from the butt, and then bends to meet the left side in a sharp point. The tang has a triangular cross-section. The base is rounded, and is about one-half as wide as the greatest width. The greatest width is at the shoulders. There is a small bulb projecting from the surface of the back of the butt. Number 38-4 is an outlier for Scar Form 3.

Number 38-6. Tanged Point.

Similar to #74 (Mathiassen 1948:58). Late Palaeolithic Ahrensburg/Bromme. From Jutland. Made of fine-grained flint, yellow gray (10YR6/2). Length 5.36 cm.

The body is squat and wide. Surfaces are smooth, with some retouching of one side of the blade. Sides run parallel, in a slight S-shape, from butt to about one-fourth of the length of the body, and then diverge to form slightly pointed shoulders. From the shoulders, the sides gradually converge to just before the point, and then steeply converge to form a sharp point. The sides are slightly convex. The tang has a rectangular cross-section, with the bottom side longer than the top side. The base is slightly concave, and about one-half as wide as the greatest width. The greatest width is at the shoulders.

FUNCTIONAL AND STYLISTIC ANALYSES

The determinations of the functions of the Unifacial artifact group are presented in Table 7 and Table 8. The transverse arrowheads have little evidence of their function. Three of the thirteen were used for cutting, the others may have been used as projectile points (Fischer et al 1984). The other Unifacial artifacts can provide more information. Sides 2 and 3 for the tanged points was used largely for cutting of soft or soft and hard materials, although number 38-3 was used for scraping soft and hard materials. Sides 2 and 3 of the burin was used for cutting soft and hard materials. The burin spall's Side 2 was used for scraping, and Side 3 was used for cutting soft materials. Both sides of the Neolithic triangular point were used for cutting of soft and hard materials. Sides 2 and 3 of the microblades were largely used for scraping of soft materials, although number 39-7 Side 3 was used for cutting soft and hard materials.

TABLE 7. FUNCTIONAL DETERMINATIONS FOR UNIFACIAL ARTIFACTS FOR SIDE 2.

NO=Number; Type: TRAR=Transverse Arrowhead, TNGPT=Tanged Point, TRIPT=Triangular Point, MCRBL=Microblade, FISH H=Fish Hook, BURIN=Burin or Burin Spall; SCRFRM=Scarform: F=Feather, H=Hinge; RETEXT=Extension of Retouch: C=Continuous, D=Discontinuous; RETLOC=Location of Retouch: V=Ventral, D=Dorsal; All have edge angles less than 85 degrees.

NO.	TYPE	FORM	SCRFRM	RETEXT	RETLOC	FUNCTION	MATERIAL
37-1	TRAR	622	.	.	.		
37-2	TRAR	131	0	D	V+D	CUTTING	
37-3	TRAR	313	0	D	EDGE		
37-4	TRAR	212	0	D	V+D	CUTTING	
37-5	TRAR	222	0	D	EDGE		
37-6	TRAR	212	0	D	EDGE		
37-7	TRAR	223	.	.	.		
37-8	TRAR	222	0	D	EDGE		
37-9	TRAR	333	0	D	EDGE		
37-10	TRAR	313	0	D	EDGE		
37-11	TRAR	122	0	D	EDGE		
37-12	TRAR	222	0	D	MIDDLE		
37-13	TRAR	312	0	D	EDGE		
38-1	TNGPT	321	F + H	C	V+D	CUTTING	SOFT AND HARD
38-2	TNGPT	333	F	D	V+D	CUTTING	SOFT
38-3	TNGPT	111	F + H	D	D	SCRAPING	SOFT AND HARD
38-4	TNGPT	211	F	D	V+D	CUTTING	SOFT
38-5	TRIPT	141	0	D	EDGE		
38-6	TNGPT	111	F	D	EDGE		SOFT
38-7	BURIN	777	F + H	C	V+D	CUTTING	SOFT AND HARD
39-1	MCRBL	141	F	D	D	SCRAPING	SOFT
39-2	MCRBL	147	F	C	D	SCRAPING	SOFT
39-3	MCRBL	111	F	D	EDGE		SOFT
39-4	TRIPT	222	F + H	D	V+D	CUTTING	SOFT AND HARD
39-5	FISH H	116	0	D	EDGE		
39-6	FISH H	336	F + H	C	EDGE		SOFT AND HARD
39-7	MCRBL	232	.	.	.		
39-8	MCRBL	213	0	C	EDGE		
39-9	BURIN	223	F + H	D	D	SCRAPING	SOFT AND HARD

TABLE 8. FUNCTIONAL DETERMINATIONS FOR UNIFACIAL ARTIFACTS FOR SIDE 3.

NO=Number; Type: TRAR=Transverse Arrowhead, TNGPT=Tanged Point, TRIPT=Triangular Point, MCRBL=Microblade, FISH H=Fish Hook, BURIN=Burin or Burin Spall; SCRFRM=Scarform: F=Feather, H=Hinge; RETEXT=Extension of Retouch: C=Continuous, D=Discontinuous; RELOC=Location of Retouch: V=Ventral, D=Dorsal; All have edge angles less than 85 degrees.

NO.	TYPE	FORM	SCRFRM	RETEXT	RETLOC	FUNCTION	MATERIAL
37-1	TRAR	222	.	.	.		
37-2	TRAR	111	.	.	.		
37-3	TRAR	111	0	D	V+D	CUTTING	
37-4	TRAR	111	0	D	EDGE		
37-5	TRAR	222	0	D	EDGE		
37-6	TRAR	222	.	.	.		
37-7	TRAR	622	.	.	.		
37-8	TRAR	222	0	D	EDGE		
37-9	TRAR	632	.	.	.		
37-10	TRAR	222	.	.	.		
37-11	TRAR	222	0	D	EDGE		
37-12	TRAR	612	0	D	MIDDLE		
37-13	TRAR	222	0	D	EDGE		
38-1	TNGPT	123	F + H	C	V+D	CUTTING	SOFT AND HARD
38-2	TNGPT	333	F	D	V+D	CUTTING	SOFT
38-3	TNGPT	111	F + H	C	D	SCRAPING	SOFT AND HARD
38-4	TNGPT	121	F	D	V+D	CUTTING	SOFT
38-5	TRIPT	114	0	D	EDGE		
38-6	TNGPT	111	F	D	EDGE		SOFT
38-7	BURIN	222	F + H	D	V+D	CUTTING	SOFT AND HARD
39-1	MCRBL	141	F	D	D	SCRAPING	SOFT
39-2	MCRBL	146	F	D	D	SCRAPING	SOFT
39-3	MCRBL	111	F	D	EDGE		SOFT
39-4	TRIPT	111	F + H	D	V+D	CUTTING	SOFT AND HARD
39-5	FISH H	114	0	D	EDGE		
39-6	FISH H	712	0	C	EDGE		
39-7	MCRBL	167	F + H.	D	V+D	CUTTING	SOFT AND HARD
39-8	MCRBL	136	F + H	D	EDGE		SOFT AND HARD
39-9	BURIN	722	F	C	V+D	CUTTING	SOFT

With respect to stylistic interpretations, transverse arrowheads contain very little evidence of style, especially style as viewed by Wiessner (1983;). There is considerable isochrestic variation evident, along the lines of Sackett (1986a). This is true, also, for the other Unifacial artifacts. Most of these tools would have been manufactured very quickly, and then discarded after relatively little use.

CHAPTER IV

BIFACIAL ARTIFACTS

Bifacial Artifacts are two sided, with flake removal on both sides. There are twenty-eight (28) artifacts classified as bifaces that are used in this analysis. These include sixteen daggers, numbers 45-11, 12, 13, 14, 17, 18, 19, 20, 22, 23, 24, 26, 27, 30, 51-200, and one unknown; five points, nos. 45-21, 25, 28, 29, and 32; four sickles, nos. 45-15, 16, 33, and 34; two stemmed scrapers, nos. 45-5 and 36; and one knife, no. 45-31.

STATISTICAL ANALYSIS

The following are the statistical results for Bifacial artifacts. These include Identifying Characteristics, Metric Variables, Indexes, Base Angles, Surface Features, and Retouch Variables. Histograms, for Bifacial Artifacts, of the Metric Variables, Indexes, Base Angles, and Retouch Length, are in Appendix B.

Set A Variables

Identifying Characteristics

The Identifying Characteristics are listed in Table 9. All of the artifacts in the Bifacial group are made of fine-grained flint. The Primary Color is predominantly in around 10YR7/2 or 5/1 range, with many also around the 2.5Y6/2 or 4/0 range. Secondary colors are around 10YR3/1. All of the Bifacial artifacts appear complete.

TABLE 9. IDENTIFYING CHARACTERISTICS FOR BIFACIAL ARTIFACTS.

Class: LANC=Lanceolate, DAG=Dagger, PL=Point/Lanceolate, STSCR=Stemmed Scraper. TYPE: SAW-ED=Saw-Edged, CRESC=Crescent. PER=Period, LP=Late Palaeolithic, TM=Terminal Mesolithic, LN=Late Neolithic. RM=Raw Material, F=Fine Grained. COL1=Primary Color. COL2=Secondary Color. PRT=Part. CIT=Citation, from Mathiassen 1948 And Callahan 1985. See Qualitative Analysis Section Below For Specific Reference.

NO.	CLASS	TYPE	PER	RM	COL1	COL2	PART	CIT
11	LANC	II	LN	F	10YR4/1		4	II
12	LANC	I	LN	F	10YR3/2	10YR4/3	4	I
13	LANC	I	LN	F	2.5Y3/0		4	I
14	LANC	I	LN	F	10YR6/1		4	IC
17	DAG	III	LN	F	10YR3/1		4	IIIA
18	DAG	IV	LN	F	10YR5/1		4	IVE
19	DAG	III	LN	F	10YR7/2		4	IIIE
20	DAG	V	EBA	F	2.5Y4/0		4	V
21	DAG	II	LN	F	2.5Y5/2		4	II
22	LANC	I	LN	F	5Y4/2	10YR3/1	4	I
23	PL	II	LN	F	2.5YR4/0		4	II
24	LANC	I	LN	F	2.5Y5/4		4	IB
25	PL	II	LN	F	5Y4/2	2.5Y3/2	4	II
26	PL	I	LN	F	2.5Y5/2	2.5Y3/2	4	I
27	DAG	II	LN	F	2.5Y6/4		4	IIB
28	PL	I	LN	F	10YR5/3	10YR7/2	4	I
29	PL	I	LN	F	10YR5/4	10YR2/1	4	I
30	LANC	II	LN	F	10YR5/1	10YR3/1	4	II
32	PL	II	LN	F	5Y3/1		4	II
200	LANC	I	LN	F	10YR3/1		4	IIIB
UNK	DAG	VI	EBA	F	5Y4/1		4	VIB
15	SICKLE	SAW-ED	LN	F	10YR3/1		4	589
16	SICKLE	CRESC	LN	F	2.5Y5/2	7.5YR3/0	4	594
33	SICKLE	SAW-ED	LN	F	5YR3/2		4	589
34	SICKLE	SAW-ED	LN	F	2.5Y6/2		4	588
5	STSCR	FLAKE	TM	F	10YR7/1		4	48.5
36	STSCR	FLAKE	TM	F	10YR7/1		4	48.5
31	KNIFE		LP?	F	2.5Y3/2		4	

Metric Variables

Table 10 presents the summary statistics for the Bifacial Artifact group. These include Metric Variables, Indexes, Base Angles, and Surface Features. Table 11 presents the coefficients of variation, skewness and kurtosis.

Variable.

LENGTH. The average for all bifacial artifacts is 13.874, with a variance of 10.402, and a standard deviation of 3.225. The median is 13.950, and the mode is 15.40. The coefficient of variation is 23.24 percent. The distribution of lengths is slightly negatively skewed (-0.246), and kurtosis (-0.236) is likewise slight and negative. There are no outliers or extremes.

WIDTH. The average for all bifacial artifacts is 3.375, with a variance of 1.645, and a standard deviation of 1.283. The median is 3.105, and there are multiple modes. The coefficient of variation is 38.01 percent. The distribution of widths are mildly positively skewed (2.640), and have a very strong positive degree of kurtosis (7.527). Two extreme cases are numbers 5 and 36, the two stemmed scrapers.

THICKNESS. The average for all bifacial artifacts is 1.145 , with a variance of 0.157, and a standard deviation of 0.396. The median is 1.055, and there are multiple modes. The coefficient of variation is 34.59 percent. The distribution of thicknesses is mildly positively skewed (1.388), and have a mild positive degree of kurtosis (1.829). Number 18 is an outlier, and number 19 is an extreme case. These are both daggers.

TABLE 10. SUMMARY STATISTICS FOR BIFACIAL ARTIFACTS, INCLUDING METRIC VARIABLES, INDEXES, BASE ANGLES, AND SURFACE FEATURES.

SD^2: variance, SD: Standard Deviation, SE: Standard Error of the Mean. MODE: MUL-MULTIPLE. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MEDIAN	MODE
LENGTH	13.87	10.40	3.23	0.61	13.950	15.40
WIDTH	3.38	1.65	1.28	0.24	3.105	MUL
THICKNESS	1.15	0.16	0.396	0.08	1.055	MUL
WEIGHT	52.99	633.08	25.16	4.76	46.800	MUL
LWINDEX	45.09	182.06	13.49	2.55	45.856	MUL
WTINDEX	31.18	95.15	9.76	1.84	31.189	MUL
LTINDEX	132.74	1976.43	44.46	8.40	149.694	MUL
RTBA	51.36	544.09	23.33	4.41	57.500	35
LTBA	133.79	973.88	31.21	5.898	136.500	135
CORTEX	7.21	1.73	1.32	0.249	7	7
DIRNEG	5.07	2.37	1.54	0.291	6	6
PLTKIND	5.61	9.14	3.02	0.571	5	9

TABLE 11. COEFFICIENTS OF VARIATION, SKEWNESS, AND KURTOSIS FOR BIFACIAL ARTIFACTS, INCLUDING METRIC VARIABLES, INDEXES, BASE ANGLES, AND SURFACE FEATURES.

CV: coefficient of variation, in percentages. See Chapter II for abbreviations for Variables.

VARIABLE	CV	SKEWNESS	KURTOSIS
LENGTH	23.24	-0.246	-0.236
WIDTH	38.01	2.640	7.527
THICKNESS	34.59	1.388	1.829
WEIGHT	47.49	1.553	3.931
LWINDEX	29.92	-1.027	1.926
WTINDEX	31.29	-0.026	-0.285
LTINDEX	33.49	-0.510	-0.888
RTBA	45.42	-0.418	0.122
LTBA	23.33	-1.213	4.342
CORTEX	18.23	-4.107	19.757
DIRNEG	30.33	-1.247	0.097
PLTKIND	53.91	-0.001	-1.723

WEIGHT. The average for all bifacial artifacts is 52.987, with a variance of 633.078, and a standard deviation of 25.161. The median is 46.800, and there are multiple modes. The coefficient of variation is 47.49 percent. The distribution of weights is mildly positively skewed (1.553), and there is a strong positive degree of kurtosis (3.931). The outlier, number 18, is a dagger.

Indexes

Index.

LENGTH/WIDTH INDEX. (LWINDEX). The average for bifacial artifacts is 45.090, with a variance of 182.060, and a standard deviation of 13.493. The median is 45.856, and there are multiple modes. The coefficient of variation is 29.92 percent. The distribution is mildly negatively skewed (-1.027), and there is mild positive kurtosis (1.926). The stemmed scrapers, numbers 5 and 36, are outliers.

WIDTH/THICKNESS INDEX. (WTINDEX). The average for bifacial artifacts is 31.1753, with a variance of 95.153, and a standard deviation of 9.755. The median is 31.189, and there are multiple modes. The coefficient of variation is 31.29 percent. The distribution is slightly negatively skewed (-0.026), and has a slight negative degree of kurtosis (-0.285). There are no outliers or extremes.

LENGTH/WIDTH INDEX. (LTINDEX). The average for bifacial artifacts is 132.7442, with a variance of 1976.433, and a standard deviation of 44.457. The median is 149.694, and there are multiple modes. The coefficient of variation is 33.49 percent. The distribution is slightly negatively skewed (-0.510), and there is a slight negative degree of kurtosis (-0.888). There are no outliers or extremes.

Base Angles

Base Angle.

RIGHT BASE ANGLE. (RTBA). The average for all bifacial artifacts is 51.357, with a variance of 544.090, and a standard deviation of 23.326. The median is 57.500, and the mode is 35.00. The coefficient of variation is 45.42 percent. The distribution is slightly negatively skewed (-0.418), and there is a slight positive degree of kurtosis (0.122). There are no outliers or extremes.

LEFT BASE ANGLE. (LTBA). The average for all bifacial artifacts is 133.7857, with a variance of 973.878, and a standard deviation of 31.207. The median is 136.500, and the mode is 135.00. The coefficient of variation is 23.33 percent. The distribution is mildly negatively skewed (-1.213), and has a strong positive degree of kurtosis (4.342). Number 12, a dagger, is an extreme, and number 20, a dagger, is an outlier.

Surface Features

Feature.

CORTEX. The average for all bifacial artifacts is 7.2143 , with a variance of 1.73, and a standard deviation of 1.315. The median is 7, and the modal code is 7. The coefficient of variation is 18.23 percent. The distribution is strongly negatively skewed (-4.107), and there is a very strongly positive degree of kurtosis (19.757). Number 31, the knife, is an extreme case.

The chi-square value is 11.6429, df=2, with a strong significance at 0.003. One, (3.6%), is coded 1, completely covered. Fifteen, (53.6%), are coded 7, no

cortex or patination present. Twelve (42.9%), are coded 8, less than 25% is covered.

DIRNEG. The average for all bifacial artifacts is 5.0714 , with a variance of 2.37, and a standard deviation of 1.538. The median is 6, and the modal code is 6. The coefficient of variation is 30.33 percent. The distribution is mildly negatively skewed (-1.247), and there is a very slight positive degree of kurtosis (0.097). There are no outliers or extremes.

The chi-square value is 20.2143, df=2, with a significance at 0.000. One, (3.6%), is coded 1, the scars are parallel to the length of the artifact. Seven, (25.0%), are coded 3, the scars are irregular. Twenty, (71.4%), are coded 6, the scars are oblique to the length and are bi-directional.

PLATFORM KIND. The average for all bifacial artifacts is 5.607, with a variance of 9.14, and a standard deviation of 3.023. The median is 5, and the modal code is 9. The coefficient of variation is 53.91 percent. The distribution is very slightly negatively skewed (-0.001), and there is a mild negative degree of kurtosis (-1.723). There are no outliers or extremes.

The chi-square value is 16.5, df=6, with a significance of 0.0113. Four, (14.3%), are coded 5, *Facetté convexe*, seven, (25.0%), are coded 3, *Dièdre*, and ten (35.7%) are coded 9. Two, (7.1%), artifacts are coded once for each of the following codes: code 2, *Formed*, and code 8, none of the above. One, (3.6%), artifact is coded 4, *Facetté*.

Set B Variables

Retouch Variables

Table 12 presents summary statistics for the Bifacial Retouch Variables. These include Form of Side, Edge Angle, Form of Retouch, Location of Retouch. Length of Retouch, Extension of Retouch, Direction of Retouch, and Scar Form. Table 13 presents the coefficients of variation, skewness and kurtosis. The histograms for Retouch Length are in Appendix B. The results are presented by Retouch Variable, by Side.

Form of Side.

FORM1. The average for all bifacial artifacts is 197.5, with a variance of 15045.91, and a standard deviation of 122.662. The median is 123, and the modal code is 111. The coefficient of variation is 62.11 percent. The distribution is mildly positively skewed (1.496), and there is a mild positive degree of kurtosis (1.067). Numbers 20, a dagger, and 21, a point, are outliers.

The chi-square value is 2.000, df=6, and is not significant at 0.9197. This statistic is questionable due to small frequencies. Three (25.0%) are coded 111. Two (16.7%) are coded 122. Two (16.7%) are coded 123. One 1 (8.3%) are coded 211. One (8.3%) are coded 222. One (8.3%) are coded 232. Two (16.7%) are coded 441. N=12, sixteen do not have a side 1, or could not be coded.

FORM2. The average for all bifacial artifact is 299.286, with a variance of 22905.69, and a standard deviation of 151.346. The median is 272, and the modal code

TABLE 12. RETOUCH VARIABLES FOR BIFACIAL ARTIFACTS, BY SIDE.

SD^2: Variance; SD: Standard Deviation, SE: Standard Error of the Mean.
MODE - MUL=Multiple Modes. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MEDIAN	MODE
FORM1	197.50	15045.91	122.66	35.419	123	111
FORM2	299.29	22905.69	151.25	28.60	272	421
FORM3	216.61	18401.51	135.65	25.64	211	111
FORM4	185.25	6075.84	77.95	22.50	177.5	111
EDANG1	5.23	2.36	1.54	0.426	6	6
EDANG2	4.36	0.534	0.73	0.138	4	4
EDANG3	4.48	0.644	0.80	0.154	5	5
EDANG4	5.25	1.93	1.39	0.348	5	6
RETFRM1	6.00	18	4.24	1.177	5	MUL
RETFRM2	3.50	6.185	2.49	0.470	2	2
RETFRM3	3.57	6.55	2.56	0.484	2	MUL
RETFRM4	5.85	18.97	4.36	1.208	5	MUL
RETLOC1	4.85	3.31	1.82	0.504	6	6
RETLOC2	6.50	5.15	2.27	0.429	6	6
RETLOC3	6.25	6.27	2.50	0.473	6	6
RETLOC4	6.39	4.76	2.18	0.605	6	6
RTLNGTH1	1.23	6.049	2.46	0.710	0.560	MUL
RTLNGTH2	1.02	2.477	1.57	0.297	0.755	0.900
RTLNGTH3	0.98	2.496	1.58	0.299	0.710	0.900
RTLNGTH4	1.35	5.865	2.42	0.699	0.760	0.900
RETEXT1	41.64	1078.06	32.83	9.90	29	MUL
RETEXT2	56.82	1165.23	34.14	6.57	80	80
RETEXT3	52.82	1224.08	34.99	6.73	80	80
RETEXT4	48.36	1065.06	32.64	9.84	30	MUL
RETDIR1	3.92	68.99	8.31	2.398	1	1
RETDIR2	2.82	4.75	2.18	0.41	1	1
RETDIR3	2.82	4.75	2.18	0.41	1	1
RETDIR4	3.75	69.66	8.36	2.41	1	1
SCRFMR1	14.83	188.52	13.73	3.96	14.5	MUL
SCRFRM2	27.82	543.16	23.316	4.49	23	32
SCRFRM3	29.78	488.87	22.11	4.26	32	32
SCRFRM4	15.09	170.49	13.06	3.94	23	23

TABLE 13. COEFFICIENTS OF VARIATION, SKEWNESS, AND KURTOSIS OF RETOUCH VARIABLES FOR BIFACIAL ARTIFACTS, BY SIDE.

CV: coefficient of variation. See Chapter II for abbreviations for Variables.

VARIABLE	CV	SKEWNESS	KURTOSIS
FORM1	62.11	1.496	1.067
FORM2	50.54	0.347	-0.784
FORM3	62.63	2.124	5.622
FORM4	42.08	0.727	-0.636
EDANG1	29.36	-0.456	-1.267
EDANG2	16.78	0.538	0.359
EDANG3	17.897	-0.176	-0.283
EDANG4	26.48	-0.510	-0.802
RETFRM1	70.72	0.758	-0.710
RETFRM2	71.06	0.638	-1.166
RETFRM3	71.66	0.503	-1.397
RETFRM4	74.51	0.759	-0.802
RETLOC1	37.54	-1.009	-1.099
RETLOC2	34.91	1.496	4.547
RETLOC3	40.06	1.097	3.064
RETLOC4	34.16	2.377	8.547
RTLNGTH1	199.27	3.395	11.653
RTLNGTH2	155.07	5.194	27.298
RTLNGTH3	161.22	5.204	27.365
RTLNGTH4	180.07	3.407	11.715
RETEXT1	78.86	0.352	-1.800
RETEXT2	60.08	-0.790	-1.443
RETEXT3	66.24	-0.544	-1.747
RETEXT4	67.48	-0.055	-1.964
RETDIR1	212.05	3.336	11.311
RETDIR2	77.21	0.547	-1.536
RETDIR3	77.21	0.547	-1.536
RETDIR4	222.56	3.355	11.404
SCRFMR1	92.56	0.153	-2.026
SCRFRM2	83.79	3.463	16.305
SCRFRM3	74.25	3.900	19.064
SCRFRM4	86.52	-0.030	-1.956

is 421. The coefficient of variation is 50.54 percent. The distribution is slightly positively skewed (0.347), and there is a slight negative degree of kurtosis (-0.784). Number 17, and the unknown dagger are outliers.

The chi-square value is 11.000, df=12, and is not significant at 0.5289. This statistic is questionable due to small sample size. Four, (14.3%), are coded 111. Three, (10.7%), are coded 121. Two, (7.1%), are coded 211. One, (3.6%), is coded 212. Two, (7.1%), are coded 222. One, (3.6%), is coded 226. One, (3.6%), is coded 233. One, (3.6%), is coded 311. One, (3.6%), is coded 323. Four, (14.3%), are coded 411. Five, (17.9%), are coded 421. One, (3.6%), is coded 431. Two, (7.1%), are coded 611. N=28.

FORM3. The average for all bifacial artifacts is 216.607, with a variance of 18401.51, and a standard deviation of 135.652. The median is 211, and the modal code is 111. The coefficient of variation is 62.63 percent. The distribution is mildly positively skewed (2.124), and there is a strong positive degree of kurtosis (5.622). There are no outliers or extremes.

The chi-square value is 19.3571, df=12, and is significant at 0.0803. This statistic may be questionable due to small sample size. Six (21.4%) are coded 111. One (3.6%) is coded 116. Five (17.9%) are coded 121. Five (17.9%) are coded 211. Two (7.1%) are coded 221. Two (7.1%) are coded 222. One (3.6%) is coded for each of 226, 233, 323, 411, 412, 421, and 711. N= 28.

FORM4. The average for bifacial artifacts is 186.250, with a variance of 6075.84, and a standard deviation of 77.948. The median 177.5, and the modal code is 111. The coefficient of variation is 42.08 percent. The distribution is slightly positively

skewed (0.727), and there is a slight negative degree of kurtosis (-0.636). There are no outliers or extremes.

The chi-square value is 3.000, df=8, and is not significant at 0.9344. Three, (25.0%), are coded 111. One, (8.3%), is coded 116. One, (8.3%), is coded 132. One, (8.3%), is coded 144. One, (8.3%), is coded 211. One, (8.3%), is coded 214. One, (8.3%), is coded 221. One, (8.3%), is coded 222. Two, (16.7%), are coded 321. N=12, sixteen have no side 4, or could not be coded.

Edge Angles.

EDANG1. The average for bifacial artifacts is 5.231, with a variance of 2.36, and a standard deviation of 1.536. The median is 6, and the modal code is 6. The coefficient of variation is 29.36 percent. The distribution is slightly negatively skewed (-0.456), and there is a mild negative degree of kurtosis (-1.267). There are no outliers or extremes.

The chi-square value is 2.000, df=4, is not significant at 0.7358. The chi-square statistic is questionable due to the small sample size. Three, (23.1%), are coded 3, between 20 and 30 degrees. One, (7.7%), is coded 4, between 30 and 50 degrees. Two, (15.4%), are coded 5, between 50 and 70 degrees. Four, (30.8%), are coded 6, between 70 and 85 degrees. Three, (23.1%), are coded 7, greater than 85 degrees. N=13, fifteen have no side 1, or could not be coded.

EDANG2. The average for bifacial artifacts is 4.357, with a variance of 0.534, and a standard deviation of 0.731. The median is 4, and the modal code is 4. The coefficient of variation is 16.78 percent. The distribution is slightly positively

skewed (0.538), and a slight positive degree of kurtosis (0.359). There are no outliers or extremes.

The chi-square value is 18.8571, df=3, and is significant at 0.003. Two, (7.1%), are coded 3, between 20 and 30 degrees. Sixteen, (57.1%), are coded 4, between 30 and 50 degrees. Eight, (28.6%), are coded 5, between 50 and 70 degrees. Two, (7.1%), are coded 6, between 70 and 85 degrees. N=28.

EDANG3. The average for bifacial artifacts is 4.481, with a variance of 0.644, and a standard deviation of 0.802. The median is 5, and the modal code is 5. The coefficient of variation is 17.897 percent. The distribution is slightly negatively skewed (-0.176), and there is a slight negative degree of kurtosis (-0.283). There are no outliers or extremes.

The chi-square value is 11.0741, df=3, and is significant at 0.0113. Three, (11.1%), are coded 3, between 20 and 30. Ten, (37.0%), are coded 4, between 30 and 50 degrees. Twelve, (44.4%), are coded 5, between 50 and 70 degrees. Two, (7.4%), are coded 6, between 70 and 85 degrees. N=27, one is not coded.

EDANG4. The average for bifacial artifacts is 5.250, with a variance of 1.93, and a standard deviation of 1.390. The median is 5, and the modal code is 6. The coefficient of variation is 26.48 percent. The distribution is slightly negatively skewed (-0.510), and there is a slight negative degree of kurtosis (-0.802). There are no outliers or extremes.

The chi-square value is 2.7500, df=4, and is not significant at 0.6005. The chi-square statistic is questionable due to the small sample size. Three, (18.8%), are coded 3 between 20 and 30 degrees. One, (6.3%), is coded 4, between 30

and 50 degrees. Four, (25.0%), are coded 5, between 50 and 70 degrees. Five, (31.3%), are coded 6, between 70 and 85 degrees. Three, (18.8%), are coded 7, greater than 85 degrees. N=16, twelve are not coded or there is no side 4.

Retouch Form.

RETFRM1. The average for bifacial artifacts is 6.000, with a variance of 18.0, and a standard deviation of 4.243. The median is 5, and there are multiple modal codes. The coefficient of variation is 70.72 percent. The distribution is slightly positively skewed (0.758), and there is a slight negative degree of kurtosis (-0.710). There are no outliers or extremes.

The chi-square value is 1.1538, df=7, and is not significant at 0.9920. The chi-square statistic is questionable due to the small sample size. Two, (15.4%), are coded 1, *retouche sommaire.* Two, (15.4%), are coded 3, *retouche scaliforme.* Two, (15.4%), are coded 4, rounding of edge due to polishing or grinding. Two, (15.4%), are coded 5, scarring of *retouche scaliforme* and minute nibbling. One, (7.7%), is coded 6, irregular. One, (7.7%), is coded 8, irregular edge and fracturing. One, (7.7%), is coded 12, edges have pinched appearance. Two, (15.4%), are coded 13, scarring creates triangular formation. N=13, fifteen are not coded.

RETFRM2. The average for all bifacial artifacts is 3.500, with a variance of 6.185, and a standard deviation of 2.487. The median is 2, and the modal code is 2. The coefficient of variation is 71.06 percent. The distribution is slightly positively skewed (0.638), and the is a mild negative degree of kurtosis (-1.166). Numbers 5, 36, stemmed scrapers, and 17, a dagger, are extremes.

The chi-square value is 4.1429, df=4, and is not significance at 0.3870. Seven, (25.0%), are coded 1, *retouche sommaire*. Eight, (28.6%), are coded 2, *retouche laminaire*. Three, (10.7%), are coded 3, *retouche scaliforme*. Seven, (25.0%), are coded 6, irregular. Three, (10.7%), are coded 8, irregular edge and fracturing. N=28.

RETFRM3. The average for all bifacial artifacts is 3.571, with a variance of 6.55, and a standard deviation of 2.559. The median is 2, and there are several modal codes. The Coefficent of Variation is 71.66 percent. The distribution is slightly positively skewed (0.503), and there is a mild negative degree of kurtosis (-1.397). Numbers 5, 36, stemmed scrapers, and 17, a dagger, are outliers.

The chi-square value is 5.9286, df=4, and is not significant at 0.2045. Eight, (28.6%), are coded 1, *retouche sommaire*. Seven, (25.0%), are coded 2, *retouche laminaire*. Two, (7.1%), are coded 3, *retouche scaliforme*. Eight, (28.6%) are coded 6, irregular. Three, (10.7%), are coded 8, irregular edge and fracturing. N=28.

RETFRM4. The average for bifacial artifacts is 5.846, with a variance of 18.97, and a standard deviation of 4.356. The median is 5, and there are several modal codes. The Coefficent of Variation is 74.51 percent. The distribution is slightly positively skewed (0.759), and there is a slight negative degree of kurtosis (-0.802). There are no outliers or extremes.

The chi-square value is 1.5385, df=8, and is not significant at 0.9921. This statistic may be questionable due to a small sample size. Two, (15.4%), are coded 1, *retouche sommaire*. One, (7.7%), is coded 2, *retouche laminaire*. Two, (15.4%), are coded 3, *retouche scaliforme*. One, (7.7%), is coded 4,

rounding of edge due to polishing or grinding. Two, (15.4%), are coded 5, scarring of *retouche scaliforme* and minute nibbling. One, (7.7%), is coded 6, irregular. One, (7.7%), is coded 8, irregular edge and fracturing. One, (7.7%), is coded 12, edges have pinched appearance. Two, (15.4%), are coded 13, scarring creates triangular formation. N=13, fifteen are not coded.

Retouch Location.

RETLOC1. The average for bifacial artifacts is 4.846, with a variance of 3.31, and a standard deviation of 1.819. The median is 6, and the modal code is 6. The coefficient of variation is 37.54 percent. The distribution is mildly negatively skewed (-1.009), and there is a mild negative degree of kurtosis (-1.099). There are no outliers or extremes.

The chi-square value of 8.0000, df=2, is significant at 0.0183. The chi-square statistic is questionable due to the small sample size. Three, (23.1%), are coded 2, on ventral surface. One, (7.7%), is coded 3, on first part of ventral surface and on second part of dorsal surface. Nine, (69.2%), are coded 6, on dorsal and ventral surfaces. N=13, fifteen were not coded.

RETLOC2. The average for bifacial artifacts is 6.500, with a variance of 5.15, and a standard deviation of 2.269. The median is 6, and the modal code is 6. The coefficient of variation is 34.91 percent. The distribution is mildly positively skewed (1.496), and there is a strong positive degree of kurtosis (4.547). Numbers 18, dagger, 36, a stemmed scraper, and 31, the knife, are extremes.

The chi-square value of 55.1429, df=3, is significant at 0.0000. One, (3.6%), is coded 1, on dorsal surface. Twenty-four (85.7%) are coded 6, on dorsal and ventral surfaces. Two (7.1%), are coded 12, on dorsal surface first,

then on both dorsal and ventral surfaces. One (3.6%) is coded 13, first on ventral surface, then on both dorsal and ventral surfaces. N=28.

RETLOC3. The average for all bifacial artifacts is 6.250, with a variance of 6.27, and a standard deviation of 2.504. The median is 6, and the modal code is 6. The coefficient of variation is 40.06 percent. The distribution is mildly positively skewed (1.097), and there is a strong positive degree of kurtosis (3.064). Numbers 18, dagger, the unknown dagger, 17, dagger, 36, stemmed scraper, and 31, the knife, are extremes.

The chi-square value of 77.4286, df=5, is significant at 0.0000. This statistic may be questionable due to small sample size. One, (3.6%), is coded 1, on dorsal surface. One, (3.6%), is coded 2, on ventral surface. One, (3.6%), is coded 3, on first part of ventral surface and on second part of dorsal surface. Twenty-two, (78.6%), are coded 6, on dorsal and ventral surfaces. Two, (7.1%), are coded 12, on dorsal surface first, then on both dorsal and ventral surfaces. One, (3.6%), is coded 13, first on ventral surface, then on both dorsal and ventral surfaces. N=28.

RETLOC4. The average for bifacial artifacts is 6.385, with a variance of 4.76, and a standard deviation of 2.181. The median is 6, and the modal code is 6. The coefficient of variation is 34.16 percent. The distribution is mildly positively skewed (2.377), and there is a strong positive degree of kurtosis (8.547). Numbers 31, the knife, 19, dagger, and 36, stemmed scraper, are extremes.

The chi-square value of 18.6923, df=3,, is significant at 0.0003. The chi-square statistic is questionable due to the small sample size. One, (7.7%), is coded 3, on first part of ventral surface and on second part of dorsal surface.

Ten, (76.9%), are coded 6, on dorsal and ventral surfaces. One, (7.7%), is coded 7, first on dorsal surface, then on ventral, then on dorsal. One, (7.7%), is coded 13, first on ventral surface, then on both dorsal and ventral surfaces. N=13, fifteen are not coded.

Retouch Length.

RTLNGTH1. The average for bifacial artifacts is 1.234, with a variance of 6.049, and a standard deviation of 2.459. The median is 0.560, and there are multiple modes. The coefficient of variation is 199.27 percent. The distribution is strongly positively skewed (3.395), and there is a very strong positive degree of kurtosis (11.653). Number 5, a stemmed scraper, is an extreme.

RTLNGTH2. The average for bifacial artifacts is 1.015, with a variance of 2.477, and a standard deviation of 1.574. The median is 0.755, and the mode is 0.900. The coefficient of variation is 155.07 percent. The distribution is strongly positively skewed (5.194), and there is a very strong positive degree of kurtosis (27.298). Number 18, a dagger, is an extreme.

RTLNGTH3. The average for bifacial artifacts is 0.980, with a variance of 2.496, and a standard deviation of 1.580. The median is 0.710, and the mode is 0.900. The coefficient of variation is 161.22 percent. The distribution is strongly positively skewed (5.204), and there is a very strong positive degree of kurtosis (27.365). Number 18, a dagger, is an extreme.

RTLNGTH4. The average for bifacial artifacts is 1.345, with a variance of 5.865, and a standard deviation of 2.422. The median is 0.760, and the mode is 0.900. The coefficient of variation is 180.07 percent. The distribution is strongly positively

skewed (3.407), and there is a very strong positive degree of kurtosis (11.715). Number 5, a stemmed scraper, is an extreme.

Extension of Retouch.

RETEXT1. The average for bifacial artifacts is 41.636, with a variance of 1078.06, and a standard deviation of 32.834. The median is 29, and there are multiple modal codes. The coefficient of variation is 78.86 percent. The distribution is slightly positively skewed (0.352), and there is a mild negative degree of kurtosis (-1.800). There are no outliers or extremes.

The chi-square value is 1.3636, df=7, is not significant at 0.9867. The chi-square statistic is questionable due to the small sample size. One (9.1%) are for each code of the following: 10, discontinuous retouch on the middle of the surface, 29, nibbling on the whole edge, 30, saw-like edge, 80, continuous retouch on the whole edge, and 81, discontinuous retouch on the whole edge. Two (18.2%) are for each code of the following: 4, continuous retouch on the middle and last part of the edge, 28, nibbling on the whole edge, and 82, denticulated, round topped, continuous retouch on the whole edge. N=11, seventeen are not coded.

RETEXT2. The average for bifacial artifacts is 56.815, with a variance of 1165.23, and a standard deviation of 34.136. The median is 80, and the modal code is 80. The coefficient of variation is 60.08 percent. The distribution is slightly negatively skewed (-0.790), and there is a mild negative degree of kurtosis (-1.443). There are no outliers or extremes.

The chi-square value is 30.7778, df=7, and is significant at 0.0001. The chi-square statistic is questionable due to the small sample size. One, (3.7%), is

coded 2, continuous retouch on the first and middle part of the edge. One, (3.7%), is coded 6, continuous retouch on the first and last parts of the edge. Two, (7.4%), are coded 7, discontinuous retouch on the middle and last part of the edge. Two, (7.4%), are coded 9, discontinuous retouch on the first and middle part of the edge. Two, (7.4%), are coded 10, discontinuous retouch on the middle part. One, (3.7%), is coded 28, nibbling on the whole edge. Twelve, (44.4%), are coded 80, continuous retouch along the whole edge. Six, (22.2%), are coded 81, discontinuous retouch along the whole edge. N=27, one case is not coded.

RETEXT3. The average for bifacial artifacts is 52.815, with a variance of 1224.08, and a standard deviation of 34.987. The median is 80, and the modal code is 80. The coefficient of variation 66.24 percent. The distribution is slightly negatively skewed (-0.544), and there is a mild negative degree of kurtosis (-1.747). There are no outliers or extremes.

The chi-square value is 30.4074 , df=9, and is significant at 0.0004. The chi-square statistic is questionable due to the small sample size. One, (3.7%), is coded 2, continuous retouch on the first and middle parts. One, (3.7%), is coded 3, continuous retouch on the middle part. One, (3.7%), is coded 6, continuous retouch on the first and last part. Two, (7.4%), are coded 7, discontinuous retouch on the middle and last part. Three, (11.1%), are coded 9, discontinuous retouche on the first and middle parts. One, (3.7%), is coded 10, discontinuous retouch on the middle part. One, (3.7%), is coded 28, nibbling along the whole edge. One, (3.7%), is coded 30. Ten, (37.0%), are

coded 80, continuous retouch along the whole edge. Six, (22.2%), are coded 81, discontinuous retouch along the whole edge. N=27, one is not coded.

RETEXT4. The average for bifacial artifacts is 48.364, with a variance of 1065.06, and a standard deviation of 32.635. The median is 30, and there are several modal codes. The coefficient of variation is 67.48 percent. The distribution is very slightly negatively skewed (-0.055), and there is a mild negative degree of kurtosis (-1.964). There are no outliers or extremes.

The chi-square value is 1.3636, df=7, and is not significant at 0.9867. The chi-square statistic is questionable due to the small sample size. One (9.1%) for each code of the following: 1, continuous retouch on the first part of the edge, 10, discontinuous retouch on the middle part of the edge, 29, strong nibbling, eventually with notches, along the whole edge, 30, saw-like edge along the whole edge, and 80, continuous retouch along the whole edge. There are two (18.2%) for each code of the following: 28, nibbling along the whole edge, 81, discontinuous retouch along the whole edge, and 82, denticulated, round topped, continuous retouch along the whole edge. N=11, seventeen artifacts are not coded.

Direction of Retouch.

RETDIR1. The average for bifacial artifacts is 3.917, with a variance of 68.99, and a standard deviation of 8.306. The median is 1, and the modal code is 1. The coefficient of variation is 212.05 percent. The distribution is strongly positively skewed (3.336), and there is a very strong positive degree of kurtosis (11.311). Numbers 16 and 15, sickles, are extremes.

The chi-square value is 16.0000, df=3, with a significance at 0.0011. Nine (75.0%) are coded 1, perpendicular to the edge. One (8.3%) is coded for each of the following codes: 3, toward the basal end, 5, decentralizing. N=12, sixteen cases were not coded.

RETDIR2. The average for bifacial artifacts is 2.821, with a variance of 4.75, and a standard deviation of 2.178. The median is 1, and the modal code is 1. The coefficient of variation is 77.21 percent. The distribution is slightly positively skewed (0.547), and there is a mild negative degree of kurtosis (-1.536). There are no outliers or extremes.

The chi-square value is 14.8571, df=3, is significant at 0.0019. Fifteen, (53.6%), are coded 1, perpendicular to the edge. One, (3.6%), is coded 2, towards the distal end. Five, (17.9%), are coded 4, retouch is centralizing. Seven, (25.0%), are coded 6, irregular. One, (3.6%), is coded 30. N=28.

RETDIR3. The average for bifacial artifacts is 2.821, with a variance of 4.75, and a standard deviation of 2.178. The median is 1, and the modal code is 1. The coefficient of variation is 77.21. The distribution is slightly positively skewed (0.547), and there is a mild negative degree of kurtosis (-1.536). There are no outliers or extremes.

The chi-square value of 14.8571, df=3, is significant at 0.0019. Fifteen, (53.6%), are coded 1, direction of retouch is perpendicular to the edge. One, (3.6%), is coded 2, towards the distal end. Five, (17.9%), are coded 4, centralizing. Seven, (25.0%), are coded 6, irregular. N=28.

RETDIR4. The average for bifacial artifacts is 3.750, with a variance of 69.66, and a standard deviation of 8.346. The median is 1, and the modal code is 1. The

coefficient of variation is 222.56 percent. The distribution is strongly positively skewed (3.355), and there is a very strong positive degree of kurtosis (11.404). Numbers 16 and 15, both sickles, are extremes.

The chi-square value is 13.5000, df=2, and is significant at 0.0012. The chi-square statistic is questionable due to the small sample size. Ten, (83.3%), were coded 1, perpendicular. One, (8.3%), was coded 5, decentralizing. One (8.3%), was coded 30. N=12, sixteen cases were not coded.

Scar Form.

SCRFRM1. The average for bifacial artifacts is 14.833, with a variance of 188.52, and a standard deviation of 13.730. The median is 14.5, and there are multiple modal codes. The coefficient of variation is 92.56 percent. The distribution is very slightly positively skewed (0.153), and there is a mild negative degree of kurtosis (-2.026). There are no outliers or extremes.

The chi-square value is 2.0000, df=5, and is not significant at 0.8491. The chi-square statistic is questionable due to the small sample size. Two, (16.7%) are coded 0, other. One, (8.3%) is coded 1, product of a fracture. Two, (16.7%) are coded 3, hinged. One, (8.3%) is coded 6, irregular. Three, (25.0%) are coded 23, feathered and hinged. Three, (25.0%), are coded 32, hinged and feathered. N=12, sixteen cases were not coded.

SCRFRM2. The average for bifacial artifacts is 27.815, with a variance of 543.16, and a standard deviation of 23.306. The median is 23, and the modal code is 32. The coefficient of variation is 83.79 percent. The distribution is strongly positively skewed (3.463), and there is a very strong positive degree of kurtosis (16.305). Number 19, dagger, is an outlier.

The chi-square of 28.7778, df=5, is significant at 0.0000. The chi-square statistic is questionable due to the small sample size. One, (3.7%), was coded 0, other. One, (3.7%), was coded 1, product of a fracture. Two, (7.4%), were coded 2, feathered. Ten, (37.0%), were coded 23, feathered and hinged. Twelve, (44.4%), were coded 32, hinged and feathered. One, (3.7%), was coded 132, fracture, hinged and feathered. N=27, one case was not coded.

SCRFRM3. The average for bifacial artifacts is 29.778, with a variance of 488.87, and a standard deviation of 22.110. The median is 32, and the modal code is 32. The coefficient of variation is 74.25 percent. The distribution is strongly positively skewed (3.900), and there is a very strong positive degree of kurtosis (19.064). There are no outliers or extremes.

The chi-square value of 33.6667, df=5, is significant at 0.0000. The chi-square statistic is questionable due to the small sample size. One, (3.7%), is coded 0, other. One, (3.7%), is coded 1, product of a fracture. Ten, (37.0%), are coded 23, feathered and hinged. One, (3.7%), is coded 25, feathered and absent. Thirteen, (48.1%), are coded 32, hinged and feathered. One, (3.7%), is coded 132, fracture, hinged, and feathered. N=27, one was not coded.

SCRFRM4. The average for bifacial artifacts is 15.091, with a variance of 170.49, and a standard deviation of 13.057. The median is 23, and the modal code is 23. The coefficient of variation is 86.52 percent. The distribution is very slightly negatively skewed (-0.030), and there is a mild negative degree of kurtosis (-1.956). There are no outliers or extremes.

The chi-square value of 3.7273, df=5, is not significant at 0.5893. The chi-square statistic is questionable due to the small sample size. Two, (18.2%), are coded 0, other. One, (9.1%), is coded 1, fracture. One, (9.1%), is coded 3, hinged. One, (9.1%), is coded 6, scalloped. Four, (36.4%), are coded 23, feathered and hinged. Two, (18.2%), are coded 32, hinged and feathered. N=11, seventeen were not coded.

DESCRIPTIVE ANALYSIS

Descriptions of Bifacial Artifacts

Daggers and Points

Danish flint daggers are important artifacts for chronological studies of the Late Neolithic, as well as studies related to influences from outside Denmark. They replaced battle axeheads as the consistent and main burial good (Vandkilde 1993:147), and hoard item (Ebbesen 1993:125). Since Denmark does not have the raw material resources for bronze (copper and tin), the manufacture of bronze items was begun much later in Denmark than other areas. Eventually, Denmark became an important source of amber. The Late Neolithic and Bronze Age peoples were then able to trade amber and other items, so that they could make bronze daggers and other items. Until then, they modeled flint and other stone tools after copper and bronze equivalents (Clarke et al 1985; Glob 1952; Jensen 1982; Midgley 1992).

In Denmark, the earlier forms of daggers, called lanceolate daggers, were modeled after copper counterparts (Green et al 1982). The later forms, called fishtail

daggers, were modeled after bronze counterparts (Vandkilde 1993:147). During the Late Neolithic I and II, some axes and daggers of copper were imported from western and central Europe. These metal artifacts were made predominately of copper, with some impurities. They were models for flint and ground-stone artifacts. During Late Neolithic I, northern Jutland was the location of production and distribution of lanceolate flint daggers, which were modeled after copper daggers of the western European Bell-Beaker Culture. Because of this modeling, or mimicry, the sociological and ideological meaning of the flint daggers may have been the same as their copper and bronze counterparts (Vandkilde 1993:147).

There are six general types of daggers (Flemming Kaul, personal communication). The first four types belong to the Late Neolithic, and the last two belong to the Nordic Early Bronze Age. Type I daggers includes lanceolates with the handles equal to the thickness of the blades (Lomborg 1973; Becker 1951; Flemming Kaul, personal communication). Handles of Type II daggers are thicker than the blade (see Becker 1951:150, Figure 14). The Type III handles have nearly parallel sides, and have a square cross-section, since they are about as thick as they are wide. Type IV daggers are called "fishtail" daggers, since the handles flair out at the base, or hilt. The cross-section is a flat triangle. The Type V daggers also have the flairs, but the cross-section of the handle is much flatter, an oval shape. Also, the handle widens towards the blade of the dagger. For Type VI daggers, the handle does not widen toward the blade, but stays narrow. The handle is nearly as flat as the blade. Since it is difficult to distinguish lanceolate points from lanceolate daggers, and the distinction itself is unclear in the literature, most lanceolate forms are classified as "Dagger/Point".

At the time of the manufacture of the flint daggers, Denmark's expertise in flintworking was impressive. The technique used is called "flat-flaked", and was used for daggers, sickles (see Numbers 15, 16, 33, 34, this chapter), and triangular points (see number 39-4, Chapter III). This method began in the Late Neolithic in Denmark (Liversage and Singh 1985).

Once a blank was formed, the dagger was ground into shape (Bordaz 1970; Becker 1951). Next, flakes were removed from prepared platforms (Bordaz 1970:108, Figures 53 and 54). The daggers, at least the early lanceolate ones, were then sheathed in skin. In Denmark, lanceolate daggers have been found still sheathed, in archaeological contexts.

Number 11. Type II. Lanceolate Dagger/Point.

Similar to Figure 21 of Lomborg (1973:44). Late Neolithic. From Køge. Made of fine-grained flint, medium reddish brown (10YR4/1). Length 18.60 cm.

The body is long and narrow. There are many scars. The cross-section is a narrow oval. Surfaces create a thick body and base, and taper towards sides and tip. The sides diverge slightly from base and then gradually converge, in a rounded fashion, to a sharp point. The sides are finely worked, and edges show slight denticulation. Maximum thickness is at one-third from base. Base is similar in thickness to the middle, and tip is considerably thinner than middle. The base is sharply notched.

Number 12. Type I. Lanceolate Dagger/Point.

Similar to Figure 9, of Lomborg (1973:32). Late Neolithic. From Seeland. Made of fine-grained flint, dark brown (10YR3/2). Length 15.45 cm.

The body is long and somewhat wide. There are many scars. The cross-section is a flat thin oval. Surfaces create a thin body and tip. The sides diverge slightly from base, are then parallel, and then gradually converge to a sharp point. The sides are finely worked. Maximum thickness is at one-third from base. Base is slightly thicker than middle, and tip is approximately as thin as middle. The base is notched.

Number 13. Type I. Lanceolate Dagger/Point.

Similar to Figure 9, of Lomborg (1973:32). Late Neolithic. From Seeland. Made of fine-grained flint, black (2.5Y3/0). Length 15.90 cm.

The body is long and somewhat wide. There are many scars. The cross-section is a flat thin oval. Surfaces create a thin body, base, and tip. The sides diverge from base, are then parallel; approximately midway, sides bend, and then gradually converge, in a rounded fashion, to a sharp point. The sides are finely worked. Maximum thickness is at base. Base is slightly thicker than middle, and tip is approximately as thin as middle.

Number 14. Type IC. Lanceolate Dagger/Point.

Similar to Figure 9C, of Lomborg (1973:32). Late Neolithic. From Seeland. Made of fine-grained flint, light grey (10YR6/1). Length 20.20 cm.

The body is very long and narrow. There are many scars; edges of scars are smoothed. The cross-section is a narrow oval. Surfaces create a thick body and base, and taper toward sides and tip. The sides diverge slightly from base to midpoint, and then gradually converge, in a slightly rounded fashion, to a sharp point. The sides are finely worked, and show some smoothing of scars. Maximum thickness is at the midpoint. Base is similar in thickness to the middle, and tip is considerably thinner than middle. The base is notched.

Number 17. Type III. Dagger.

Type III, possibly VIb, or reworked Type IIIa, Similar to Figures 24A and VIb, of Lomborg (1973:48 and 61; see also Jensen 1982:171). Late Neolithic/Early Bronze Age. From Seeland. Made of fine-grained flint, mottled black and tan (10YR3/1, 2.5Y6/4). Length 13.10 cm.

The sides diverge from base, forming a handle; approximately midway, the sides bend, and form a convex shoulder. From the shoulder, the sides converge to a dull point. The body and handle are thick. The surfaces taper toward sides and tip. The surface has many small, fine scars, which show smoothing of the edges. The cross-section is a flattened thick oval. Maximum thickness is at the shoulder. The tip is thinner than the middle. Base is as thick as the middle, and is asymmetrically rounded. Handle is finely worked, the surfaces are steeply rounded. Number 17 is an outlier for Form 2, and Retouch Form 3, and an extreme for Retouch Form 2, and Retouch Location 3.

Number 18. Type IVE. Fishtail Dagger.

Similar to Figure 29E, of Lomborg (1973:53). Late Neolithic. From Køge. Made of fine-grained flint, light grey (10YR5/1). Length 18.10 cm. "Visko" is written on the surface.

The sides converge from the base, then turn to run parallel to one another, so that they form a handle. Approximately midway along the body of the dagger, the sides bend, and form a convex shoulder. From the shoulder, the sides converge, in a convex fashion, to an asymmetrical dull point. The point appears unfinished, due to a flat surface at the point. The point may have been broken or not completed. The body and handle are thick. The surfaces taper toward the sides and tip. The surfaces

have many small, fine scars, which show smoothing of the edges. The cross-section of the blade is a flattened thick oval. The maximum thickness is at the shoulder. The tip is thinner than the middle. The base and handle are as thick as the middle, and have a squat triangular cross-section. The base is flat. The handle is well formed and well worked. The surface of the front of the handle has many small scars which shows fine working to shape the handle. This working includes small scars which form a line perpendicular to the base and parallel to the sides of the handle. Two lines of scars form a squat inverted V-shape at the end of the base, from each of the tips of the base to the beginning of the perpendicular line of scars. A third line of scars forms the third side of the triangle, and runs parallel to, and along the front of, the base. The other surface of the handle does not have these small scars, but has larger scars with smooth edges. The sides of the handle also have small scars to shape and form the handle. The base is as wide as the shoulders. Number 18 is an extreme for Retouch Location 2, 3, and Retouch Length 2 and 3.

Number 19. Type IIIE. Dagger.

Similar to Figure 24E, of Lomborg (1973:48). Late Neolithic. No provenience. Made of fine-grained flint, light yellow-grey (10YR7/2). Length 15.40 cm.

The body is very long and narrow. There are many scars; edges of scars are smoothed. The blade is narrower than the handle. The cross-section of the blade is a narrow oval. Surfaces create a thick handle and base, and taper from the midpoint toward the tip. The sides of the handle are parallel, and then converge to a sharp point. The sides are finely worked, and show some smoothing of scars. Maximum thickness is towards the base. The base is much thicker than the blade, and the tip is

considerably thinner than the middle. The base has a round oval cross-section. Number 19 is an outlier for Scar Form 2, and an extreme for Retouch Location 4.

Number 20. Type V. Fishtail Dagger.

Similar to Figure 35 of Lomborg (1973:58). Early Bronze Age. No provenience. Made of fine-grained flint, mottled dark grey and light yellow-grey (2.5Y4/0, 10YR7/2). Length 15.40 cm.

The body is very long and thin. There are many scars; edges of scars are smoothed. The cross-section is a very narrow oval. Surfaces create a thin body and base, and taper toward sides and tip. The sides converge from base, to create a poorly formed fishtail. The sides then run parallel up to the midpoint of the body, forming a handle. They then bend outward to form convex shoulders, and then gradually converge to a sharp point. The sides are finely worked, and show some denticulation. The surfaces have many small smoothed scars. Maximum thickness is at the midpoint of the handle. Base is thinner than the handle, and the blade and tip are considerably thinner than the handle. The base of the butt is concave. The handle is poorly formed, with scars which run horizontal to the base. Number 20 is an outlier for Form 1.

Number 21. Type II. Lanceolate Dagger/Point.

Similar to Figure 21, of Lomborg, (1973:44). Late Neolithic. No provenience. Made of fine-grained flint, light brown/caramel/tan, (2.5Y5/2). Length 14.10 cm.

The body is very long and narrow. There are many scars; edges of scars are smoothed. The cross-section of the blade is a narrow oval. The blade is narrower than the handle. Surfaces create a thick handle and base, and taper from the midpoint toward the tip. The sides of the handle are parallel, and then, after about midway, the

sides gradually converge to a sharp point. The sides are finely worked, and show some smoothing of scars. Maximum thickness is the middle of the handle. The base is similar in thickness to the handle, and the blade and tip are considerably thinner than the handle. The base is rounded, and has a diamond cross-section. The handle has several large scars, which meet to form pointed convex surfaces. Number 21 is an outlier for Form 1.

Number 22. Type I. Lanceolate.

Similar to Figure 9, Lomborg, (1973:32). Late Neolithic. Made of fine-grained flint, mottled dark brown and medium brown (5Y4/2 , 10YR3/1). Length 16.90 cm.

The numbers "1" and "8" are written on the surface, at the tip. The body is very long and narrow, and in poor condition. There are many scars; edges of scars are very smoothed. The cross-section is a very narrow oval. Surfaces create a thin body and base, and taper toward sides and tip. The base is notched. The sides diverge slightly from the base and notch to about the first third of the body, and then gradually converge, in a rounded fashion, to a sharp point. The sides are finely worked, with fine scars around the edges of the sides. Maximum thickness is at about the first third of the body. Base is similar in thickness to the middle, and tip is considerably thinner than middle. The butt of the base is irregular, with a small knob-like feature at the butt, and a flat notch covered with cortex.

Number 23. Type II. Lanceolate Dagger.

Similar to Figure 21, of Lomborg (1973:44). Late Neolithic. No provenience. Made of fine-grained flint, reddish dark brown (2.5YR4/0). Length 17.00 cm.

The body is long, and wide at the midpoint. There are many scars; edges of scars are lightly smoothed. The cross-section is a thin narrow oval. Surfaces create a

thin body and base, and taper toward sides and tip. The sides diverge slightly from base to midpoint, bend, and then gradually converge, in a slightly rounded fashion, to a sharp point. The sides are thin and finely worked, and show some smoothing of scars. Maximum thickness is at the base. Base is slightly thicker than the middle, and the tip is considerably thinner than middle. The cross-section of the base is a pointed oval. The base has larger scars than the body, and are worked horizontal to the body. These scars are worked from opposing sides, to create a midline on the first third of the body. This may be the formation of a handle. The base has a slight notch, so that the butt of base is assymetrical.

Number 24. Type IB. Lanceolate Dagger/Point.

Similar to Figure IB of Lomborg(1973:32). Late Neolithic. No provenience. Made of fine-grained flint, light yellow brown (2.5Y5/4). Length 17.35 cm.

The body is very long and narrow. Surface is smooth, and edges of scars are extensively smoothed. The cross-section is a narrow oval. Surfaces create a thin body, and taper toward sides and tip. The sides diverge slightly from base to midpoint, and then gradually converge, in a slightly rounded fashion, to a sharp point. The sides are finely worked, and show extensive smoothing of scars. Maximum thickness is at the base. The butt of the base is slightly thicker than the body. The base is similar in thickness to the middle, and the tip is similar in thickness to the middle. The base is slightly notched, with two scars forming a platform.

Number 25. Type II. Lanceolate Point/Dagger.

Similar to Figure 21 of Lomborg (1973:44). Late Neolithic. No provenience. Made of fine-grained flint, dark grey brown (5Y4/2, 2.5Y3/2). Length 14.45 cm.

The body is very long and slightly wide. Surface is smooth, and edges of scars are extensively smoothed. The cross-section is a flat narrow oval. Surfaces create a thin body, and taper toward sides and tip. The sides diverge from base to midpoint to form a convex base, and then gradually converge, in a slightly rounded fashion, to a very sharp, straight point. The sides are finely worked, with fine scars around the edges of the sides. Maximum thickness is at the base. The butt of the base is slightly thicker than the body, and the tip is similar in thickness to the middle. The base has a large smooth scar, with rounded edges, and form a knob-like projection from the surface towards the end of the base. The butt is well developed and convex.

Number 26. Type I. Lanceolate Point/Dagger.

Similar to Figure 9 of Lomborg (1973:32). Late Neolithic. No provenience. Made of fine-grained flint, butt-end is dark brown, middle and tip-end are light grey brown (2.5Y5/2, 2.5Y3/2). Length 13.40 cm.

The body is long. The widest point is about two-thirds from base. There are some scars, and edges of scars are smoothed; but there are large areas on the surfaces which are smooth and signify the removal of single large scars. The cross-section is a very thin narrow oval. Surfaces create a thin body and base, and taper slightly toward sides and tip. The sides diverge from base to about two-thirds from base, and then converge, in a rounded fashion, to a sharp point. The sides are finely worked, and show some smoothing of scars. Maximum thickness is at the midpoint. The base and tip are similar in thickness to the middle. The base is wide and flat. The side of the butt is formed from one scar.

Number 27. Type IIB. Lanceolate Dagger.

Similar to Figure 21B of Lomborg (1973 :44). Late Neolithic. No provenience. Made of fine-grained flint, light brown/tan (2.5Y6/4). Length 12.10 cm.

The body includes a thick handle and a thin blade. It is short and narrow. There are many scars on the blade; the edges of these scars are smoothed. The cross-section of the blade is a narrow oval. Surfaces create a thin blade and a thick handle. Surfaces of the blade taper toward sides and tip. The sides diverge slightly from base to the end of the handle, about one-third from the base, and then diverge more, to form slightly convex shoulders. The sides then gradually converge, in a rounded fashion, to a dull, rounded point. The sides are finely worked, and show some smoothing of scars. Maximum thickness is at the midpoint of the handle. The handle is thicker than the blade, and the tip is of similar thickness to the blade. The handle is made by large scars. The butt of the base is flat. The cross-section of the handle is a rounded square.

Number 28. Type I. Lanceolate Point-Small.

Similar to Figure 9 of Lomborg (1973:32, 39-40). Late Neolithic. No provenience. Made of fine-grained flint, bands of light gray and reddish dark brown (10YR5/3, 10YR7/2). Length 10.57 cm.

The body is short and squat. The edges of scars are smoothed. The cross-section is a very thin narrow oval. Surfaces create a thin body and base, and gradually taper toward sides and tip. The sides diverge strongly from base to about one-third from the base, bend to form pointed shoulders, and then gradually converge, in a slightly rounded fashion, to a dull point. The sides are finely worked, and show smoothing of scars. Maximum thickness is at the midpoint. The base is

similar in thickness to the middle, and tip is similar in thickness to the middle. The butt of the base is formed by a wide flat surface, which is about one third as wide as the greatest width. There is a small knob-like projection from the surface of the end of the base.

Number 29. Type I. Lanceolate Dagger/Point.

Similar to Figure 9 Lomborg (1973:32). Late Neolithic. No provenience. Made of fine-grained flint, medium reddish brown and dark brown (10YR5/4, 10YR2/1). Length 12.59 cm.

The body is very long and pear shaped. There are many scars; edges of scars are smoothed. The cross-section is a very thin narrow oval. Surfaces create a thin body and base, and taper toward sides and tip. The sides diverge strongly from base to about one-fifth from base, bend in a slightly pointed convex fashion to form shoulders, and then gradually converge to a sharp point. The sides are finely worked, and show some smoothing of scars. Maximum thickness is at the shoulders. Base is similar in thickness to the middle, and tip is thinner than the middle. The butt of the base is formed by a wide flat surface, so that the butt is about half of the greatest width.

Number 30. Type II. Lanceolate Dagger/Point.

Similar to Figure 21 of Lomborg (1973:44). Late Neolithic. From Hasselmine, Jutland. Made of fine-grained flint, very dark grey/black (10YR5/1, 10YR3/1). Length 12.09 cm.

The body is long and narrow. There are many large scars; edges of some scars are smoothed. The cross-section is a thick pointed oval. Surfaces create a thick body and base, and taper toward sides and tip. The sides diverge slightly from base to

about two-thirds from base, and then gradually converge, in a rounded fashion, to an irregular sharp point. Maximum thickness is at the midpoint. The base is slightly thinner than the middle, and the tip is slightly thinner than the middle. The base is notched. There are large scars on the base, which form a small knob-like projection on the surface of the base. The butt of the base is rounded.

Number 32. Type II. Lanceolate Point, Small.

Based on form, this may represent a reworked dagger. Similar to Figure 21 of Lomborg (1973:44). Late Neolithic. No provenience. Made of fine-grained flint, very dark grey/black (5Y3/1). Length 10.59 cm.

The body is short, with scars. The cross-section of the blade is a very thin narrow oval. The surfaces create a thin blade and thick base. The surfaces of the blade gradually taper toward sides and tip. The surfaces of the base taper steeply toward the sides. The sides diverge slightly from the notch. One side diverges to about the midpoint, and then begins to converge, in a rounded fashion. The side with the notch runs parallel with the midline of the body to about two-thirds from the butt, bends slightly to form a convex side, and then converges with the other side, to a sharp point. Maximum thickness is at the midpoint of the base. The base is much thicker than the blade, and the tip is thinner than the blade. The butt of the base is pointed, formed by an asymmetrical V-shape to create a notch.

Number 51-200. Type I. Lanceolate Dagger.

Not from Wulff's Collection. Similar in form to Figure 11b of Lomborg (1973:34). Late Neolithic. No provenience. Made of fine-grained flint, black (10YR3/1). Length 15.30 cm.

The body is very long and wide at the midpoint. There are many small scars; edges of scars are very smoothed. The cross-section is a narrow oval. Surfaces create a thin body and base, and taper toward sides and tip. The sides diverge slightly from base to midpoint, bend to form a slightly convex shoulder, and then gradually converge, to a dull point. The sides are finely worked, and show smoothing of scars. Maximum thickness is at the midpoint. Base is similar in thickness to the middle, and tip is similar in thickness to the middle. The butt of the base is straight and well worked. The width of the butt is about one-half that of the greatest width.

Number Unknown. Type VIB. Dagger.

Similar to Figure 36 of Lomborg (1973:61), Flemming Kaul, personal communication . Early Bronze Age. No provenience. Made of fine-grained flint, dark grey (5Y4/1). Length 16.20 cm.

The body is very long with many small fine scars; edges of scars are very smoothed. The cross-section of the blade is a very thin narrow oval. Surfaces create a thin blade and base, and taper toward sides and tip. The sides converge very slightly from butt, to form a slight fish-tail. The sides then run parallel to just before the midpoint, to from a handle. At the midpoint, the sides then bend sharply to form convex shoulders at the midpoint. The sides then gradually converge, in a slightly rounded fashion, to a sharp point. The sides are finely worked with small scars, and show some smoothing of scars. Maximum thickness is at the midpoint. The surfaces of the handle taper steeply to form a very narrow handle. The handle is similar in thickness to the middle, and the tip is slightly thinner than the middle. The surfaces of the handle taper to form a thin butt. The butt is flat and narrow, about one-third as

wide as the shoulders. Number Unknown is an outlier for Form 2, and an extreme for Retouch Location 3.

Sickles

Sickle blades or knives are important artifacts for archaeologists who are studying agriculture (Midgley 1992; Jensen 1982). They are traditionally interpreted as sickles for harvesting grain. Sickle blades are frequently found in graves and hoards. Sickles, daggers, and triangular points are made by a flat-flaked technique, which was first used in Denmark in the Late Neolithic (Liversage and Singh 1985). They can also be found in Early Bronze Age contexts (e.g. Johansen 1985). Like the daggers, the forms of these sickle blades may be modeled after copper or bronze counterparts.

Number 15. Saw-edged crescent sickle.

Similar to #589 Glob (1952:129; Steensberg 1943). Late Neolithic. From Seeland. Made of fine-grained flint, dark reddish brown (10YR3/1). Length 13.80 cm.

The body is very long, straight, and narrow. There are many scars; edges of scars are smoothed. The cross-section is a narrow oval. Surfaces create a thin body, and taper toward sides, to form very thin edges. The cutting side is generally straight, with a slight bend at one end. It is finely worked, to create a saw-edge-like cutting edge. The back side is asymmetrically convex, with a slight bend at one end, and greater convexivity at that end. The back side is straighter towards the other end. The edge of the back side is finely worked to form a thin edge. Maximum thickness is at the midpoint. Number 15 is an extreme for Retouch Direction 1 and 4.

Number 16. Crescent Sickle Blade.

Similar to #594 Glob (1952:129; Steensberg 1943), but not as bent. Late Neolithic. From Seeland. Made of fine-grained flint, medium yellow brown and dark brown (2.5Y5/2, 7.5Y3/0). Length 11.02 cm.

The body is very long, bent, and wide. There are many scars; edges of scars are smoothed. The cross-section is a thick, asymmetrical oval. The body is thicker towards the cutting side, so that the surfaces taper steeply to the cutting edge, and gradually to the back side and edge. Surfaces create a thick body, and taper toward sides, to form very thin edges. About two-thirds of the cutting side is straight; it then bends sharply, and then is straight. The cutting edge is finely worked and smooth. Likewise. the back side is asymmetrically convex, with greater convexivity at one end. The edge of the back side is finely worked to form a thin edge. Maximum thickness is at the bend. Number 16 is an extreme for Retouch Direction 1 and 4.

Number 33. Saw-edged crescent sickle.

Similar to #588 or 589, of Glob (1952:129; Steensberg 1943), with a deeper blade than #589. Late Neolithic. No provenience. Made of fine-grained flint, orange red and dark grey brown (5YR3/2, 5Y4/2,). Length 13.50 cm.

The body is very long and wide. There are many scars; edges of scars are smoothed. The cross-section is a very thin narrow oval. Surfaces create a thin body, and taper toward sides, to form very thin edges. The cutting side is straight, and finely worked, to create a saw-edge-like cutting edge. The back side is strongly and symmetrically convex. The edge of the back side is finely worked to form a thin edge. Maximum thickness is at the midpoint.

Number 34. Saw-edged crescent sickle, Small.

Similar to #588, of Glob (1952:129; Steensberg 1943), but smaller. Late Neolithic. No provenience. Made of fine-grained flint, light green-yellow brown (2.5Y6/2). Length 9.92 cm.

The body is small and narrow. There are many scars; edges of scars are smoothed. The cross-section is an asymmetrical oval. The body is thicker towards the cutting side, so that the surfaces taper steeply to the cutting edge, and gradually to the back side and edge. Surfaces create a thick body, and taper toward sides, to form very thin edges. The cutting side is generally straight, with a very slight bend at one end. It is finely worked, to create a slight saw-edge-like cutting edge. The back side is strongly and symmetrically convex. The edge of the back side is finely worked to form a thin edge. Maximum thickness is at the midpoint.

Stemmed-Scrapers

Flake stemmed scrapers, like side-blow flake axes, are bifacially worked flakes, with the bit being the original edge of the flake. Compared to the axes, the body of the scraper is shorter, and the sides of the body are retouched and blunt (Clark 1975; Larsson 1985; Petersen 1989). These date to the Ertebolle phase of the Late Mesolithic (Clark 1975 :182, Figures 41 and 48; Mathiassen 1948, #67; Midgley 1992:14, Figure 4). Numbers 5 and 36 of the collection are of this form of scraper. Scrapers are used to clean materials, such as hides.

Number 5. Stemmed Scraper.

Similar to Figures 41 and 48, of Clark (1975:182); and #65 of Mathiassen (1948), but with more concave sides. Late Neolithic. From Seeland. Made of fine-grained flint, light grey (10YR7/1). Length 7.69 cm.

The scraper is T-shaped. The cross-section is trapezoidal. Surfaces create a thick body. The surfaces taper toward the butt and cutting sides, and create thick sides along the body of the T. The sides are parallel, and diverge slightly from base to midpoint. At the midpoint, the sides bend in a rounded concave fashion, and diverge to the ends of the upper part of the T. These ends are convex, and the sides turn back to form an irregular straight cutting edge. The sides are poorly worked. Maximum thickness is at the midpoint. The butt is thinner than the middle, and the cutting side is considerably thinner than the middle. The base is rounded. Number 5 is an outlier for Retouch Form 3, and an extreme for Retouch Form 2, and Retouch Length 1 and 4.

Number 36. Stemmed Scraper.

Similar to Figures 41 and 48, of Clark (1975:182), and #65 of Mathiassen (1948), but with more concave sides. Late Neolithic. No provenience. Made of fine-grained flint, light grey (N6/). Length 6.88 cm.

The scraper is T-shaped. The cross-section is a squat triangle. Surfaces create a thick body. The surfaces taper toward the sides, so that all sides are thin compared to the center. The sides are parallel, and diverge slightly from base to midpoint. At the midpoint, the sides bend inward, and then diverge, straight, to the ends of the upper part of the T. These ends are rounded, and the sides turn back to form a flat, straight cutting edge. The sides are poorly worked. Maximum thickness is at the center of the T. The sides are thinner than the middle. The butt is square, with a flake

missing to form an irregular side. Number 36 is an outlier for Retouch Form 2 and 3, and an extreme for Retouch Location 2, 3, and 4.

Knife

Number 31. Knife or blade.

There is a wide range of possible time periods to which it could belong, from the Upper Palaeolithic, or early Mesolithic, or the Neolithic, or even the Bronze Age. It is similar to Upper Palaeolithic/early Mesolithic specimens (Semenov 1964:105-106, Figures 43-44). The strong degree of patination makes analysis difficult, but there is some evidence of use retouch. Knives are used to cut materials such as meat. Similar also to Figure 11b, of Nielsen (1987:74). Upper Palaeolithic to Bronze Age. From Hallelengg. Made of fine-grained flint, medium reddish brown-small visible area (2.5Y3/2). Length 10.88 cm.

Surfaces are strongly patinated, with only a small area visible. The body is long and narrow. One surface is made of two incomplete scars, which meet to form a midline which runs the axis of the body. The other surface is a flat surface formed from one scar. Cutting edges have small scars. The cross-section is a squat triangle. The sides are parallel to about one-fourth of body from base. The sides then diverge sharply, and then gradually converge to a rounded point. The sides are rough, and show clear evidence of use retouch. Maximum thickness is at the midpoint. Base is similar in thickness to the middle, and tip is similar in thickness to the middle. Base is relatively flat, but poorly formed. Number 31 is an extreme for Retouch Location 2 , 3, and 4.

FUNCTIONAL AND STYLISTIC ANALYSES

The determinations of the functions of the Bifacial artifact group are presented in Table 14 and Table 15. There is an interesting pattern of Side 2 being used for cutting, and Side 3 being used for scraping or for cutting. This is especially true for daggers, where the right blade has evidence only for cutting, but the left blade was used for either cutting or scraping. This may relate to butchering and skinning (scraping) of animals. This pattern may also be interesting from the standpoint of sheathing (c.f. Green et al 1982). It is also interesting to note that the stemmed scrapers show evidence of cutting, not scraping, for Side 2. Side 3 for stemmed scrapers is actually the but, and the pattern there may represent hafting, or how the pieces were held. Also, the sickles' Side 2 was used for cutting, but the back of the sickles, where they would have been hafted, reveal evidence for scraping. This may actually be a product of hafting, and is a puzzle as to how they would have bee hafted so that the location of retouch is only on one side. The knife exhibits evidence for its expected function, cutting.

Most of these tools would have taken a relatively long time to manufacture, and used for a relatively long length of time. The exception would be the knife. With respect to stylistic interpretations, the dagger type group is the perfect example of stylistic variation in lithic artifacts. The earlier types were modeled after copper counterparts, and the later types were modeled after bronze counterparts, and are, therefore, mimics (Green et al 1982; Clarke et al 1985; Glob 1952; Jensen 1982; Midgley 1992). There is some geographic variation of stemmed scrapers within Denmark, so

TABLE 14. FUNCTIONAL DETERMINATIONS FOR BIFACIAL ARTIFACTS FOR SIDE 2.

TYPE: L=Lanceolate, D=Dagger, PL=Lanceolate Point. SCRFRM=Scarform: F=Feather, H=Hinge. RETEXT=Extension of Retouch: C=Continuous, D=Discontinuous. RETLOC=Location of Retouch: V=Ventral, D=Dorsal. All Have Edge Angles Less Than 85 Degrees.

NO.	TYPE	FORM	SCRFRM	RETEXT	RETLOC	FUNCTION	MATERIAL
11	L	421	F+H	D	V + D	CUTTING	SOFT AND HARD
12	L	411	F+H	C	V + D	CUTTING	SOFT AND HARD
13	L	211	F+H	C	V + D	CUTTING	SOFT AND HARD
14	L	421	F+H	D	V + D	CUTTING	SOFT AND HARD
17	D	611	.	C	V + D	CUTTING	SOFT AND HARD
18	D	111	F+H	D	D	SCRAPING	SOFT AND HARD
19	D	111	F	D	V + D	CUTTING	SOFT
20	D	111	F+H	D	V + D	CUTTING	SOFT AND HARD
21	D	111	F+H	D	V + D	CUTTING	SOFT AND HARD
22	L	411	F+H	D	V + D	CUTTING	SOFT AND HARD
23	PL	421	0	28	V + D	CUTTING	.
24	L	411	F+H	D	V + D	CUTTING	SOFT AND HARD
25	PL	121	F+H	C	V + D	CUTTING	SOFT AND HARD
26	PL	211	1	C	V + D	CUTTING	.
27	D	411	F+H	C	V + D	CUTTING	SOFT AND HARD
28	PL	311	F+H	C	V + D	CUTTING	SOFT AND HARD
29	PL	121	F+H	D	V + D	CUTTING	SOFT AND HARD
30	L	421	F+H	D	V + D	CUTTING	SOFT AND HARD
32	PL	431	F+H	C	V + D	CUTTING	SOFT AND HARD
200	L	212	F+H	C	V + D	CUTTING	SOFT AND HARD
UNK	D	611	F+H	C	V + D	CUTTING	SOFT AND HARD
15	SICKLE	226	F+H	C	V + D	CUTTING	SOFT AND HARD
16	SICKLE	233	F+H	C	V + D	CUTTING	SOFT AND HARD
33	SICKLE	222	F+H	C	V + D	CUTTING	SOFT AND HARD
34	SICKLE	222	F+H	C	V + D	CUTTING	SOFT AND HARD
31	KNIFE	421	F	.	V + D	CUTTING	SOFT
5	STSCR	121	F+H	D	V + D	CUTTING	SOFT AND HARD
36	STSCR	323	F+H	D	V + D	CUTTING	SOFT AND HARD

TABLE 15. FUNCTIONAL DETERMINATIONS FOR BIFACIAL ARTIFACTS FOR SIDE 3.

TYPE: L=Lanceolate, D=Dagger, PL=Lanceolate Point. SCRFRM=Scarform: F=Feather, H=Hinge. RETEXT=Extension of Retouch: C=Continuous, D=Discontinuous. RETLOC=Location of Retouch: V=Ventral, D=Dorsal. All Have Edge Angles Less Than 85 Degrees.

NO.	TYPE	FORM	SCRFRM	RETEXT	RETLOC	FUNCTION	MATERIAL
11	L	121	F+H	D	V + D	CUTTING	SOFT AND HARD
12	L	111	F+H	C	D	SCRAPING	SOFT AND HARD
13	L	211	F+H	C	V	SCRAPING	SOFT AND HARD
14	L	421	F+H	D	V + D	CUTTING	SOFT AND HARD
17	D	116	.	C	MIDDLE		.
18	D	111	F+H	D	V	SCRAPING	SOFT AND HARD
19	D	111	F+H	D	V	SCRAPING	SOFT AND HARD
20	D	111	F+H	D	D	SCRAPING	SOFT AND HARD
21	D	111	F+H	D	D	SCRAPING	SOFT AND HARD
22	L	411	F+H	D	V	SCRAPING	SOFT AND HARD
23	PL	211	0	28	V + D	CUTTING	.
24	L	111	F+H	D	D	SCRAPING	SOFT AND HARD
25	PL	121	F+H	C	V + D	CUTTING	SOFT AND HARD
26	PL	211	1	C	V + D	CUTTING	.
27	D	211	F+H	C	V + D	CUTTING	SOFT AND HARD
28	PL	211	F+H	C	V + D	CUTTING	SOFT AND HARD
29	PL	121	F+H	D	D	SCRAPING	SOFT AND HARD
30	L	121	F+H	D	D	SCRAPING	SOFT AND HARD
32	PL	711	F+H	C	V + D	CUTTING	SOFT AND HARD
200	L	221	F+H	C	V + D	CUTTING	SOFT AND HARD
UNK	D	221	F+H	C	D	SCRAPING	SOFT AND HARD
15	SICKLE	226	F+H	C	V	SCRAPING	SOFT AND HARD
16	SICKLE	233	F+H	C	V	SCRAPING	SOFT AND HARD
33	SICKLE	222	F+H	C	V	SCRAPING	SOFT AND HARD
34	SICKLE	222	F+H	C	D	SCRAPING	SOFT AND HARD
31	KNIFE	412	F+H	.	V + D	CUTTING	SOFT AND HARD
5	STSCR	121	F+H	D	MIDDLE		SOFT AND HARD
36	STSCR	323	F+H	D	MIDDLE		SOFT AND HARD

that there may be some stylistic variation in these as well. The sickles have only very little stylistic variation, possibly as mimics of bronze equivalents. Most of the variation in the sickles and the knife is isochrestic.

CHAPTER V

MULTIFACIAL ARTIFACTS

Multifacial artifacts have four sides, and flake removal on all sides. These include various chipped stone celts: axeheads, chisels, picks, and adzes. There are twenty-three (23) artifacts classified as multifacial that are used in this analysis. These include seven (7) thin-butted axeheads, numbers 45-1, 2, 52, 53, 54, 55, and 57; nine (9) thick-butted axeheads, numbers 45-3, 4, 41, 43, 44, 46, 47, 51, and 56; three (3) chisels, numbers 45-10, 48, and 49; one (1) pick, number 45-35; two (2) adzes, numbers 45-45, and 50; and one (1) whetstone, number 45-42.

In the Mesolithic, celts, which include chipped stone axes, adzes, chisels, and gouges, would be used to make dugout canoes, paddles, sledges, skis, and staves for boats that were covered by skins (Bordaz 1970:95). During the Neolithic, axes were important for felling trees to clear land as part of the slash-and-burn, or swidden, method of agriculture. These were also used in the Neolithic to build houses and other structures, as well as dugout canoes and paddles.

Axes and Adzes made from bifacially worked, thick flakes of flint began around 9000 B.C. in Europe (Bordaz 1970:93). The manufacturing technique is called Tranchet, where the original edge of the flake is used as the bit. The edges were ground starting around 7000 B.C.. Eventually, the axes would be multifacial, and the whole axe would be ground and then polished.

In areas without flint sources, other kinds of stones were used for axeheads (Olausson 1983a and b; Bordaz 1970:101,104). The forms of these axeheads could be like flint axeheads; or, in the Middle and Late Neolithic, could be the so called "battle axe" form (e.g. Glob 1952). Ground-stone axeheads will be described in Chapter VI.

The celts were made through a series of stages (Bordaz 1970:99-101). First, the maker of the implement would flake a nodule into a crude form of the finished product, called a "rough-out". After a series of chipping of flakes to clarify the form, the rough-out was then ground. This was done by rubbing the piece on rock or slabs with progressively finer surfaces, so that the surface of the rough-out became smoother. Finally, the implement would be rubbed with or on a fine-grained surface. Various researchers (c.f. Bradley 1975:56) have identified five stages for the manufacture of thin-butted axeheads (Hansen and Madsen 1983). Stage 1: obtainment of the raw material; Stage 2: the making of the blank; Stage 3: pre-forming of the axehead; Stage 4: the final shaping of the axehead; and, Stage 5: the polishing of the axehead. These stages will identified for all of the flint axeheads.

The advantage of polishing the implements is that the smooth surface penetrates the wood more deeply. The point of the tool was more symmetrical, so that the force of striking was more evenly distributed, and the head was less likely to break (Bordaz 1970:99). Therefore the polished axes were more efficient and durable than non-polished forms.

The celts were also hafted (Bordaz 1970:101-02; Becker 1945a). Axeheads found in graves were most likely placed in the grave with a handle. Axeheads without handles are almost only found in hoards (Becker 1945a:155). For some celts, a hole

was pecked into it, for a handle. Alternatively, a hole was made in a wooden handle, or one end of the handle was split (Olausson 1983a and b). The celt would then be placed into the handle. This later method was the more common one in the Neolithic. When a hole was pecked into the stone, the stone was more easily broken, so that the second method was more durable. Since the wooden handle might also break, sometimes the celt would be placed in a modified antler, and then the antler attached to the shaft. The antler was a shock absorber.

STATISTICAL ANALYSIS

The following are the statistical results for Multifacial artifacts. These include Identifying Characteristics, Metric Variables, Indexes, Base Angles, Surface Features, and Retouch Variables. Histograms, for Bifacial Artifacts, of the Metric Variables, Indexes, and Negatives Variables are in Appendix C.

Set A Variables

Identifying Characteristics

The Identifying Characteristics are listed in Table 16. All but four of the artifacts in the Multifacial group are made of fine-grained flint. The Primary Color is predominantly around the 10YR7/4 or 5/1 range. Secondary color is predominantly around the 4/1 to 4/4. All but two of the Multifacial artifacts appear complete.

TABLE 16. IDENTIFYING CHARACTERISTICS FOR MULTIFACIAL ARTIFACTS.

CLASS: WHETSTO=Whetstone. TYPE: SYMET=Symetrical. Per=Period, M=Mesolithic, EN=Early Neolithic, MN=Middle Neolithic, LN=Late Neolithic, NBA=Neolithic to Bronze Age. RM=Raw Material, F=Fine Grained, M=Medium Grained. COL1=Primary Color. COL2=Secondary Color. POL=Polish, 0=Absent, 3=Present, PRT=Part, CIT=Citation, from Mathiassen 1948 And Callahan 1985. See Qualitative Analysis Section Below For Specific References.

NO.	CLASS	TYPE	PER	RM	COL1	COL2	POL	PART	CIT
1	AXEHEAD	THIN-	EN	F	2.5Y6/4		0	4	116
2	AXEHEAD	THIN-	EN	F	10R4/2	7.5YR5/2	0	4	117
3	AXEHEAD	THICK-	LN	F	10YR7/4	5Y4/1	0	4	552
4	AXEHEAD	THICK-	LN	F	7.5YR5/4	10YR3/3	3	4	552
10	AXEHEAD	SQUARE	MN	F	10YR7/2	5Y6/2	3	4	250
41	AXEHEAD	THICK-	MN	F	10YR4/4		3	4	383
43	AXEHEAD	THICK-	MN	F	10YR7/2		3	4	383
44	AXEHEAD	THICK-	MN	F	2.5Y6/2		3	4	387
46	AXEHEAD	THICK-	MN	F	10YR5/2		3	4	232
47	AXEHEAD	THICK-	MN	M	10YR5/1		3	4	231
51	AXEHEAD	THICK-	MN	M	10YR6/3		3	4	383
52	AXEHEAD	THIN-	MN	M	7.5YR5/6		0	4	228
53	AXEHEAD	THIN-	EN	F	2.5Y3/0	5Y4/2	0	4	115
54	AXEHEAD	THIN-	EN	F	2.5Y4/2	10YR4/4	0	4	115
55	AXEHEAD	THIN-	EN	F	5Y2.5/1	10YR4/3	3	3	115
56	AXEHEAD	THICK-	LN	F	2.5Y5/2		3	3	553
57	AXEHEAD	THIN-	EN	F	10YR7/1	5Y4/1	3	4	115
45	ADZE	THICK	MN	M	10YR5/1		3	4	
50	ADZE	SYMET	M	F	2.5YR4/2	7.5YR4/6	3	4	55
48	CHISEL	SQUARE	MN	F	10YR6/1		3	4	245
49	CHISEL	SQUARE	MN	F	5Y8/1		0	4	389
35	PICK	PICK	M	F	N6/		0	4	57
42	WHETSTO		NBA	F	7.5YR4/2		3	4	

Metric Variables

Table 17 presents the summary statistics for the Multifacial Artifact group. These include Metric Variables, Indexes, Base Angles, and Surface Features. Table 18 presents the coefficients of variation, skewness and kurtosis.

Variable.

LENGTH. The average for all multifacial artifacts is 15.344, with a variance of 29.162, and a standard deviation of 5.40. The median is 14.40, and there are multiple modes. The coefficient of variation is 35.19 percent. The distribution is mildly positively skewed (1.280), and there is a mild positive degree of kurtosis (2.208). Number 54 is an outlier.

WIDTH. The average for all multifacial artifacts is 5.065, with a variance of 3.836, and a standard deviation of 1.959. The median is 5.090, and there are multiple modes. The coefficient of variation is 38.68 percent. The distribution is slightly positively skewed (0.313), and there is a slight negative degree of kurtosis (-0.691). There are no outliers or extremes.

THICKNESS. The average for all multifacial artifacts is 2.785, with a variance of 1.356, and a standard deviation of 1.165. The median is 2.570, and the mode is 1.58. The coefficient of variation is 41.83 percent. The distribution is slightly positively skewed (0.634), and there is a very slight positive degree of kurtosis (0.097). There are no outliers or extremes.

WEIGHT. The average for all multifacial artifacts is 354.143, with a variance of 133900.295, and a standard deviation of 365.924. The median is 197.700, and there are multiple modes. The coefficient of variation is 103.33 percent. The

TABLE 17. SUMMARY STATISTICS FOR MULTIFACIAL ARTIFACTS, INCLUDING METRIC VARIABLES, INDEXES, AND SURFACE FEATURES.

SD^2: variance, SD: Standard Deviation, SE: Standard Error of the Mean. MODE: MUL-MULTIPLE. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MEDIAN	MODE
LENGTH	15.344	29.162	5.40	1.126	14.400	MUL
WIDTH	5.065	3.836	1.959	0.408	5.090	MUL
THICKNESS	2.785	1.356	1.165	0.243	2.57	1.580
WEIGHT	354.143	133900.295	365.924	76.300	197.700	MUL
LWINDEX	32.851	165.801	12.876	2.685	29.531	MUL
WTINDEX	19.450	45.446	6.741	1.406	18.249	MUL
LTINDEX	59.607	349.843	18.704	3.900	53.913	MUL
CORTEX	7.421	0.368	0.607	0.139	7	7,8
DIRNEG	3.25	0.934	0.967	0.216	3	3
PLTKIND	8.048	4.148	2.037	0.444	9	9

TABLE 18. COEFFICIENTS OF VARIATION, SKEWNESS, AND KURTOSIS FOR MULTIFACIAL ARTIFACTS, INCLUDING METRIC VARIABLES, INDEXES, BASE ANGLES, AND SURFACE FEATURES.

CV: coefficient of variation, in percentages. See Chapter II for abbreviations for Variables.

VARIABLE	CV	SKEWNESS	KURTOSIS
LENGTH	35.19	1.280	2.208
WIDTH	38.68	0.313	-0.691
THICKNESS	41.83	0.634	0.097
WEIGHT	103.33	2.018	4.746
LWINDEX	39.20	2.024	4.197
WTINDEX	34.66	0.489	-0.050
LTINDEX	31.38	0.617	0.151
CORTEX	8.18	-0.498	-0.502
DIRNEG	29.75	2.55	6.136
PLTKIND	25.31	-2.583	6.908

distribution is mildly positively skewed (2.018), and there is a strong positive degree of kurtosis (4.746). Number 54 is an extreme.

Indexes

Index.

LENGTH/WIDTH INDEX. The average for all multifacial artifacts is 32.851, with a variance of 165.801, and a standard deviation of 12.876. The median is 29.531, and there are multiple modes. The coefficient of variation is 39.20 percent. The distribution is mildly positively skewed (2.024), and there is a strong positive degree of kurtosis (4.197). Numbers 48 and 10 are extremes.

WIDTH/THICKNESS INDEX. The average for all multifacial artifacts is 19.450, with a variance of 45.446, and a standard deviation of 6.741. The median is 18.249, and there are multiple modes. The coefficient of variation is 34.66 percent. The distribution is slightly positively skewed (0.489), and there is a very slight negative degree of kurtosis (-0.050). There are no outliers or extremes.

LENGTH/THICKNESS INDEX. The average for all multifacial artifacts is 59.607, with a variance of 349.843, and a standard deviation of 18.704. The median is 53.913, and there are multiple modes. The coefficient of variation is 31.38 percent. The distribution is slightly positively skewed (0.617), and there is a very slight positive degree of kurtosis (0.151). There are no outliers or extremes.

Surface Features

Feature.

CORTEX. The average for all multifacial artifacts is 7.421, with a variance of 0.368, and a standard deviation of 0.607. The median is 7, and there are multiple modal codes. The coefficient of variation is 8.18 percent. The distribution is slightly negatively skewed (-0.498), and there is a slight negative degree of kurtosis (-0.502). There are no outliers or extremes.

The chi-square value is 6.7368, df=2, and is significant at 0.0344. One, (5.3%), is coded 6, more than 25% of the surface is covered. Nine, (47.4%), are coded 7, no cortex or patina. Nine, (47.4%), are coded 8, less than 25% of the surface is covered. N= 19, four are not coded.

DIRECTION OF NEGATIVES. The average for all multifacial artifacts is 3.25, with a variance of 0.934, and a standard deviation of 0.967. The median is 3, and the modal code is 3. The coefficient of variation is 29.75 percent. The distribution is mildly positively skewed (2.55), and there is a strong positive degree of kurtosis (6.136). Numbers 54, thin-butted axehead, 49, and 48, both chisels, are extremes.

The chi-square value is 24.1000, df=2, and is significant at 0.0000. One, (5.0%), is coded 2, Formed. Seventeen, (85.0%), are coded 3, Diedre. Two, (10.0%), are coded 6, Edged. N= 20, three are not coded.

PLATFORM KIND. The average for all multifacial artifacts is 8.048, with a variance of 4.148, and a standard deviation of 2.037. The median is 9, and the modal code is 9. The coefficient of variation is 25.31 percent. The distribution is mildly negatively

skewed (-2.583), and there is a strong positive degree of kurtosis (6.908). Numbers 44, thick-butted axehead, 48, and 10, both chisels, are extremes.

The chi-square value is 34.9524, df=4, and is significant at 0.0000. The chi-square statistic is questionable here, due to the small sample size. One, (4.8%), is coded 1, *Cortical*. Two, (9.5%), are coded 5, *Facetté convexe*. One, (4.8%), is coded 7, *Punctiforme*. Two, (9.5%), are coded 8, none of the above. Fifteen, (71.4%), are coded 9, cannot be coded. N=21, two are not coded.

Set C Variables

Negatives Variables

Table 19 presents summary statistics for the Multifacial Negatives Variables. These include Number of Platforms, Number of Flake Negatives, Number of Blade Negatives, Length of Largest Negative, Width of Largest Negative, Length of Smallest Negative, and Width of Smallest Negative. Table 20 presents the coefficients of variation, skewness and kurtosis. The histograms for Negatives Variables are in Appendix C.

Variable.

NUMBER OF PLATFORMS. The average for all multifacial artifacts is 66.000, with a variance of 2218.762, and a standard deviation of 47.104. The median is 56.50, and there are multiple modes. The coefficient of variation is 71.37 percent. The distribution is mildly positively skewed (1.440), and there is a mild positive degree of kurtosis (3.210). Number 54, thin-butted axehead, is an outlier.

TABLE 19. SUMMARY STATISTICS FOR MULTIFACIAL ARTIFACTS, NEGATIVES VARIABLES.

SD^2: Variance; SD: Standard Deviation, SE: Standard Error of the Mean.
MODE - MUL=Multiple Modes. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MED	MOD
NOPL	66.00	2218.76	47.10	10.04	56.50	MUL
NOFLNEG	130.23	5905.61	76.85	16.38	105.50	MUL
NOBLNEG	8.09	13.33	3.65	0.778	7.00	6.00
LLNEG	2.41	1.92	1.38	0.302	1.87	MUL
WLNEG	1.40	1.15	1.07	0.234	0.96	MUL
LSNEG	0.51	0.132	0.363	0.079	0.40	MUL
WSNEG	0.31	0.036	0.19	0.041	0.26	0.40

TABLE 20. COEFFICIENTS OF VARIATION, SKEWNESS, AND KURTOSIS FOR MULTIFACIAL ARTIFACTS, NEGATIVES VARIABLES.

CV: coefficient of variation. See Chapter II for abbreviations for Variables.

VARIABLE	CV	SKEW	KURT
NOPL	71.37	1.44	3.21
NOFLNEG	59.01	0.98	0.055
NOBLNEG	45.11	0.495	-0.622
LLNEG	57.55	0.92	-0.450
WLNEG	76.37	2.12	4.22
LSNEG	71.18	2.61	7.799
WSNEG	60.51	2.295	6.28

NUMBER OF FLAKE NEGATIVES. The average for all multifacial artifacts is 130.227, with a variance of 5905.613, and a standard deviation of 76.848. The median is 105.500, and there are multiple modes. The coefficient of variation is 59.01 percent. The distribution is slightly positively skewed (0.981), and there is a very slight positive degree of kurtosis (0.055). Numbers 1, a thin-butted axehead, and 56, a thick-butted axehead, are outliers.

NUMBER OF BLADE NEGATIVES. The average for all multifacial artifacts is 8.091, with a variance of 13.325, and a standard deviation of 3.650. The median is 7.000, and the mode is 6.000. The coefficient of variation is 45.11 percent. The distribution is slightly positively skewed (0.495), and there is a slight negative degree of kurtosis (-0.622). There are no outliers or extremes.

LENGTH OF LARGEST NEGATIVE. The average for all multifacial artifacts is 2.405, with a variance of 1.915, and a standard deviation of 1.384. The median is 1.870, and there are multiple modes. The coefficient of variation is 57.55 percent. The distribution is slightly positively skewed (0.923), and there is a slight negative degree of kurtosis (-0.450). There are no outliers or extremes.

WIDTH OF LARGEST NEGATIVE. The average for all multifacial artifacts is 1.401, with a variance of 1.145, and a standard deviation of 1.070. The median is 0.960, and there are multiple modes. The coefficient of variation is 76.37 percent. The distribution is mildly positively skewed (2.122), and there is a strong positive degree of kurtosis (4.216). Numbers 35, a pick, and 50, an adze, are outliers, and numbers 49, a chisel, 53, a thin-butted axehead, and 3, a thick-butted axehead, are extremes.

LENGTH OF SMALLEST NEGATIVE. The average for all multifacial artifacts is 0.510, with a variance of 0.132, and a standard deviation of 0.363. The median is 0.400, and there are multiple modes. The coefficient of variation is 71.18 percent. The distribution is mildly positively skewed (2.614), and there is a very strong positive degree of kurtosis (7.799). Numbers 47, a thick-butted axehead, and 49, a chisel, are outliers, and number 45, a thick-butted adze, is an extreme.

WIDTH OF SMALLEST NEGATIVE. The average for all multifacial artifacts is 0.314, with a variance of 0.036, and a standard deviation of 0.190. The median is 0.260, and the mode is 0.400. The coefficient of variation is 60.51 percent. The distribution is mildly positively skewed (2.295), and there is a very strong positive degree of kurtosis (6.275). Number 45, a thick-butted adze, is an outlier.

DESCRIPTIVE ANALYSIS

Descriptions of Multifacial Artifacts

Chipped Axeheads

Chipped Axeheads were an important utilitarian and symbolic item in European Mesolithic and Neolithic societies. A distinctive feature of Neolithic axeheads, compared to Mesolithic ones, is that, after they are formed by flaking, the axeheads are ground and polished (Madsen 1984:48). The forms of these axe-heads in Denmark were influenced by the forms of flint, and later, copper and bronze, axe-heads from areas outside of Denmark. There are two main types of chipped axe-

heads: thin-butted and thick-butted (Madsen 1984). Each of these has variations in form, as well as occurring in various sizes. In the collection under study, there are nine thin-butted axe-heads, and seven thick-butted axe-heads, Six of the thin-butted belong to the Early Neolithic, three belong to the Middle Neolithic. Four of the Thick-Butted belong to the Middle Neolithic, and three belong to the Late Neolithic. Using Hansen and Madsen's (1983) stages of thin-butted axehead manufacture, nine of the axeheads in this collection belong to Stage 5, four to Stage 4 to 5; two to Stage 4, and one to Stage 3 to 4.

Early Neolithic Thin-Butted Axeheads

The Thin-Butted axehead has gently convex sides and edges (Glob 1952:86-87). Edges evenly slope to a thin, broad butt, creating a rectangular cross-section, or, in extreme cases, an oval cross-section. The blade is slightly curved. The surfaces are heavily polished, on all sides, although the butt end may be less so. They are typically between 10 and 20 centimeters. Shorter ones may be a result of resharpening. D. S. Olausson (Midgley 1992:282) has studied the lengths of thin-butted axeheads in relation to provenience, and has found that thin-butted axeheads found in hoards have an average length of 25.8 cm, while those found in graves have an average length of 15.2 cm.

The typical work-axe of the early Neolithic period, these axe-heads are found at settlement sites, as hoard items, in earth graves, and dolmens. Similar types are found throughout Western Europe. There is a two-sided type (Glob 1952, #116) which is derived from stone forms in Northern Germany, which, itself, is based on metal

axeheads. The transition of the two-sided type into flint, and the modification of it for efficiency's sake, meant that the form developed into a Nordic type (Glob, 1952, #115). The Thin-Butted axeheads in this collection are similar to Glob's #115, and #116. P. O. Nielsen (Midgley 1992:263-270) has developed a typology of thin-butted axeheads. There are seven types (I-VII), which are based on butt form. Type I through III have sharp butts, and Types IV through VII have blunt butts. Other important characteristics are the angles of the sides, the thicknesses of the butts, the shapes of the cross-sections, and the degree and placement of polish.

Number 1. Thin-Butted, Two-Sided Axehead.

Derived from Western European forms. Similar to #116 of Glob (1952:87). Axe Type C of Madsen (1984:49, Figure 1). Dates between 3500 to 3200 BC. From Kage Sø. Made of fine-grained flint, light yellow brown (2.5Y6/4). Length 14.40 cm.

Many visible scars, and only a slight evidence of polish. Stage 4 to 5: shaped in initial stages of manufacture, but without the grinding and polishing stage (Hansen and Madsen 1983:34, Figure 3). The cross-section is a pointed oval, with sharply curved surfaces which create thin sides and ends. Sides diverge gradually from butt-end, and are very straight. Ends are very curved, and in similar degrees of curvature to one another. Butt-end is about two-third as wide as cutting edge. Number 1 is an outlier for Number of Flake Negatives.

Number 2. Thin-Butted Axehead, Small.

Similar to #117 of Glob (1952::87). Axe Type C, Madsen (1984:49, Figure 1). Dates from 3500 to 3200 BC. From Randers. Made of fine-grained flint, mottled medium dark red brown and dark brown (10R4/2, 7.5YR5/2). Length 13.85 cm.

Sides are rough and not well developed. Scars are large, and visible, with some smoothing of edges of scars by grinding or polishing. Stage 4 to 5: evidence of initial stages of manufacture with initial grinding and polishing before more refined flaking for further shaping of the axehead. The cross-section is round. The sides are very straight, and nearly parallel. The butt-end is flat, is shaped by a single flake, and is not worked. The cutting end is very curved, and flairs. Butt-end is almost as wide as cutting edge.

Number 53. Thin-Butted Axehead, Large.

Similar to #115 of Glob (1952:87). Axe Type C, Madsen (1984:49, Figure 1). Dates from 3500 to 3200 BC. No provenience. Made of fine-grained flint, mottled black and tan (2.5Y3/0, 5Y4/2). Length 25.50 cm.

There are many visible scars, and no evidence of polish or grinding. Scars appear fresh and not smoothed. Stage 4: shaped in initial stages of manufacture, but without the grinding and polishing stage. The cross-section is a narrow oval , with curved surfaces which create blunt sides. Ends are tapered to thin points. Sides diverge gradually from butt-end, and are straight. Ends are very curved, and in similar degrees of curvature to one another. Butt-end is incomplete, but would be about two-third as wide as cutting edge. Similar shape to Number 1, but much larger. Number 53 is an extreme for Width of Largest Negative.

Number 54. Thin-Butted Axehead.

Similar to #115 of Glob (1952:87). Axe Type C, Madsen 1984:49, Figure 1). Dates from 3500 to 3200 BC. No provenience. Made of fine-grained flint, mottled light yellowish brown and medium reddish brown (2.5Y4/2, 10YR4/). Length 31.00 cm.

Scars are large, and visible, with some smoothing of edges of scars by grinding or polishing. Well developed form. Stage 4: shaped in initial stages of manufacture, but without the grinding and polishing stage. Sides are slightly curved , and butt-end is slightly narrowed. Maximum breadth is halfway between blade and middle of axe-head. The cross-section is an oval, with gently curved surfaces which create blunt sides. Surface tapers towards ends, so that maximum thickness is in the middle, and ends are considerably thinner than middle. Ends are very curved, and in similar degrees of curvature to one another. Cutting edge is incomplete. Butt-end is about two-third as wide as cutting edge. Number 54 is an outlier for Length and Number of Platforms, and an extreme for Weight and Direction of Negatives.

Number 55. Thin-Butted Axehead, Large, Fragment.

Similar to # 115 of Glob (1952:87). Axe Type C, Madsen 1984:49, Figure 1). Dates to 3500 to 3200 BC. No provenience. Made of fine-grained flint, mottled medium reddish brown and dark brown (5Y2.5/1, 10YR4/3). Length 12.20 cm, butt only.

Butt-end fragment. Stage 5: a completed axehead, but was broken. The cross-section is a narrow oval, with sharply curved surfaces which create blunt sides. Sides diverge gradually from butt-end, and are very straight. Very polished. Scars are mainly restricted to butt-end, large and visible, with smoothing of edges of scars by polishing.

Number 57. Thin-Butted Axehead, Large.

Similar to # 115 of Glob (1952:87). Axe Type C, Madsen (1984:49, Figure 1). Dates from 3500 to 3200 BC. No provenience. Made of fine-grained flint, gray with some reddish yellow (10YR7/1, 5Y4/1). Length 22.10 cm.

The cross-section is a narrow oval with curved surfaces which create blunt sides. Surfaces gradually slope towards ends. Stage 5: shaped in initial stages of manufacture, and then ground and polished. Cutting edge is much thinner than body of axehead. Sides diverge gradually from butt-end, and are slightly curved. Cutting end is very curved. Butt-end is irregular in form, and some scars are evident. Butt-end is about two-third as wide as cutting edge. Extensively polished. The few scars are small and smoothed by polishing.

Middle Neolithic Thin-Butted Axehead

This is a heavier, less polished version of the Early Neolithic types, and is considered to be directly derived from these types. It is from the first phases of the early Middle Neolithic, before the Passage Grave Culture. These are either found in settlements, or as stray finds, only. There is one specimen of this type in the collection.

Number 52. Heavy Thin-Butted Axehead.

Similar to #228 of Glob (1952:97). Axe Type D, Madsen 1984:49, Figure 1). Dates to around 3000 BC. No provenience. Made of medium-grained flint, medium yellow brown, (7.5YR5/6). Length 17.70 cm.

Lightly polished, sides are rough, scars are large, and visible, with some smoothing of edges of scars by grinding or polishing. Many visible scars, and only a slight evidence of polish. Stage 4 to 5: shaped in initial stages of manufacture, but with some grinding and polishing. The cross-section is a squared oval, with straight, thick sides. Sides diverge gradually from butt-end, and are curved, so that widest and thickest part is at the middle. Ends are very curved, and in similar degrees of curvature to one another. Butt-end is about two-thirds as wide as cutting edge.

Middle Neolithic Thick-Butted Axeheads --Passage Grave

Thick-Butted axeheads (Glob's #231) have straight or slightly curved sides, and side edges slope into a rectangular butt (Glob 1952:97). The cutting edge is slightly curved. The cutting edge and sides are completely polished, with much less polishing on the side edges, or none at all. The thin-bladed types (Glob's #232) have much less polishing, only at the cutting edges, and presence of flat flaking.

Axeheads of this type occur in the Passage Grave Culture of Scandinavia and Central Europe, and can occur in the Early Neolithic with the Thin-Butted, but are uncommon. They are found at settlement sites, and in burials, in the Passage Grave culture area and Central Europe.

Number 46. Thin Bladed Thick-Butted Axehead.

Similar to #232 Glob (1952:97). Axe Type F, Madsen 1984:49, Figure 1. Dates from 2800 to 2600 BC. No Provenience. Made of fine-grained flint, very dark brown/black (10YR5/2). Length 13.03 cm.

Highly polished on both sides, but with some scarring still present on side edges. Stage 5: scars are small, and visible, with smoothing of edges of scars by grinding or polishing. The cross-section is rectangular, with flat surfaces which create thick sides and butt-end. Surfaces gradually taper towards ends, so that maximum thickness is in the middle, and cutting end is considerably thinner than middle. The sides are well developed, straight, with slight inward curvature; they diverge gradually from butt-end, so that they form a narrow V-shape, which is truncated at the butt-end. The butt-end is flat, and about half as wide as the cutting end. The cutting end is slightly curved.

Number 47. Heavy Thick-Butted Axehead.

Similar to #231 of Glob (1952:97). Axe Type E, Madsen (1984:49, Figure 1). Dates from 2900 to 2800 BC. No provenience. Made of medium-grained flint, gray (10YR5/1). Length 18.00 cm.

Also occurs in the Passage Grave Culture of Scandinavia and Central Europe. Stage 5: polished on both sides, but with some scars still present on surfaces. Scars are large, with smoothing of edges of scars by grinding or polishing. The cross-section is rectangular, with flat surfaces which create thick sides and butt-end. Surfaces gradually taper towards ends, so that maximum thickness is in the middle, and cutting end is considerably thinner than middle. The sides are rough, with slight inward curvature; they diverge gradually from butt-end, so that they form a wide V-shape, which is truncated at the butt-end. The butt-end is flat, and about half as wide as the cutting end. The cutting end is slightly curved. Number 47 is an outlier for Length of Smallest Negative.

Middle Neolithic Thick-Butted Axeheads -- Single Grave

These Thick-Butted axe-heads (Glob's #383) are found in ground and bottom graves in Jutland. The difference between these axe-heads and the Passage Grave ones is that, in addition to being formed by flaking and polishing, they are also formed by crushing (Glob 1952:110). They have a thick butt and rectangular cross-section, but the polishing is usually restricted to the blade area, and is less extensive than that of the Passage Grave period. The edges and sides are very curved.

Number 41. Thick-Butted Axehead, Very Small/Whetstone.

Similar to #383 of Glob (1952:110). Axe Type F, Madsen 1984:49, Figure 1). Dates from 2800 to 2600 BC. No provenience. Made of fine-grained flint, medium yellow-brown (10YR4/4). Length 8.29 cm.

Appears to have been subsequently modified into a whetstone, so that the form and surface features are not original to the axehead (see further discussion under Whetstone category. One surface is very similar in appearance, form and texture to the working surface of the whetstone, Number 42. Stage 5 and further modifications: highly polished on both sides, but with some scars still present on side edges. The cross-section is trapezoidal. Sides are thick. Surfaces gradually taper towards ends, so that maximum thickness is in the middle, and cutting end is considerably thinner than middle. The sides diverge gradually from butt-end, and are curved. The butt-end is flat, and about half as wide as the cutting end. The cutting end is flat, and chipped.

Number 43. Thick-Butted Axehead, Small.

Similar to #383 Glob (1952:110). Axe Type F, Madsen (1984:49, Figure 1). Dates from 2800 to 2600 BC. No provenience. Made of fine-grained flint, light gray/white (10YR7/2). Length 8.05 cm.

Stage 4 and 5: polished on both sides, but with some scars still present on surfaces. Scars are small, with smoothing of edges of scars by grinding or polishing. The cross-section is rectangular, with flat surfaces which create thick sides and butt-end. Surfaces gradually taper towards ends, maximum thickness is slightly towards the cutting end, which is considerably thinner than the thickest part. The sides are rough,

straight, and are slightly curved; they diverge gradually from the butt-end, so that they form a very narrow V-shape, which is truncated at the butt-end. The butt-end is flat, and about two-thirds as wide as the cutting end. The cutting end is slightly convex.

Number 44. Thin Bladed Thick-Butted Axehead.

Similar to #387 of Glob (1952:110). Axe Type E, Madsen 1984:49, Figure 1). Dates from 2900 to 2800 BC. No Provenience. Made of fine-grained flint, light gray (2.5Y6/2). Length 11.90 cm.

Highly polished on both sides, but with some scarring still present on side edges and surfaces, especially towards the butt-end. Stage 5: some scars are large, with smoothing of edges of scars by grinding or polishing. The cross-section is rectangular, with flat surfaces which create thick sides and butt-end. Surfaces gradually taper towards ends, so that maximum thickness is in the middle, and cutting end is considerably thinner than middle. One side is well developed and straight, the other is rough, with slight inward curvature; they diverge gradually from butt-end, so that they form a wide V-shape, which is truncated at the butt-end. The butt-end is slightly curved, and about one-third as wide as the cutting end. The cutting end is very slightly curved. Number 44 is an extreme for Platform Kind.

Number 51. Thick-Butted Axehead.

Similar to #383 Glob (1952:110). Axe Type F, Madsen (1984:49, Figure 1). Dates from 2800 to 2600 BC. No provenience. Made of medium-grained flint, yellow brown (10YR6/3). Length 16.05 cm.

Polished on both sides, but with scarring still present on side edges and surfaces. There is a general rough aspect to this axehead. Stage 5: scars are large,

and visible, with smoothing of edges of scars by grinding or polishing. There is clear evidence of crushing by grinding. The cross-section is rectangular, with flat surfaces which create thick sides and butt-end. Surfaces gradually taper towards ends, so that maximum thickness is in the middle, and cutting end is considerably thinner than the middle. The sides are poorly developed, rough, with slight outward curvature; they diverge gradually from butt-end, so that they form a narrow V-shape, which is truncated at the butt-end. The butt-end is asymmetrical and flat, and about half as wide as the cutting end. The cutting end is slightly curved.

Late Neolithic Thick-Butted Axehead

These artifacts have a rectangular cross-section, and can have a very narrow, square butt (Glob 1952:126-27). The side edges and butt are finely flaked, and unpolished, while the sides are thoroughly polished. Usually much smaller than the earlier forms. These axeheads are usually found in cists in Denmark, and with bronze artifacts in Sweden. The typical Broad-Bladed axehead (Glob's #553) is most likely modeled after the contemporary bronze axehead (#555).

Number 3. Broad Bladed Thick butted Axehead.

Similar to #552 of Glob (1952:126-127). Axe Type G, Madsen (1984:49, Figure 1). Dates from 2500 to 2200 BC. From Sorø (d). Made of fine-grained quartz-like flint, very mottled in diagonal striped fashion, light gray/white, medium reddish brown, and dark brown/black (10YR7/4, 5Y4/1). Length 13.50 cm.

A flake appears to be missing from one of the surfaces, which may be a result of fracture during manufacture. Stage 3 to 4: there are many large scars, and there is

no evidence of polish. There is a general rough aspect to this axehead. This may signify that the axehead remained unfinished due to breakage. The cross-section is square, with surfaces which create thick sides and butt-end, so that butt-end is block-like. Surfaces gradually taper towards cutting-end, so that maximum thickness is in the middle, the butt-end is similar in thickness to the middle, and cutting end is considerably thinner than the middle. The surfaces and sides are poorly developed and rough. The sides diverge gradually from the butt-end, so that they form a narrow V-shape, which is truncated at the butt-end. The butt-end is asymmetrical, and about half as wide as the cutting end. The cutting end is curved and rough. Number 3 is an extreme for Width of Largest Negative.

Number 4. Broad-Bladed Thick-Butted Axehead.

Similar to #552 Glob (1952:126-127). Axe Type G, Madsen (1984:49, Figure 1). Dates from 2400 to 2200 BC. From Seeland. Found in cist burial. Made of fine-grained flint, medium brown and dark brown (7.5YR5/4, 10YR3/3). Length 10.55 cm.

Highly polished on both sides, but with some scarring still present on side edges and surfaces, especially towards the butt-end. Stage 5: some scars are large, with smoothing of edges of scars by grinding or polishing. The cross-section is square, with flat surfaces which create thick sides and butt-end, so that butt-end is block-like. Surfaces gradually taper towards cutting end, so that maximum thickness is in the middle, the butt-end is similar in thickness to the middle, and cutting end is considerably thinner than the middle. One side is well developed and straight, the other has an inward curvature; they diverge gradually from butt-end, so that they form a wide V-shape, which is truncated at the butt-end. The butt-end is flat, and

about half as wide as the cutting end. The cutting end is very slightly curved, and there is a slight flair to the sides.

Number 56. Broad-Bladed Thick-Butted Axehead.

Similar to #553 Glob (1952:126-127). Presumably modeled after continental bronze axehead (such as Glob's #555 and 556). Axe Type G, Madsen (1984:49, Figure 1). Dates from 2400 to 2200 BC. No provenience. Made of fine-grained flint, very dark brown (2.5Y5/2). Length 9.40 cm.

Polished surfaces, but with scarring still present on side edges, and surfaces, especially towards the butt-end. Stage 5: some scars are large, with smoothing of edges of scars by grinding or polishing. The cross-section is square, with flat surfaces which create thick sides and butt-end, so that butt-end is block-like. Surfaces gradually taper towards cutting-end, so that maximum thickness is in the middle, and butt-end is similar in thickness to the middle, and cutting end is considerably thinner than middle. Sides are rough. Sides are straight at butt-end, then curve to create flairs at cutting-end. Form is a general truncated V-shape, but with strong flairing of cutting edge. The butt-end is flat, and about one-third as wide as the cutting end. The cutting end is strongly curved, but almost half of the blade is missing due to fracture. Number 56 is an outlier for Number of Flake Negatives.

Chisels

The flint chisel is one of the most commonly found artifacts in passage graves (Glob 1952:98). It is also frequently found at settlement sites. These artifacts are made in a similar way as the axeheads, but with a different form. They are often thoroughly polished, and, at the same time, and in the same context, can be only polished at the

tip. There are three general forms: a four-sided, which is most common, a one-sided, and a thick form, these last two uncommon. The earliest form is slim and thin-butted. In this collection, chisels Number 10 and Number 48 are of the four-sided Early Neolithic form.

Number 10. Four-Sided Thin-Butted Chisel.

Similar to Glob's (1952:98) #247; and to #250, but not bent. Early Neolithic. From Seeland. Made of fine-grained flint, mottled in stripes, gray-white, reddish medium brown, and dark brown (10YR7/2, 5Y6/2). Length 14.90 cm.

The sides are highly polished so that the half of the chisel that is towards the tip is very rounded, and the cross-section is a rounded rectangle. The half towards the butt-end is square in cross-section, is not polished, and has many scars. The sides are parallel, and diverge slightly and gradually from butt-end and then converge at the tip. Butt-end is flat and straight. Cutting edge is straight and flat; it is highly polished, straight and narrow. Number 10 is an extreme for Platform Kind and Length/Width Index.

Number 48. Four-Sided Thin-Butted Chisel.

Similar to Glob's (1952:98) #247, but not extensively polished. Early Neolithic. No provenience. Made of fine-grained flint, light gray (10YR6/1). Length 17.30 cm.

The sides are rough, and unpolished, with many scars. Scars show only a little smoothing from grinding or polishing. The sides are parallel, and diverge slightly and gradually from butt-end and then converge at the tip. The tip is polished. The cutting edge is straight and flat. Butt-end is flat and straight. It is straight and narrow, and the cross-section is square. Number 48 is an extreme for Direction of Negatives, Platform Kind, and Length/Width Index.

Number 49. Thick-Butted Chisel.

Similar to Glob's #389 (Glob 1952:110-111). It dates to the Battleaxe Culture, and is often found in the bottom graves of the Middle Neolithic. Chisels of this kind, like the axeheads of the Late Neolithic, are made, in part, by crushing the sides. They are found in Middle and West Jutland. This specimen in the collection is similar to a strike-a-light (Glob 1952:131, #633), but the strike-a-light was not made with crushing, and the point is different. No provenience. Made of fine-grained flint, chalky, light gray/white (5Y8/1). Length 18.70 cm.

The sides are rough, and unpolished, with many scars. Scars show evidence of grinding. One side is straight, the other exhibits considerable curvature. It is thick. The cross-section is generally square, but irregular. The widest and thickest part is the butt-end. Sides gradually converge at the tip. The cutting edge is flat and irregular. The butt-end is curved and thick. Number 49 is an outlier for Length of Smallest Negative, and an extreme for Direction of Negatives, and Width of Largest Negative.

Pick/Adze

Like the chisels, the pick and adze also have methods of manufacture like that of the ground stone axeheads. According to Glob (1952), #385-86 occur with the East Danish Single Grave Culture on the Danish islands and northern and eastern Jutland, and rarely in central Jutland. These were brought into Denmark during the invasions from Holstein and Northern Germany.

Number 35. Pick.

Tip and edge treatment is similar to Mathiassen's (1948:55, 57) # 46, and butt is like Mathiassen's # 64. Mesolithic. No provenience. Made of fine-grained flint, mottled light gray and dark gray (N6/). Length 12.31 cm.

Surfaces and edges are rough and not well developed. Scars are large, and visible, with no evidence of polish. Unlike Neolithic multifacial implements, Mesolithic multifacial implements were not polished, and lack of polish is not evidence of an unfinished implement. Therefore, this pick represents a completed tool. It is three sided, and the cross-section is in the form of a triangle, with two sides curved. These two surfaces taper towards ends, and the third surface, the base, is flat and formed by one large scar. The maximum thickness is in the middle, and ends are considerably thinner than middle. Sides diverge from butt-end, are then generally parallel, and then converge at the tip, to create a very pointed tip. The tip is strongly pointed, and the butt is curved.

Number 50. Adze.

Similar to Mathiassen's (1948:56) #55, and Clark's (1975:182) Figures 41 and 48. Mesolithic. No provenience. Made of fine-grained flint, mottled medium reddish brown and dark brown (2.5YR4/2, 7.5YR4/6). Length 15.50 cm.

Surfaces and edges are rough and not well developed. Scars are large, and visible, with no evidence of polish. Unlike Neolithic multifacial implements, Mesolithic multifacial implements were not polished, and lack of polish is not evidence of an unfinished implement. Therefore, this adze represents a completed tool. This tool is generally three-sided, but the top surfaces are worked with large scars, so that they

are not clearly distinguishable. Bottom surface is relatively flat, and is formed by one large scar. Top surfaces are strongly curved to form a rounded triangle cross-section. The maximum thickness is in the middle. The butt-end is considerably thinner than the middle. The sides gradually diverge from butt-end, and form a general truncated V-shape. One side is slightly curved outward, but generally straight. The other side expands more widely from the butt-end. The cutting-end is incomplete, the blade was broken. The butt-end is poorly developed, and irregular.

Number 45. Thick-Butted Adze.

Similar to #385 of Glob (1952:110), and Ebbessen's (1984:128), Figure 6b, but wider. Middle Neolithic Battle-Axe and Passage Grave. No provenience. Made of medium-grained flint, yellow gray brown (10YR5/1). Length 16.90 cm.

The scars are large, and there is evidence of grinding and polishing. The surfaces and edges are rough, and the texture is sandy. This adze is four-sided, and has a rectangular cross-section. The features of this adze are well developed. The sides gradually diverge from the butt-end, and form a general truncated V-shape. Before the tip of the cutting-edge, the sides on one surface turn towards the other surface, meet the sides of that surface, and form a distinct flat surface at the cutting-end, This flat surface was well ground and polished, and creates a cutting-edge which is thin and smooth. The sides are straight, and well developed. The surface with the flat surface at the cutting-edge in relatively straight, while the opposite surface is convex, so that the adze appears bent in the middle, in profile view. The maximum thickness is in the middle, at the point of this "bend". The butt-end is considerably thinner than the middle, and it is rectangular in cross-section. It is distinct from the

body of the axehead since there is modification by flaking, grinding, and polishing, so that there is a slight ledge at the juncture of the butt-end and the body.

Whetstones

Number 42 is clearly a whetstone. In addition, Number 41, a small chipped stone axehead, described above, appears to have been modified into a whetstone. This axehead has one surface, which is smooth, and similar in form to the working edge of the other whetstone. Whetstones were used in the manufacture of ground stone axe-heads and bronze artifacts, to smooth rough surfaces.

Number 42. Whetstone.

Similar to Figure 539 of Evans (1881:452), but without perforation, the symmetrical overall forms, and quared ends. Neolithic and Bronze Age. No provenience. Made of fine-grained flint, reddish brown (7.5YR4/2). Length 11.78 cm.

The whetstone is highly polished on all surfaces. The sides are parallel and thick, and the cross-section is rectangular. One end is very rounded. The other end is flat; the sides do not end at the same point, so that the end is not straight across, but at an angle to the length. The surfaces are flat and straight. Maximum thickness is towards the rounded end. One surface is very smooth, and signifies extensive use: it is similar in appearance, form and texture to the working surface of the axehead, Number 41, see above, which shows evidence of having been modified into a whetstone.

FUNCTIONAL AND STYLISTIC ANALYSES

Multifacial artifacts in this collection are not analyzed with the same variables as the Unifacial and Bifacial artifact groups. Therefore, interpretations of their functions are based on those in the literature. Axeheads can be used for chopping, levering, or scraping. Picks are used for picking and levering. Adzes and chisels are used for scraping (Olausson 1983a and b).

The thin-butted and thick-butted axeheads have some elements of stylistic variation. This can be seen in the change from thin to thick butts, and the derivation of the flairing blade from bronze counterparts for the later thick-butted axeheads. Most of the variation within time periods is due to workabiility and isochresticism. There is some possible stylistic variation in the chisels, adzes and pick, although most variation is due to workability and isochresticism.

CHAPTER VI

MISCELLANEOUS ARTIFACTS

There are several other artifacts in the collection that do not clearly fall into the above categories; these are presented here.

GROUNDSTONE AXEHEADS

There are six (6) ground stone axeheads used in this analysis. These are numbers 45-6,7, 8, 58, and 59. In addition, number 119, from Accession 2, is a Danubian groundstone axehead.

Groundstone axeheads have been used by archaeologists to identify a prehistoric cultural group we call the Battle-Axe Culture. Groundstone battle-axeheads have been found in Early Neolithic as well as Middle Neolithic contexts (Glob 1952:85). The earliest forms were based on Central European battle-axeheads (Glob 1952). Early LBK axeheads are called Danubian Shaft-Holed Axes (Fischer 1982), and are similar to number 2-119. In turn, these ground stone axe-heads, like the daggers, were influenced in form by bronze equivalents (Bordaz 1970:101,104; Glob 1952:84).

The form and styles of the axeheads changed through time. The earliest Early Neolithic axeheads have shaftholes which are oval, rather than round, like later ones (Glob 1952:85). There were also raised ridges on the upper and lower surfaces, which

apparently imitate casting seams of bronze counterparts. Dating to the later Early Neolithic, there are two general forms identified by archaeologists. The first form, like Danubian axeheads, has a flat upper and lower surfaces, and occurs in western Germany and along the Rhine to Switzerland (Glob 1952:85). The second form has a knob-like butt, and occurs in eastern and central Europe and Russia.

Middle Neolithic Passage-Grave axeheads are much more symmetrical, in relation to the blade and butt ends, although the butt-ends are not blade-shaped (Glob 1952:96-97). These are found throughout Denmark, and central and western Europe, and are interpreted as imitations of metal double-axes.

There are a great variety of forms and styles of axeheads dating to the Middle Neolithic Single Grave/Battle-Axe Culture (Glob 1952:97). Early forms have convex upper surfaces and concave lower surfaces; the butts are round, and the cross-sections are rounded or pointed ovals, or, later, rectangular. There are also vertical ridges or encised lines by the shafthole on some of the axeheads. These are found in the earliest bottom grave burials. Later forms are more symmetrical in relation to blade and butt and also have incised lines. These are found in later bottom, ground, and upper graves.

Statistical Analysis of Groundstone Axeheads

The following are the statistical results for the Groundstone Axeheads. These include Identifying Characteristics, Metric Variables and Indexes. Histograms, for the Groundstone Axeheads, of Metric Variables and Indexes, are in Appendix D.

Identifying Characteristics -- Groundstone Axeheads

The Identifying Characteristics for Groundstone Axeheads are listed in Table 21. These axeheads are made of hard stone, including basalt and gyprock. Three are coarse, two are fine, and one is medium-grained. The Primary Color is predominantly around 2.5Y5/2. All are complete.

TABLE 21. IDENTIFYING CHARACTERISTICS FOR GROUNDSTONE AXEHEADS.

LBK: Linearbandkeramik, EN: Early Neolithic, MN: Middle Neolithic, LN: Late Neolithic, SGC: Single Grave Culture, DP: Dagger Period. RM: Raw Material, F: Fine Grained, M: Medium Grained, C: Coarse Grained. COL1: Primary Color. COL2: Secondary Color. PRT: Part, 4: Complete. CIT: Citation, from Glob 1952, Fischer 1982. See Qualitative Analysis Section Below For Specific References.

NO.	TYPE	PERIOD	RM	STONE	COL1	COL2	PRT	CIT
6	BATTLE	MN SGC	F	BASALT	2.5Y3/0		4	347, 342
7	BATTLE	MN SGC	M		10YR4/2		4	347
8	BATTLE	MN SGC	F		10YR7/1		4	336, 338
58	BATTLE	EN	C	GYPROCK	2.5Y6/2		4	102
59	SHAFT-H	LN DP	C		2.5Y5/2		4	544
119	DANUB	LBK	C		5Y5/2	10YR3/1	4	1

Metric Variables -- Groundstone Axeheads

Table 22 presents the summary statistics and the coefficients of variation, skewness and kurtosis for the Grounstone Axeheads. These include Metric Variables and Indexes.

Variable.

LENGTH. The average for all groundstone axeheads is 14.610, with a variance of 9.298, and a standard deviation of 3.049. The median is 13.845, and there are multiple modes. The coefficient of variation is 20.88 percent. The distribution is slightly positively Skewed (0.601), and there is a mild negative degree of Kurtosis (-1.029).

TABLE 22. SUMMARY STATISTICS OF METRIC VARIABLES FOR GROUNDSTONE AXEHEADS.

SD^2: Variance, SD: Standard Deviation, SE: Standard Error of the Mean, MED: Median, MOD: Multiple. CV: coefficient of variation, in percentages. SKEW: Skewness, KURT: Kurtosis. See Chapter II for abbreviations for Variables.

VARIABLE	MEAN	SD^2	SD	SE	MED	MOD	CV	SKEW	KURT
LENGTH	14.61	9.29	3.05	1.25	13.85	MUL	20.88	0.60	-1.03
WIDTH	5.00	0.79	0.89	0.36	5.18	MUL	17.80	-1.798	3.76
THICKNESS	4.65	0.92	0.96	0.39	4.98	MUL	20.65	-0.88	-0.15
WEIGHT	365.07	25,807.63	160.65	65.58	411.60	MUL	44.01	-0.46	-1.32
LWINDEX	29.73	39.53	6.29	2.57	30.55	MUL	21.16	-0.16	-1.83
WTINDEX	10.84	0.85	0.919	0.38	10.69	MUL	8.48	1.91	4.11
LTINDEX	32.16	46.17	6.795	2.77	34.34	MUL	21.13	-0.57	-1.60

WIDTH. The average for all groundstone axeheads is 5.003, with a variance of 0.795, and a standard deviation of 0.892. The median is 5.180, and there are multiple modes. The coefficient of variation is 17.80 percent. The distribution is mildly negatively Skewed (-1.798), and there is a strong positive degree of Kurtosis (3.760).

THICKNESS. The average for all groundstone axeheads is 4.647, with a variance of 0.9197, and a standard deviation of 0.959. The median is 4.975, and there are multiple modes. The coefficient of variation is 20.65 percent. The distribution is slightly negatively Skewed (-0.884), and there is a slight negative degree of Kurtosis (-0.146).

WEIGHT. The average for all groundstone axeheads is 365.067, with a variance of 25,807.63, and a standard deviation of 160.648. The median is 411.600, and there are multiple modes. The coefficient of variation is 44.01 percent. The distribution is slightly negatively Skewed (-0.461), and there is a mild negative degree of Kurtosis (-1.323).

Indexes -- Groundstone Axeheads

Index.

LENGHT/WIDTH INDEX. The average for all groundstone axeheads is 29.728, with a variance of 39.534, and a standard deviation of 6.288. The median is 30.551, and there are multiple modes. The coefficient of variation is 21.16 percent. The distribution is slightly negatively Skewed (-0.155), and there is a mild negative degree of Kurtosis (-1.831).

WIDTH/THICKNESS INDEX. The average for all groundstone axeheads is 10.840, with a variance of 0.8445, and a standard deviation of 0.919. The median is 10.69, and there are multiple modes. The coefficient of variation is 8.48 percent. The distribution is mildly positively Skewed (1.906), and there is a strong positive degree of Kurtosis (4.109).

LENGTH/THICKNESS INDEX. The average for all groundstone axeheads is 32.16, with a variance of 46.166, and a standard deviation of 6.795. The median is 34.336, and there are multiple modes. The coefficient of variation is 21.13 percent. The distribution is slightly negatively Skewed (-0.572), and there is a mild negative degree of Kurtosis (-1.602).

Descriptive Analysis of Groundstone Axeheads

Groundstone Axeheads

Number 6. Battle-axe(head).

Similar in general form, butt and incised vertical lines to #347, (Glob 1952:106), but with the facetting of #342 (ibid:107). Commonly found in later bottom graves and ground graves in southwestern and central North Jutland. Dates to the Middle Neolithic Single Grave/Battle-Axe Culture. From a stone cist burial in Jutland, dating to around 2000 B. C. (1949 date). Between 3000/2800 to 2300 B.C., modern dates. Made of fine-grained very dark gray/black basalt (2.5Y3/0). Length 17.40 cm.

All surfaces are very smooth, and finely ground and polished. Overall form is a slightly asymmetrical diamond, with a slightly rounded base. The sides diverge gradually from butt-end, so that they form a V-shape, with a rounded base at the

butt-end. The sides then bend, about midway along the body, to form an inverted, and slightly longer triangle, with a sharp point at the top. The bottom surface is recessed, with a raised ridge along the sides. The sides are thick, and the surfaces of the sides are steep and slightly rounded. The top surface is slightly concave, and the bottom surface is strongly concave, so that the butt-end and cutting-end are considerably thicker than the middle. The maximum thickness is at the cutting-end, and the butt-end is slightly thinner than the cutting-end. The butt-end is rounded, and is distinct from the body by a fine incision along either side of the butt. The narrowest part of the body is the cutting end. The butt-end is slightly wider than the cutting-end. The widest part is at about the middle, at the shaft-hole. The cutting-end has a curved profile, is generally very smooth, but has a slight indentation or chip. The butt-end has a very slightly curved profile. The shaft-hole is at the widest point, and is well formed. The width of the hole is about half of the greatest width. At the juncture of the upper and lower triangles, at the widest part of the diamond shape, there are two fine incisions on the surfaces of the sides. The incisions are perpendicular to the top and bottom surfaces, and run from one surface to the other. The cross-section of the widest point is rectangular.

Number 7. Battle-axe(head).

Similar in butt and incised vertical lines to #347, (Glob 1952:106). Commonly found in later bottom graves and ground graves in southwestern and central North Jutland. Dates to the Middle Neolithic Single Grave/Battle-Axe Culture. From a stone cist burial in Jutland, around 2000 B. C. (1949 date). Between 3000/2800 to 2300 B.C., modern dates. Made of medium-grained yellow brown stone (10YR4./2). Length 19.10 cm.

All surfaces are very smooth, and finely ground and polished. Overall form is an asymmetrical diamond, with a slightly rounded base. The sides diverge gradually from butt-end, and are slightly concave, so that they form a V-shape, with concave sides, and a rounded base at the butt-end. At just over one-third of the length of the body, the sides curve, and then form an inverted, and longer triangle, with a sharp point at the top. At the juncture of these triangles, the sides are rounded, with a slight pointing of the sides. The bottom surface is slightly recessed, with a raised ridge along the sides. The sides are thick, and the surfaces of the sides are steep and slightly rounded. The top surface is slightly concave, and the bottom surface is strongly concave, so that the butt-end and cutting-end are considerably thicker than the middle. The maximum thickness is at the cutting-end, and the butt-end is slightly thinner than the cutting-end. The butt-end is slightly rounded and wide. The butt-end is distinct from the body by a fine incision along either side of the butt. The narrowest part of the body is the cutting end. The butt-end is slightly wider than the cutting-end. The widest part is at about the middle, at the shaft-hole. The cutting-end has a curved profile, and is very smooth. The butt-end has a very slightly curved profile. The shaft-hole is at the widest point, and is well formed. The width of the hole is at least half of the greatest width. The cross-section of the widest point is rectangular.

Number 8. Battle-axe(head).

Similar profile and butt form to #336 (Glob 1952:106), but with similar form to #338. They have been found in central and west Jutland, usually in graves, often in bottom or ground graves. Dates to the Middle Neolithic Single Grave/Battle-Axe Culture. From a stone cist burial in Jutland, from about 2000 B. C. (1949 date).

Between 3000/2800 to 2300 B.C., modern dates. Made of fine-grained light grey stone (10YR7/1). Length 12.37 cm.

All surfaces are very smooth, and finely ground and polished. Overall form is a slightly asymmetrical, truncated diamond, with a flat base. The sides diverge gradually from butt-end, so that they form a truncated V-shape, with a flat base at the butt-end. At about half-way along the body, the sides then gradually converge to a sharp point, and form an inverted triangle. The surfaces are smooth, and the edges of the sides are slightly rounded. The sides are thick, and the surfaces of the sides are steep and slightly rounded. The top surface is slightly convex, and the bottom surface is strongly concave. The greatest thickness and width are at the middle. The butt-end is slightly thicker than the middle, and the cutting-end is slightly thicker than the butt-end. The butt-end is square in cross-section, and is generally flat, with some curvature. The narrowest part of the body is the cutting end. The butt-end is about two-thirds as wide as the greatest width. The cutting-end has a very curved profile, and is very smooth. The butt-end has a very slightly curved profile. The shaft-hole is at the middle, it is about half the width of the greatest width, and is well formed and narrow. The cross-section of the widest point is rectangular.

Number 58. Battle-Axehead.

Similar profile and form to #102 (Glob 1952:86), but without the broad groove; found throughout Denmark, especially earth graves in Jutland. Dates to the late Early Neolithic. Made of coarse-grained yellow gyprock (2.5Y6/2). Length 13.70 cm.

All surfaces are very smooth, and finely ground and polished. Overall form is an asymmetrical, truncated diamond, with concave sides, and a flat, slightly rounded, base at the butt-end. The sides diverge gradually from butt-end, so that they form a

truncated, slightly concave, V-shape, with a flat base at the butt-end. At about one-third of the length of the body, the sides are very convex, and then converge to form an inverted, and longer triangle, with slightly convex sides, and meet at a sharp point at the top. At the juncture of these triangles, the sides are convex, and are very rounded and smooth. The surfaces are smooth, and the edges of the sides are very rounded. The sides are thick, and the surfaces of the sides are steep and slightly rounded. The top surface is slightly convex, and the bottom surface is slightly concave. The greatest thickness and width are at the middle. The butt-end is slightly thinner than the middle, and the cutting-end is slightly thicker than the butt-end. The butt-end is round in cross-section, and is generally flat, with some curvature. The narrowest part of the body is the cutting end. The butt-end is about half as wide as the greatest width. The cutting-end has a curved profile, and is very smooth. The butt-end has a very slightly curved profile. The shaft-hole is about half the width of the greatest width, and is well formed and narrow. The shaft-hole is at about two-fifths of the length of the body. The cross-section of the widest point is a wide oval with flat top and bottom sides.

Number 59, Shaft-Holed Axehead.

Similar to #544 (Glob 1952:126). These axeheads are imitations of early bronze forms. They date to the Late Neolithic Dagger Period. No provenience. Made of coarse-grained medium brown grey stone (2.5Y5/2). Length 13.98 cm.

All surfaces are very smooth, and finely ground and polished. Overall form is a very truncated diamond, with very convex sides and a very flat and wide base. The sides diverge steeply from butt-end. At about one-third along the body, the sides run

parallel, and then at about two-thirds along the body, the sides gradually converge to a sharp point. The surfaces are smooth, and the edges of the sides are rounded. The sides are very thick, and the surfaces of the sides are very steep and slightly rounded. The top and bottom surfaces are convex. The greatest thickness is at the middle, and the greatest width is at about two-fifths of the length of the body. The butt-end is thinner than the middle, and the cutting-end is slightly thicker than the butt-end. The butt-end is square in cross-section, and is generally flat, with some curvature. The narrowest part of the body is the cutting-end. The butt-end is about two-thirds as wide as the greatest width. The cutting-end has a slightly curved profile, and is very smooth, with a small chip. The butt-end has a very slightly curved profile. The shaft-hole is at about two-fifths of the length of the body. The shaft-hole is about half the width of the greatest width, and is well formed and wide. The cross-section of the widest point is a wide oval with flat top and bottom sides.

Number 2-119. Danubian Shaft-Holed Axehead.

Similar to Danubian axeheads (Fischer 1982:8, figure 1). The provenience for this artifact is not known. It is not part of Wulff's collection. May date to Ertebolle in Denmark, or Linearbandkeramik in Central Europe. Made of coarse-grained medium brown grey stone (5Y5/2, 10YR3/1). Length 11.10 cm.

All surfaces are smooth, and ground and polished. Overall form is a triangle, with rounded corners as the base. The sides run parallel from butt-end, and are slightly convex. At about half-way along the body, the sides then gradually converge to a sharp point. The surfaces are smooth, and the edges of the sides form ninety-degree angles. The sides are thick, and the surfaces of the sides are very steep and straight. The top and bottom surfaces are very flat and straight. The greatest width is

toward the base. The thickness is uniform across and along the body, so that the butt-end, the middle, and the tip are about the same thickness. The butt-end is rectangular in cross-section, with slightly convex sides. The narrowest part of the body is the cutting end. The butt-end is slightly narrower than the greatest width. The cutting-end has a slightly curved profile, and is very smooth. The butt-end has a very slightly curved profile. The shaft-hole is about half the width of the greatest width, and is well formed and wide. The cross-section of the widest point is rectangular, with slightly convex sides. The shaft-hole is at about one-third the length of the body.

BRONZE AND STONE ARTIFACTS

Bronze Artifacts

These items were most likely grave goods, rather than hoard items (Janet Levy, personal communication). The pin and bracelet are from the same period, and could have been found in the same grave. The raw materials are interpreted as copper and tin since most Danish bronze was made with these (Liversage 1993). Weights were taken with a digital scale.

Bronze Artifacts

Number 60. Ring.

Similar to gold ring, Plate 13, A, number 2 (Randsborg 1972). Period III to IV. This is a common ring form, dating from the Late Neolithic and continuing through the Bronze Age (Broholm 1952; Randsborg 1972; Jensen 1982). No provenience. Made of

copper and tin (2.5YR3/0). Length 2.13 cm, Width 1.97 cm, Thickness 1.17 cm, Circumference 6.21 cm, Length of wire 24.0 cm, Thickness of wire 0.17 cm, Diameters of end-circles 0.32 and 0.31 cm, Weight 2.9 grams.

Made with a single wire, which was wound in a circular spiral, so that it meets the same point almost five times, and forms four lines of bronze wire. The ends are curved to form circles at the ends of the wire. The wire is well formed and well rounded.

Number 61. Double-Button/Stud.

Appears to be a Nortvig Type double-button, similar to number 2, Plate 28, of Randsborg (1972:52). This type occurs in southern Denmark and northwestern Germany. Dates to Periods III to IV of the Bronze Age. Double-buttons may be used to attach a sword, or perhaps a dagger, sheath to a belt (Olsen 1990:149, Figure 15). No provenience. Made of copper and tin (2/5YR3/0). Length 2.22 cm, Weight 3.4 grams.

The poor condition of this button prevents detailed identification. The double-button in this collection is badly corroded, but appears to have concentric circles around the base of a vertical projection from the surface.

Number 62. Cuff-Shaped Bracelet.

Similar to Plate 15, number B 2 (Randsborg 1972:55-56, 99). These are found in northwest Jutland. Dates to Periods III to IV of the Bronze Age. No provenience. Made of copper and tin (2.5YR2.5/0). Length 6.48 cm, Width 5.18 cm, Thickness 1.53 cm, Circumference 18.1 cm, Weight 32.7 grams.

Made from a strip of bronze which is curved to form a circle. The ends of the strip meet and are pinched and welded together. There are a series of six (6) horizontal, concentric ridges on the exterior surface which run around the exterior. The two outer ridges are larger than the ones within the surface of the body. The interior is very smooth, with two vertical ridges at the seam. These designs were most likely formed with a punch-technique (Levy 1982).

Number 63. Pin.

The pin in Broholm's (1952) illustration #261 is very similar, except that the head of this one is pointed up, and the one in Broholm is turn "forward". Broholm's pin is rare in Denmark. They are imported, from northern and eastern Germany, and in Sweden. Dates to the Sixth Period of the Bronze Age (Broholm 1953:82, #261). Also similar to #1315 of Montelius (1917:87), except that this pin has two horizontal, concentric rings just bellow the head, not a series of wound lines. Dates to Period V. Made of copper and tin (2.5YR2.5/0). Length 11.36 cm, Length of shank 11.0 cm, Thickness of shank 0.25 cm, Diameter of cup 1.13 cm, Height of cup 0.38 cm, Weight 4.7 grams.

The shank is long, thin, and straight. It is well developed, and circular in cross-section. The thickest part of the shank is at about two-thirds of the length of the shank from the point. The head is shaped like a shallow cup, and is pointed upward. There are two horizontal, concentric rings just bellow the head. The point is very sharp.

Number 64. Socketted Axe-Head.

Similar to Plate 16, number 9 (Broholm 1949). Also similar to #VII C 1b of Baudou (1960). Dates between Periods III and VI (Broholm 1977), and probably to Period V by proportions (Levy, personal communication). No provenience. Made of

copper and tin (2.5Y3/0). Length 6.58 cm, Width of socket 3.99, Thickness of socket 3.15 cm, Weight 64 grams.

The sides diverge from the neck. They curve slightly to meet the cutting-end. The cutting-end is slightly convex. There are two ridges which run the circumference of the side of the mouth of the socket. There is a small loop of bronze from the mouth of the socket to just below the lower ridge.

Stone Artifacts

Netweight/Hammerstone

Number 9. Netweight.

Similar to Broholm (1953:96, #456; Broholm identifies this as an axehead). Period 6 of the Late Bronze Age. No provenience. Made of medium grained yellow tan stone (2.5Y6/2). Length 11.56 cm, Width 5.22 cm, Thickness 2.62 cm, Weight 159.8 grams.

Also called a club head or axehead. Ground. Sides diverge straight from base, they then curve, in a convex fashion, and then converge to a dull point. Base is flat. Hole is slightly off-set from center of body. Relief design of swirling lines on top surfaces.

Number 40. Hammerstone.

Similar to Bordaz (1970:104, fig. 51). Neolithic through Bronze Age. No provenience. Made of fine-grained yellow tan stone, possibly flint (10YR7/1). Diameter 6.4 cm, Weight 296.2 grams.

The overall form is a sphere. There are many small scars visible. It was used as a pecking stone. Hammerstones originate in contexts when ground tools, such as ground stone axeheads, were made. They were used to shape stone or bronze.

FUNCTIONAL AND STYLISTIC ANALYSES

Based on the literature sources, the functions of the ground stone axeheads are basically the same as the chipped flint axeheads (Olaussen 1983a and b). They were used for chopping, levering, and scraping. Likewise, the bronze sacketted axehead was likely used for chopping. The hammerstone was used in the manufacturing processes of flint and bronze. The function of the netweight is largely indeterminant in the literature. The pin and double-button were most likely used to keep clothes on, with the double-button also being used with belts to attach daggers or swords to a belt.

With respect to stylistic interpretations, the groundstone axeheads exhibit considerable temporal and geographic stylistic variation, as well as variation attributable to derivation, workability, and isochrestic variation. The variation in hammerstones is most likely attributable to workability and isochrestic variation, with no stylistic variation. The netweights do contain stylistic variation, with some designs on netweights having aquatic symbols.

All of the bronze objects in this collection have some variation which is derivative, although much of stylistic variation in Denmark's bronze working was developed within Denmark. The socketted axeheads have little stylistic variation, but considerable isochrestic variation, and some variation due to workability. The

remainder of the bronze objects are largely jewelry, and, thus, necessarily contain style (Wiessner 1983). There is also isochrestic variation which is stylistic in these bronze items.

SECTION III:

BETWEEN-GROUP ANALYSES AND CONCLUSIONS

CHAPTER VII

BETWEEN-GROUP STATISTICAL COMPARISONS

This chapter illustrates that the three groups of Unifacial, Bifacial, and Multifacial artifacts differ from one another in attributes relating to form and function. There is evidence for variation within each of the three artifact groups. This is shown by comparisons of the coefficients of variation, skewness, kurtosis, and chi-square test results from within the groups.

Chi-square tests of homogeneity between the groups further illustrate the differences and similarities between these groups. The general hypotheses for the chi-square tests of homogeneity are:

Ho: The groups are homogenous

Hr: The groups are not homogenous

These tests of homogeneity are conducted for the three groups for the Surface Features; and for the Unifacial and Bifacial artifact groups for the Retouch Variables. Because of the small sample sizes in this collection, most of these chi-square tests of homogeneity are questionable. Therefore, Guttman's coefficient of predictability (Lambda, λ) is calculated as a measure of association between the variables and the three groups of artifacts.

WITHIN-GROUP COMPARISONS

Set A Variables

Metric Variables, Indexes, and Base Angles

Coefficients of Variation.

The coefficients of variation for the Metric Variables exhibit differences between the groups in the degree of variation that exists within these groups. The coefficients of variation are greater than one-hundred percent for Weight for Unifacial artifacts and Multifacial artifacts. The coefficient of variation for Length of Unifacial artifacts is greater than fifty percent. Weight for Bifacial artifacts, and Thickness for Multifacial artifacts have coefficients of variation greater than forty-percent. The remainder of the Metric Variables (Width and Thickness for Unifacial artifacts, Length, Width, and Thickness for Bifacial artifacts, and Length and Width for Multifacial artifacts) have coefficients of variation between twenty and forty percent. The coefficients of variation for Width for each of the three groups are very similar, between thirty-five and forty percent.

Like the Metric Variables, the coefficients of variation of the Indexes also exhibit differences. The Length/Width Index for Unifacial artifacts has a high coefficient of variation, at about seventy-six percent. The Length/Width Indexes for Bifacial and Multifacial artifacts are about thirty and forty percent, respectively. The Length/Thickness Index has a coefficient of variation of about forty-seven percent. Both of the Length/Thickness Indexes for Bifacial and Multifacial artifacts are about thirty to thirty percent. The Width/Thickness Indexes for the three groups are all between thirty and forty percent.

There are considerable differences between the coefficients of variation for the Base Angles of the three groups. The coefficient of variation of the Right Base Angle for Bifacial artifacts is forty-five percent. In contrast, the coefficient of variation of the Right Base Angle for the Multifacial artifacts is very small, at about eight percent. For the Unifacial artifacts, the Right and Left Base Angles have very similar coefficients of variation, around nineteen percent. The coefficients of variation of the Left Base Angles for the Bifacial and Multifacial artifacts are between twenty and thirty percent.

Skewness and Kurtosis.

Variation can be seen in the degrees of skewness and kurtosis for each variable within each group. For the Metric Variables, there is slight to mild degrees of skewness for each variable, within each group. Length is mildly positively skewed for the Unifacial and Multifacial artifact groups, and only slightly negatively skewed for the Bifacial artifact group. Width and Thickness are mildly positively skewed for the Bifacial group, and are only slightly skewed for the Unifacial and Multifacial groups. The degrees of kurtosis have similar patterns for these variables and these groups, although there is a strong positive degree of kurtosis for the Bifacial group. Weight is mildly positively skewed within each of the three groups, and has strong positive degrees of kurtosis within these groups. Generally, the Indexes have only slight degrees of kurtosis, although the Length/Width Index does have mild to strong degrees of kurtosis and skewness. Therefore, the variation within these groups show some clustering into groups, and there appears to be some relationship between width and thickness.

Surface Features

Coefficients of Variation.

The coefficients of variation for the Surface Features exhibit differences between these variables. The coefficients of variation are over sixty percent for the Direction of Negatives and Platform Kind for the Unifacial artifacts. For Platform Kind for the Bifaical artifacts, the coefficient of variation is over fifty percent. The coefficients of variation are between twenty-five and thirty percent for Cortex for Unifacial and Multifacial artifacts, Direction of Negatives for Bifacial and Multifacial artifacts, and Platform Kind for Multifacial artifacts. Cortex for Bifacial artifacts has the smallest coefficient of variation, at about eighteen percent.

Skewness and Kurtosis.

There are mild to strong degrees of skewness and kurtosis for Cortex for Unifacial and Bifacial artifact groups, and only slight degrees of skewness and kurtosis for Multifacial artifacts. There is mostly mild to strong degrees of skewness and kurtosis for Direction of Negatives for the three groups, with there being only a slight positive degree of kurtosis for the Bifacial artifact group. Likewise, there is mostly mild to strong degrees of skewness and kurtosis for Platform Kind for each of the three groups, with only a slight skewness for the Bifacial group.

Chi-Square Goodness-of-Fit Tests.

Chi-square tests for Cortex for Unifacial and Bifacial artifacts are both significant, but for Multifacial artifacts it is not. The chi-square tests for Direction of Negatives is significant within each of the three groups. The chi-square test for Multifacial artifacts is significant for Platform Kind, but not significant for Unifacial and Bifacial artifacts for Platform Kind.

Set B Variables

Retouch Variables

Coefficients of Variation.

The coefficients of variation for the Retouch Variables show considerable differences between these variables. The coefficient of variation for Form is about fifty percent for Side 2 for the Bifacial artifacts, and about sixty percent for Side 2 for the Unifacial artifacts, and Side 3 for the Bifacial artifacts. It is about eighty percent for Side 3 for the Unifacial artifacts. The coefficients of variation for Form are between forty and forty-five percent for the Unifacial artifacts for Sides 1 and 4, and for the Bifacial artifacts for Side 4. The coefficient of variation for Bifacial artifacts is over sixty percent for Side1.

The coefficient of variation for Edge Angle is about sixty for Sides 2 and 3 for the Unifacial artifacts, and about seventeen percent for Sides 2 and 3 for the Bifacial artifacts. The coefficients of variation are between twenty and thirty percent for the Unifacial artifacts for Side 4, and for the Bifacial artifacts for Sides 1and 4. The coefficient of variation for Unifacial artifacts is about twelve percent for Side1.

The coefficients of variation for Form of Retouch for Bifacial artifacts are about seventy percent for Sides 2 and 3, and between twenty-five and thirty percent for Sides 2 and 3 for the Unifacial artifacts. The coefficients of variation for Form of Retouch for Bifacial artifacts are between seventy and seventy-five percent for Sides 1 and 4, and about forty to forty-five percent for Sides 1 and 4 for the Unifacial artifacts.

The coefficients of variation for Retouch Location are between about thirty-five and forty-five percent for the Unifacial artifacts for Sides 2 and 3m and for the

Bifacial artifacts for Sides 1, 2, 3 and 4. The coefficients of variation for Unifacial artifacts for Side 1 and 4 and about ninety-five and eighty-five percent, respectively.

The coefficients of variation for Retouch Length are between about one hundred-fifty and two hundred percent for the Bifacial artifacts for Sides 1, 2, 3, and 4. The coefficents of variation for Unifacial artifacts are between about seventy and ninety percent for Sides 2 and 3, and between about forty and fifty percent for Sides 1 and 4.

The coefficients of variation for Extension of Retouch are between seventy and eighty percent for Unifacial artifacts Sides 1 and 3, and for Bifacial artifacts for Side 1. The coefficients of variation are between sixty and seventy percent for Bifacial artifacts for Sides 2, 3, and 4, and for Unifacial artifacts for Side 4. The coefficient of variation for Side 2 is fifty-five percent.

The coefficients of variation for Retouch Length are seventy-seven percent for Bifacial artifacts Sides 2 and 3. The coefficients of variation are between two hundred ten and two hundred twenty-five percent for Bifacial artifacts for Sides 1 and 4. There is no variation in Unifacial artifacts for this variable.

The coefficients of variation for Scar Form are between one hundred and one hundred seventy-five percent for the Unifacial artifacts for Sides 2, 3, and 4, and about seventy-five percent for Side 1. The coefficients of variation for Bifacial artifacts are between about seventy-five and ninety-five percent for Sides 1, 2, 3, and 4.

Skewness and Kurtosis.

For the Unifacial group, Form has degrees of skewness and kurtosis which are positively mild to strong for Sides 1, 2, and 3, and slight positive skewness and kurtosis for Side 4. For Form for the Bifacial group, there is mild to positive degrees of skewness

and kurtosis for Sides 1 and 3, and slight degrees of skewness and kurtosis for Sides 2 and 4. These relate to the shape of the artifacts. For Bifacial artifacts, it is interesting to note that the recording of Form for Sides 1 and 3 are mirror images of Sides 2 and 4, respectively. For analysis purposes, comparisons will be made between Sides 2 and 3, and between Sides 1 and 4, because for most of the artifacts, such as the tanged points and the daggers, Sides 2 and 3 are the blade sides.

For Sides 2 and 3, there are similar patterns across the Retouch Variables, especially for Bifacial artifacts, although this is also true of the Unifacial artifacts. Sides 1 and 4 also have similar patterns of skewness and kurtosis for both the Unifacial and Bifacial artifact groups.

Chi-Square Goodness-of-Fit Tests.

The chi-square tests for Retouch Variables also reveal patterns of variation within the Unifacial and Bifacial groups. Within both the Unifacial and Bifacial groups, Form for Sides 1, 2, and 4 are not significantly different, but there are significant differences between Side 3 within each of these two groups. Like skewness and kurtosis, the chi-square tests reveal patterns between Sides 2 and 3, and between Sides 1 and 4, especially for the Bifacial artifacts.

Set C Variables

Negatives Variables

Coefficients of Variation.

The coefficients of variation for the Negatives Variables reveal differences between these variables. The coefficients of variation are over seventy percent for

Number of Platforms, Width of Largest Negative, and Length of Smallest Negative. The coefficients of variation are about sixty percent for the Number of Flake Negatives, Length of Largest Negative, and Width of Smallest Negative. Number of Blade Negatives has the smallest coefficient of variation for the Negatives variables, at about forty-five percent.

Skewness and Kurtosis.

For Multifacial artifacts, there is mild positive skewness for Number of Platforms, Length of Largest Negative, Width of Largest Negative, Length of Smallest Negative, and Width of Largest Negative. There is mild to strong positive kurtosis for these variables as well, and only slight skewness and kurtosis for the Number of Flake Negatives and Number of Blade Negatives variables.

BETWEEN-GROUP COMPARISONS

Set A Variables

Surface Features

Chi-Square Tests of Homogeneity.

Between-group comparisons of Surface Features were conducted using the chi-square test of homogeneity (Weiss and Hassett 1982). Testing for homogeneity between groups is expected to clarify differences between these groups.

For the chi-square test for homogeneity for the amount of Cortex between the three artifact groups of Unifacial, Bifacial, and Multifacial artifacts, the hypotheses are:

Ho: The three groups are homogenous for the variable Cortex.

Hr: The three groups are not homogenous for the variable Cortex.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 6.26

The Codes have been combined into the following categories:
A: Codes 1, 3, 6 and 8 - Present; B: Code 7- Absent
Code 11: Not Applicable/Unknown is not included in this analysis

Group	CORTEX Codes A	B	Total
Unifacial			
(observed)	5	24	29
(expected)	10.68	18.32	
Bifacial			
(observed)	13	15	28
(expected)	10.32	17.68	
Multifacial			
(observed)	10	9	19
(expected)	7	12	
Total	28	48	76

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Cortex, the Unifacial, Bifacial, and Multifacial groups are not homogenous.

For the chi-square test for homogeneity for Direction of Negatives between the three groups, Unifacial, Bifacial, and Multifacial artifacts, the hypotheses are:

Ho: The three groups are homogenous for the variable Direction of Negatives.

Hr: The three groups are not homogenous for the variable Direction of Negatives.

Critical Values: $X^2\alpha.10 = 10.64$, $X^2\alpha.05 = 12.59$
D.F. = 6

Chi-Square Value is 105.78

Code 11: Not Applicable/Unknown is not included in this analysis

	DIRNEG Codes 1	2	3	6	Total
Unifacial					
(observed)	15	12	1	1	29
(expected)	6.03	7.53	6.78	8.66	
Bifacial					
(observed)	1	7	0	20	28
(expected)	5.82	7.27	6.3	6.55	
Multifacial					
(observed)	0	1	17	2	23
(expected)	4.16	5.19	4.68	5.97	
Total	16	20	18	23	77

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Direction of Negatives, the Unifacial, Bifacial, and Multifacial groups are not homogenous.

For the chi-square test for homogeneity for Kind of Platform between the three artifact groups of Unifacial, Bifacial, and Multifacial artifacts, the hypotheses are:

Ho: The three groups are homogenous for the variable Kind of Platform.

Hr: The three groups are not homogenous for the variable Kind of Platform.

Critical Values: $X^2\alpha.10 = 21.06$, $X^2\alpha.05 = 23.68$
D.F. = 14

Chi-Square Value is 46.20

Code 11: Not Applicable/Unknown is includeddue to its high frequency analysis

	PLTKIND Codes 1	2	3	4	5	7	8	9	Total
Unifacial									
(observed)	0	5	2	3	0	0	2	17	29
(expected)	0.36	2.54	3.26	1.45	2.18	0.36	5.44	13.41	
Bifacial									
(observed)	0	2	7	1	4	0	11	3	28
(expected)	0.35	2.45	3.15	1.4	2.10	0.35	5.25	12.95	
Multifacial									
(observed)	1	0	0	0	2	1	2	17	23
(expected)	0.29	2.01	2.59	1.15	1.73	0.29	4.31	10.64	
Total	1	7	9	4	6	1	15	37	80

The chi-square is questionable since six cells have expected frequencies less than 1.00, and more than twenty percent of the cells have expected frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Kind of Platform the Unifacial, Bifacial, and Multifacial groups are not homogenous.

Guttman's Lambda.

For Direction of Negatives, Lambda-C, Lambda-R, and Lambda-S are all high, so that there are strong relationships, both asymmetric and symmetric between the Direction of Negatives and the Artifact groups (see Table 23). For Platform Kind, Lambda-C shows a strong relationship for predicting the Artifact group from the kind of platform. Lambda-R shows a moderate relationships for predicting the kind of platform from the artifact group. Lamda-S shows a moderate general relationship between Platform Kind and the Groups. The Lambda-C and Lambda-S show moderate relationships between Cortex and the groups. Lambda-R shows only a weak predictability of Cortex from the artifact groups.

Set B Variables

The patterns of variation in relation to Side and artifact groups are explored with chi-square tests of homogeneity between the Unifacial and Bifacial groups for each Side, and Guttman's Lambdas. First, chi-square tests of homogeneity and Guttman's Lambda are presented for Sides 2 and 3. Then, chi-square tests of homogeneity and Guttman's Lambda are presented for Sides 1 and 4.

TABLE 23. GUTTMAN'S LAMBDA RESULTS FOR SURFACE FEATURES.

GROUPS: Unifacial, Bifacial, and Multifacial artifact groups.

SURFACE FEATURES	DEPENDENT: SURFACE FEATURE	DEPENDENT: GROUPS	SYMMETRIC
CORTEX	0.170	0.036	0.120
DIRNEG	0.729	0.537	0.627
PLTKND	0.392	0.186	0.298

Retouch Variables - Sides 2 and 3

Chi-Square Tests of Homogeneity.

For the chi-square test for homogeneity for Edge Angle Side 2 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Edge Angle, Side 2.

Hr: The two groups are not homogenous for the variable Edge Angle, Side 2.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 8.81

The Codes have been combined into the following categories:
A : Codes 1 and 2; B : Codes 3 and 4; C : Codes 5 and 6; D : Code 7

		EDANG2 Category A	B	C	D	Total
Unifacial	(observed)	5	11	5	1	22
	(expected)	2.20	12.32	6.60	0.44	
Bifacial	(observed)	0	18	10	0	28
	(expected)	2.80	15.68	8.40	0.56	
Total		5	28	15	1	50

The chi-square is questionable since two cells have expected frequencies less than 1.00, and more than twenty percent have expected frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Edge Angle for Side 2, the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Edge Angle Side 3 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Edge Angle, Side 3.

Hr: The two groups are not homogenous for the variable Edge Angle, Side 3.

Critical Values: $X^2\alpha.10 = 6.26$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 13.24

The Codes have been combined into the following categories:
A: Codes 1 and 2; B: Codes 3 and 4; C: Codes 5 and 6; D: Code 7

		EDANG3 Category A	B	C	D	Total
Unifacial	(observed)	6	9	4	1	20
	(expected)	2.55	9.36	7.66	0.43	
Bifacial	(observed)	0	13	14	0	27
	(expected)	3.45	12.64	10.34	0.57	
Total		6	22	18	1	47

The chi-square is questionable since two cells have expected frequencies less than 1.00, and more than twenty precent have frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Edge Angle for Side 3, the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Retouch Form Side 2 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Retouch Form for Side 2.

Hr: The two groups are not homogenous for the variable Retouch Form for Side 2.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 19.51

The Codes have been combined into the following categories:
A: Code 1; B: Code 2; C: Codes 3 and 5; D: Codes 6 and 8

		RETFRM2 Category A	B	C	D	Total
Unifacial	(observed)	0	0	8	18	26
	(expected)	3.37	3.85	5.3	13.48	
Bifacial	(observed)	7	8	3	10	28
	(expected)	3.63	4.15	5.70	14.51	
Total		7	8	11	28	54

The chi-square is questionable since more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Retouch Form Side 2, the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Retouch Form Side 3 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Retouch Form for Side 3.

Hr: The two groups are not homogenous for the variable Retouch Form for Side 3.

Critical Values: $X^2\alpha.10 = 6.26$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 17.996

The Codes have been combined into the following categories:
A: Code 1; B: Code 2; C: Codes 3 and 5; D: Codes 6 and 8

		RETFRM3 Codes A	B	C	D	Total
Unifacial	(observed)	0	0	10	13	23
	(expected)	3.60	3.16	5.41	10.82	
Bifacial	(observed)	8	7	2	11	28
	(expected)	4.39	3.84	6.56	13.18	
Total		8	7	12	24	51

The chi-square is questionable since more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Retouch Form for Side 3, the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Retouch Location for Side 2 between the two artifact groups of Unifacial and Bifacial artifacts the hypotheses are:

Ho: The two groups are homogenous for the variable Retouch Location for Side 2.

Hr: The two groups are not homogenous for the variable Retouch Location for Side 2.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 31.13

The Codes have been combined into the following categories:
A: Code 1; C: Codes 3, 6, 7, 12, and 13; D: Codes 8 and 9

		RETLOC2 Category A	C	D	Total
Unifacial	(observed)	4	6	16	26
	(expected)	2.41	15.89	7.70	
Bifacial	(observed)	1	27	0	28
	(expected)	2.59	17.11	8.296	
Total		5	33	16	54

The chi-square is questionable since more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Retouch Location Side 2, the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Retouch Location for Side 3 between the two artifact groups of Unifacial and Bifacial artifacts the hypotheses are:

Ho: The two groups are homogenous for the variable Retouch Location for Side 3.

Hr: The two groups are not homogenous for the variable Retouch Location for Side 3.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 22.22

The Codes have been combined into the following categories:
A: Code 1; B: 2; C: Codes 3, 6, 12, and 13; D: Codes 8 and 9

		RETLOC3 Codes A	B	C	D	Total
Unifacial	(observed)	3	0	8	12	23
	(expected)	1.80	0.45	15.33	5.86	
Bifacial	(observed)	1	1	26	0	28
	(expected)	2.196	0.55	18.67	7.14	
Total		4	1	34	13	51

The chi-square is questionable since two cells have expected frequencies less than 1.00, and more than twenty percent of the cells have frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Retouch Location Side 3 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Extension of Retouch for Side 2 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Extension of Retouch for Side 2.

Hr: The two groups are not homogenous for the variable Extension of Retouch for Side 2.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 6.18

	RETEXT2 Codes Continuous	Discontinuous	Nibbling	Total
Unifacial				
(observed)	6	20	0	26
(expected)	9.81	15.698	0.49	
Bifacial				
(observed)	14	12	1	27
(expected)	10.19	16.30	0.51	
Total	20	32	1	53

The chi-square is questionable since one cell has an expected frequency less than 1.00.

The chi-square value is between the two Critical Values, therefore, the null hypothesis is not rejected. For Retouch Extension 2, the Unifacial and Bifacial groups are homogenous.

For the chi-square test for homogeneity for Extension of Retouch for Side 3 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Extension of Retouch for Side 3.

Hr: The two groups are not homogenous for the variable Extension of Retouch for Side 3.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 7.19

	RETEXT3 Continuous	Discontinuous	Nibbling	Total
Unifacial				
(observed)	4	19	0	23
(expected)	7.98	14.55	0.47	
Bifacial				
(observed)	13	12	1	26
(expected)	9.02	16.45	0.53	
Total	17	31	1	49

The chi-square is questionable since two cells have expected frequencies less than 1.00, and more than twenty percent have frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Extension of Retouch Side 3 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Direction of Retouch for Side 2 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Direction of Retouch for Side 2.

Hr: The two groups are not homogenous for the variable Direction of Retouch for Side 2.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 16.93

		RETDIR2 Codes 1	2	4	6	Total
Unifacial	(observed)	28	0	0	0	28
	(expected)	21.50	0.5	2.5	3.5	
Bifacial	(observed)	15	1	5	7	28
	(expected)	21.50	0.5	2.50	3.50	
Total		43	1	5	7	56

The chi-square is questionable since two cells have expected frequencies less than 1.00, and more than twenty percent have expected frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Direction of Retouch for Side 2 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Extension of Retouch for Side 3 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Extension of Retouch for Side 3.

Hr: The two groups are not homogenous for the variable Extension of Retouch for Side 3.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 14.86

		RETDIR3 Codes 1	2	4	6	Total
Unifacial	(observed)	24	0	0	0	24
	(expected)	18.0	0.46	2.31	3.23	
Bifacial	(observed)	15	1	5	7	28
	(expected)	21.0	0.54	2.69	3.77	
Total		39	1	5	7	52

The chi-square is questionable since two cells have expected frequencies less than 1.00, and more than twenty percent have expected frequencies less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Extension of Retouch for Side 3 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Scar Form for Side 2 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Scar Form for Side 2.

Hr: The two groups are not homogenous for the variable Scar Form for Side 2.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 9.03

		SCRFRM2 Codes 1	2	2 and 3	Total
Unifacial	(observed)	0	6	6	12
	(expected)	0.32	2.53	9.16	
Bifacial	(observed)	1	2	23	26
	(expected)	0.68	5.47	19.84	
Total		1	8	29	38

The chi-square is questionable since two cells have expected frequencies of less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Scar Form for Side 2 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Scar Form for Side 3 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Scar Form for Side 3.

Hr: The two groups are not homogenous for the variable Scar Form for Side 3.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 13.46

		SCRFRM3 Codes 1	2	2 and 3	Total
Unifacial	(observed)	0	7	6	13
	(expected)	0.33	2.67	10.0	
Bifacial	(observed)	1	1	24	26
	(expected)	0.67	5.33	20	
Total		1	8	30	39

The chi-square is questionable since two cells have expected frequencies of less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Scar Form for Side 3 the Unifacial and Bifacial groups are not homogenous.

Guttman's Lambda.

Lambda-C shows a moderate predictability of group from Edge Angle 2. For the remainder of the Retouch Variables for Sides 2 and 3, the Retouch Variables are strong predictors of the artifact groups (see Table 24). According to the Lambda-Rs, Edge Angle 2 and Retouch Location 2 are strong predictors of these variables from the artifact groups. Retouch Location 3, and Scar Form 3 are moderate predictors of these variables from the artifact groups. The remainder of the Retouch Variables have little or no predictability from the artifact groups. The Lambda-Ss signifiy a strong association between the artifact groups and Retouch Location 2 and 3, Retouch Direction 2, and Scar Form 3. There is a moderate association between the artifact groups and the remainder of the Retouch Variables for Sides 2 and 3.

TABLE 24. GUTTMAN'S LAMBDA FOR RETOUCH VARIABLES, FOR SIDES 2 AND 3.

GROUPS: Unifacial and Bifacial artifact groups.

RETOUCH VARIABLES	DEPENDENT: RETOUCH VARIABLES	DEPENDENT: GROUPS	SYMMETRIC
EDANG2	0.273	0.450	0.159
EDANG3	0.350	0.040	0.178
RETFRM2	0.500	0.000	0.250
RETFRM3	0.435	0.000	0.200
RETLOC2	0.730	0.476	0.617
RETLOC3	0.609	0.235	0.450
RETEXT2	0.308	0.095	0.213
RETEXT3	0.304	0.056	0.195
RETDIR2	0.464	0.000	0.317
RETDIR3	0.375	0.000	0.243
SCRFRM2	0.330	0.000	0.190
SCRFRM3	0.462	0.111	0.318

Retouch Variables - Sides 1and 4

Chi-Square Tests of Homogeneity.

For the chi-square test for homogeneity for Edge Angle for Side 1 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Edge Angle for Side 1.

Hr: The two groups are not homogenous for the variable Edge Angle for Side 1.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 6.29

The Codes have been combined into the following categories:
B: Code 3; C: Codes 5 and 6; D: Code 7

		EDANG1 Codes B	C	D	Total
Unifacial	(observed)	0	16	3	19
	(expected)	1.84	13.48	3.68	
Bifacial	(observed)	3	6	3	12
	(expected)	1.16	8.52	2.32	
Total		3	22	6	31

The chi-square is questionable since more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Edge Angle for Side 1 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Edge Angle Side 4 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Edge Angle for Side 4.

Hr: The two groups are not homogenous for the variable Edge Angle for Side 4.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 38.85

The Codes have been combined into the following categories:
A: Code 2; B: Codes 3 and 4; C: Codes 5 and 6; D: Code 7

		EDANG4 Category A	B	C	D	Total
Unifacial	(observed)	1	2	12	8	23
	(expected)	0.59	3.54	12.38	6.49	
Bifacial	(observed)	0	4	9	3	16
	(expected)	0.41	2.46	8.62	4.51	
Total		1	6	21	11	39

The chi-square is questionable since two cells have expected frequencies of less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Edge Angle for Side 4 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Retouch for Side 1 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Retouch for Side 1.

Hr: The two groups are not homogenous for the variable Retouch for Side 1.

Critical Values: $X^2\alpha.10 = 7.78$, $X^2\alpha.05 = 9.49$
D.F. = 4

Chi-Square Value is 12.67

	RETFRM1 Codes					
	1	3 and 5	4	6 and 8	12 and 13	Total
Unifacial						
(observed)	3	15	0	1	0	19
(expected)	2.97	11.28	1.19	1.78	1.78	
Bifacial						
(observed)	2	4	2	2	3	13
(expected)	2.03	7.72	0.81	1.22	1.22	
Total	5	19	2	3	3	32

The chi-square is questionable since one cell has an expected frequency less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Form of Retouch for Side 1 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Form of Retouch for Side 4 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Form of Retouch for Side 4.

Hr: The two groups are not homogenous for the variable Form of Retouch for Side 4.

Critical Values: $X^2\alpha.10 = 9.24$, $X^2\alpha.05 = 11.07$
D.F. = 5

Chi-Square Value is 8.57

	RETFRM4 Codes 1	2	3 and 5	4	6 and 8	12 and 13	Total
Unifacial							
(observed)	3	2	16	0	2	0	23
(expected)	3.19	1.92	12.78	0.64	2.56	1.92	
Bifacial							
(observed)	2	1	4	1	2	3	13
(expected)	1.81	1.08	7.22	0.36	1.44	1.08	
Total	5	3	20	1	4	3	36

The chi-square is questionable since two cells have expected frequencies of less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is less than either critical value, therefore, the null hypothesis is not rejected. For Form of Retouch for Side 4 the Unifacial and Bifacial groups are homogenous.

For the chi-square test for homogeneity for Location of Retouch for Side 1 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Location of Retouch for Side 1.

Hr: The two groups are not homogenous for the variable Location of Retouch for Side 1.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 16.83

The Codes have been combined into the following categories:
A: Code 1; B: Code 2; C: Codes 3, 6, 12, and 13; D: Codes 8 and 9

		RETLOC1 Codes A	B	C	Total
Unifacial	(observed)	13	0	6	19
	(expected)	7.72	1.78	3.56	
Bifacial	(observed)	0	3	10	13
	(expected)	5.28	1.22	6.50	
Total		13	3	16	32

The chi-square is questionable since more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Location of Retouch for Side 1 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Location of Retouch for Side 4 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Location of Retouch for Side 4.

Hr: The two groups are not homogenous for the variable Location of Retouch for Side 4.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 11.19

The Codes have been combined into the following categories:
A: Code 1; B: Code 2; C: Codes 4, 5, 6, 7, and 13; D: Codes 9

		RETLOC4 Codes A	B	C	D	Total
Unifacial	(observed)	12	1	8	2	23
	(expected)	8.31	0.64	12.78	1.28	
Bifacial	(observed)	1	0	12	0	13
	(expected)	4.69	0.36	7.22	0.72	
Total		13	1	20	2	36

The chi-square is questionable since three cells have expected frequencies of less than 1.00, and more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Location of Retouch for Side 4 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Extension of Retouch for Side 1 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Extension of Retouch for Side 1.

Hr: The two groups are not homogenous for the variable Extension of Retouch for Side 1.

Critical Values: $X^2\alpha.10 = 7.78$, $X^2\alpha.05 = 9.49$
D.F. = 4

Chi-Square Value is 14.39

	RETEXT1 Category Continuous	Discontinuous	82	28 and 29	30	Total
Unifacial						
(observed)	5	14	0	0	0	19
(expected)	5.07	1.01	1.27	1.90	0.63	
Bifacial						
(observed)	3	2	2	3	1	11
(expected)	2.93	5.87	0.73	1.10	0.37	
Total	8	16	2	3	1	30

The chi-square is questionable since three cells have expected frequencies of less than 1.00, and more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Extension of Retouch for Side 1 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Extension of Retouch for Side 4 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Extension of Retouch for Side 4.

Hr: The two groups are not homogenous for the variable Extension of Retouch for Side 4.

Critical Values: $X^2\alpha.10 = 7.78$, $X^2\alpha.05 = 9.49$
D.F. = 4

Chi-Square Value is 15.22

	RETEXT4 Category					
	Continuous	Discontinuous	82	28 and 29	30	Total
Unifacial						
(observed)	6	17	0	0	0	23
(expected)	5.42	13.53	1.35	2.03	0.68	
Bifacial						
(observed)	2	3	2	3	1	11
(expected)	2.59	6.47	0.65	0.97	0.32	
Total	8	20	2	3	1	34

The chi-square is questionable since four cells have expected frequencies less than 1.00, and more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is greater than either critical value, therefore, the null hypothesis is rejected. For Extension of Retouch for Side 4 the Unifacial and Bifacial groups are not homogenous.

For the chi-square test for homogeneity for Direction of Retouch for Side 1 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Direction of Retouch for Side 1.

Hr: The two groups are not homogenous for the variable Direction of Retouch for Side 1.

Critical Values: $X^2\alpha.10 = 6.25$, $X^2\alpha.05 = 7.81$
D.F. = 3

Chi-Square Value is 7.58

		RETDIR1 Codes 1	3	5	30	Total
Unifacial	(observed)	28	0	0	0	28
	(expected)	25.90	0.70	0.70	0.70	
Bifacial	(observed)	9	1	1	1	12
	(expected)	11.10	0.30	0.30	0.30	
Total		37	1	1	1	40

The chi-square is questionable, since six cells have expected frequencies less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is between either critical value, therefore, the null hypothesis is not rejected. For Direction of Retouch for Side 1 the Unifacial and Bifacial groups are homogenous.

For the chi-square test for homogeneity for Direction of Retouch for Side 4 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Direction of Retouch for Side 4.

Hr: The two groups are not homogenous for the variable Direction of Retouch for Side 4.

Critical Values: $X^2\alpha.10 = 4.61$, $X^2\alpha.05 = 5.99$
D.F. = 2

Chi-Square Value is 4.74

		RETDIR4 Codes 1	5	30	Total
Unifacial	(observed)	27	0	0	27
	(expected)	25.62	0.69	0.69	
Bifacial	(observed)	10	1	1	12
	(expected)	11.38	0.31	0.31	
Total		37	1	1	39

The chi-square is questionable since four cells have expected frequencies less than 1.00, and more than twenty percent of the cells have expected frequencies of less than 5.

The chi-square value is between either critical value, therefore, the null hypothesis is not rejected. For Direction of Retouch for Side 4 the Unifacial and Bifacial groups are homogenous.

For the chi-square test for homogeneity for Scar Form for Side 1 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Scar Form for Side 1.

Hr: The two groups are not homogenous for the variable Scar Form for Side 1.

Critical Values: $X^2\alpha.10 = 10.64$, $X^2\alpha.05 = 12.59$
D.F. = 6

Chi-Square Value is 8.64

	SCRFRM1 Codes							
	1	2	3	2 and 3	6	20	0	Total
Unifacial								
(observed)	0	1	7	10	0	1	0	19
(expected)	0.61	0.61	5.52	9.81	0.61	0.61	1.23	
Bifacial								
(observed)	1	0	2	6	1	0	2	12
(expected)	0.39	0.39	3.48	6.19	0.39	0.39	0.77	
Total	1	1	9	16	1	1	2	31

The chi-square is questionable since nine cells have expected frequencies less than 1.00, and more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is less than either critical value, therefore, the null hypothesis is not rejected. For Scar Form for Side 1 the Unifacial and Bifacial groups are homogenous.

For the chi-square test for homogeneity for Scar Form for Side 4 between the two artifact groups of Unifacial and Bifacial artifacts, the hypotheses are:

Ho: The two groups are homogenous for the variable Scar Form for Side 4.

Hr: The two groups are not homogenous for the variable Scar Form for Side 4.

Critical Values: $X^2\alpha.10 = 10.64$, $X^2\alpha.05 = 12.59$
D.F. = 6

Chi-Square Value is 8.91

	SCRFRM4 Codes 1	2	3	2 and 3	6	20	0	Total
Unifacial								
(observed)	0	3	8	9	0	1	2	23
(expected)	0.68	2.03	6.09	10.15	0.68	0.68	2.88	
Bifacial								
(observed)	1	0	1	6	1	0	2	11
(expected)	0.32	0.97	2.91	4.85	0.32	0.32	1.29	
Total	1	3	9	15	1	1	4	34

The chi-square is questionable since seven cells have expected frequencies less than 1.00, and more than twenty percent of the cells have frequencies of less than 5.

The chi-square value is less than either critical value, therefore, the null hypothesis is not rejected. For Scar Form for Side 4 the Unifacial and Bifacial groups are homogenous.

Guttman's Lambda.

Lambda-C shows a moderate predictability of group from Edge Angle 1 and 4, Direction of Retouch 1 and 4, and Scar Form 4 (see Table 25). For the remainder of the Retouch Variables for Sides 1 and 4, the Retouch Variables are strong predictors of the artifact groups. According to the Lambda-Rs, Retouch Location 1 is a strong predictor of this variable from the artifact groups. Retouch Location 4 is a moderate predictor of this variable from the artifact groups. The remainder of the Retouch Variables have little or no predictability from the artifact groups. The Lambda-S signifies a strong association between the artifact groups and Retouch Location 1. Edge Angle 4 and Scar Form 4 have no or little association with the groups. There is a moderate association between the artifact groups and the remainder of the Retouch Variables for Sides 1 and 4.

TABLE 25. GUTTMAN'S LAMBDA FOR RETOUCH VARIABLES, FOR SIDES 1 AND 4.

GROUPS: Unifacial and Bifacial artifact groups.

RETOUCH VARIABLES	DEPENDENT: RETOUCH VARIABLES	DEPENDENT: GROUPS	SYMMETRIC
EDANG1	0.250	0.000	0.143
EDANG4	0.125	0.000	0.059
RETFRM1	0.462	0.000	0.231
RETFRM4	0.308	0.000	0.138
RETLOC1	0.538	0.438	0.483
RETLOC4	0.308	0.250	0.276
RETEXT1	0.545	0.071	0.280
RETEXT4	0.545	0.000	0.240
RETDIR1	0.250	0.000	0.200
RETDIR4	0.200	0.000	0.167
SCRFRM1	0.333	0.000	0.148
SCRFRM4	0.182	0.000	0.067

SUMMARY

This presentation of the Within-Group and Between-Group analyses illustrate that there is considerable variation within and between these three groups. The results of the chi-square tests of homogeneity suggest that the three groups are not homogenous, and, therefore, exhibit considerable variation. The Surface Features are not homogenous for the three groups of Unifacial, Bifacial, and Multifacial artifacts. The Unifacial and Bifacial artifacts are homogenous for Form of Retouch 4, Direction of Retouch 1 and 4, and Scar Form 1 and 4. The remainder are not homogenous. The results of the Guttman's Lambdas illustrate that the Surface Features and Retouch Variables enable the prediction or inference of the artifact group from these variables.

All but two of the chi-square tests of homogeneity are questionable, due to the small sample sizes. However, the Guttman's Lambdas and the contingency tables allow some interpretations of the materials used in this analysis. The general interpretations of the between-group comparisons are that the three groups are not homogenous, and therefore, exhibit variation. This review of the statistical results within and between each of the three groups emphasizes the variety that exists in this collection with respect to form and attributes. This variety is not restricted to functional differences, and Chapter VIII discusses stylistic variation.

CHAPTER VIII

INTERPRETATIONS AND CONCLUSIONS

This chapter presents interpretations of the artifacts, and related artifacts described in the literature, in relation to the predictions of variation. The artifact type groups are then interpreted with respect to the four realms of variation. There is also a discussion of the role of style-bearing objects in the Ideotechnic, Sociotechnic, and Technomic spheres of societies, in particular, prehistoric Denmark. Finally, the parameters of stylistic variation, and the significance of the findings in relation to various paradigms of style, are discussed.

PREDICTIONS OF VARIATION

In her model, Wiessner uses predictions based on Wilmsen and Roberts (1978:26-27) and Wobst (1977) for the identification of factors which effect investment in style (Wiessner 1983:260). These factors include the length of time required to manufacture an artifact, and, the length of the lifetime of an artifact, the *chaine operatoire* (Simek 1994; Pelegrin 1990; Inizan et al 1992). In addition, stylistic content can be measured in two ways. The first is, the degree of variation in the artifact within the type group. And, secondly, the percentages of artifacts which have other forms of decoration than the one identified.

The longer it takes to manufacture an artifact, and the longer it will be used, the more likely it is that the artifact will have some stylistic content. Artifacts which are

a form of expedient technology (Cross 1983:98), made quickly and disposed of after a short time, often have little or no stylistic content. Artifacts which take a long time to make, and/or will be used for a long time, are more likely to have some stylistic content.

Therefore, based on Wiessner's (1983) article, there are four areas which can be used to assess the existence of stylistic content in lithic artifacts: length of time for manufacture, lifetime, variation within a type group, and, percentage of artifacts with other forms of decoration. The percentages of artifacts with other forms of decoration cannot be directly assessed with this collection, because the artifacts are not provenienced. Therefore, this analysis relies on the comparison within type groups which may enable some understanding of the variety of forms and combinations of attributes which could be possible in lithic artifacts. While these interpretations are largely subjective, examples which are extreme in the three areas of manufacture time, lifetime, and variation, may at least enable the archaeologist to begin to recognize the loci of style in lithic artifacts. These form the basis for the interpretation of stylistic variation in artifacts for this thesis.

The length of time for manufacture (TIME) for various artifact types can be estimated through experimentation. Many researchers have studied the manufacturing processes for various types and forms of artifacts (e.g. Olausson 1983a). For this analysis, length of time is considered as low, medium, or high.

The length of the lifetime (LIFETIME) of lithic artifacts can be difficult to determine. This has generally been viewed as the length of time that an artifact is used or useful, and can include time after an artifact has been modified. For this analysis, length of lifetime is considered as either low (short) or high (long). However, many of the artifacts in this collection are types which can be found in hoards and

graves. Within the Sociotechnic and Ideotechnic spheres of the societies, the lifetime of the artifact extends after deposition. This issue was taken into consideration when estimating length of lifetime.

Variation within type groups (VARIATION) involves the comparison of attributes within and between various related type groups, such as daggers. This is largely based on the descriptions of the artifacts. The discussion of the type groups in this collection includes comparison with other types and forms described in the literature. For this analysis, variation is considered as low, medium, or high.

Table 26 presents interpretations of the manufacturing time, lifetime, and degree of variation within the type groups represented in the artifacts used in this analysis. Both the artifacts in the collection, and those illustrated and described in various literature sources, are used to make these determinations.

REALMS OF VARIATION

I propose that, when tools are functionally equivalent, the variation or differences between the forms of these tools lay in four general realms. These are: workability, isochrestic variation, derivation, and stylistic variation. Workability and isochrestic variation can be related to each other; and derivation and stylistic variation can also be related to each other.

Variation attributable to the perfection of the workability of the tool has elements which are functional, in that the differences enable the individual object to work better than if it were made precisely the same way as other objects of the same type. This can be seen in the differences between axeheads. Olausson (1983a and b)

TABLE 26. INTERPRETATIONS WITH RESPECT TO THE THREE PREDICTIONS FOR VARIATION DUE TO STYLISTIC CONTENT.

TIME=Length Of Manufacture Time: L=Low; M=Medium; H=High. LIFETIME: L=Low; M=Medium; H=High. VARIATION: L=Low; M=Medium; H=High.

ARTIFACT GROUP	TYPE GROUP	TIME	LIFETIME	VARIATION
UNIFACIAL	TRANSVERSE ARROWHEADS	L-M	L	M
	MICROBLADES	L	L	L
	TANGED POINTS	L	L	M
	TRIANGULAR POINTS	L-M	L-H	L
	BURIN AND BURIN SPALL	L	L	L
	FISH HOOKS	L	L	M
BIFACIAL	DAGGERS AND POINTS	H	H	H
	SICKLES	H	H	M
	STEMMED SCRAPERS	L-M	L	L
	KNIVES	L	L	L
MULTIFACIAL	AXEHEADS	H	H	H
	CHISELS	H	H	M
	PICKS	H	H	M
	ADZES	H	H	M
	WHETSTONES	L	H	L
MISCELLANEOUS	GROUNDSTONE AXEHEADS	H	H	H
	NETWEIGHTS	H	H	H
	HAMMERSTONES	L	H	L
BRONZE	RINGS	L	H	L
	BRACELETS	H	H	M
	PINS	M	H	H
	DOUBLE-BUTTONS	H	H	H
	SOCKETTED AXEHEADS	H	H	M

has discussed the idea of workability of axehead forms and types, and has found that, while length of an axehead does not determine the efficiency of an axehead, the efficiency is determined by the overall proportions of an individual axehead. Therefore, the differences in metric variables of length, width, thickness, and weight, taken together, contribute to the workability of the axeheads. In contrast with isochrestic variation, workability is strictly a feature of function.

A related concept to workability is isochrestic variation, which is the normal range of possible alternatives in the manufacturing process (Sackett 1985a; cf. Hegmon 1992; Gebauer 1987). Sackett (1985a, 1986b) states that isochrestic variation can be both functional and stylistic. For example, this might be the source of the differences between, at least in part, the transverse arrowheads. Like workability, isochrestic variation is peculiar to an individual object, and is the product of an individual's manufacturing decision making.

The third realm of variation is derivation of attributes from other forms, or invention of attributes which co-occur from independent sources (c.f. Hill 1985:376). Using an evolutionary model, Hill (1985:376) describes two ways change occurs in populations: mutation and gene flow. In archaeological contexts, Hill, equates mutation with innovation and invention, and gene flow with diffusion. I combine these two sources of change into the general concept of derivation.

An example of variation due to derived attributes is the late thick-butted axeheads which are modeled after bronze counterparts (Glob 1952); or the Pitted Ware tanged arrowheads which may be derived from Late Palaeolithic tanged arrowheads (Rasmussen 1993). These tanged arrowheads can be contrasted with the Neolithic triangular arrowhead. Each of these types of arrowheads have different historical backgrounds, and, therefore, different invention origins (Rasmussen 1993;

Clarke et al 1985). Derivation may be most often identifiable in functionally comparative forms which have considerable temporal and/or geographic distances; or where there is clear evidence for the use of selected attributes as models for other types of objects. Unlike variation due to isochrestic behavior and workability, attributes which are derivative would not be peculiar to an individual object, but would be consistently included within a type or type group; or even several type groups might have similar attributes. Like isochrestic variation, derivative attributes can be functional and/or stylistic.

The final realm of variation is stylistic variation, where attributes have social and/or ideological meaning. Stylistic variation is related to derivation, in that, in some circumstances, those attributes which are derived from models, are then used in a stylistic manner. The changes in form and attributes of the Late Neolithic daggers may be a prime example of stylistic content in stone tools. The seam lines on bronze objects, such as daggers and battle-axeheads, were used as models, to create attributes on flint and stone counterparts as representations of those seams (and therefore derived). This modeling is what I call "mimicry", where the attributes are used to look like attributes which may or may not have been functional, but were worked into other objects as (non-technologically functional) designs. These attributes are thereby stylistic.

Table 27 presents interpretations as to sources of differences or variation in these artifacts type groups. The four realms of derivation, workability, isochrestic, and stylistic variation, are considered as one of three states: exists (X), probably or possibly exists (P), or absent (A).

TABLE 27. ASSESSMENT OF THE REALMS OF VARIATION.

DERIV=Derivative; WORK=Workability; ISO=Isochrestic
MISC=Miscellaneous
X=Exists; P=Probable Or Possible; A=Absent

GROUP	TYPE GROUP	WORK	ISO	DERIV	STYLE
UNIFACIAL	TRANSVERSE ARROWHEADS	P	X	P	A
	MICROBLADES	P	X	P	A
	TANGED POINTS	P	X	P	A
	TRIANGULAR POINTS	P	X	P	A
	BURIN AND BURIN SPALL	P	X	P	A
	FISH HOOKS	P	X	P	A
BIFACIAL	DAGGERS AND POINTS	P	P	X	X
	SICKLES	P	X	P	P
	STEMMED SCRAPERS	P	X	P	A
	KNIVES	P	X	P	A
MULTIFACIAL	AXEHEADS	X	P	X	X
	CHISELS	P	X	P	A
	PICKS	P	X	P	A
	ADZES	P	X	P	A
	WHETSTONES	P	X	P	A
MISCELLANEOUS	GROUNDSTONE AXEHEADS	P	P	X	X
	NETWEIGHTS	P	P	P	X
	HAMMERSTONES	P	X	P	A
BRONZE	RINGS	A	P	P	X
	BRACELETS	A	P	P	X
	PINS	A	P	X	X
	DOUBLE-BUTTONS	A	P	P	X
	SOCKETTED AXEHEADS	P	X	P	X

INTERPRETATIONS OF VARIATION

Unifacial Artifacts

Transverse Arrowheads
Tanged Points
Burin and Burin Spall
Microblades
Triangular Points
Fish Hooks

For most of the Unifacial artifacts, the length of time for manufacture was very short relative to the other artifacts. With respect to lifetime, some of these type groups, such as transverse arrowheads and tanged points, have been found as burial items, although they are largely expedient technologies. There is a mild degree of variation within the type groups.

For Unifacial artifacts most differences can be explained by isochrestic variation, workability, or derivation. The Unifacial artifacts all exhibit isochrestic variation, and most probably exhibit variation due to workability. The Pitted Ware tanged points probably contain variation attributable to derivation, with possible roots in Swedish Pitted Ware and Late Palaeolithic cultural traditions. Variation attributable to style is most likely absent from all of the Unifacial artifacts.

Bifacial Artifacts

Daggers and Points
Stemmed Scrapers
Sickles
Knife

Based on the fineness of flake removal, the knife and stemmed scrapers most likely required less time to make than the sickles, points, and daggers. Within the groups of daggers and points, the fish-tailed dagger most likely would have required a relatively high length of manufacture time to make, compared with the lanceolate

daggers and points. Most of the artifact type groups have been found in burials, therefore, the intended lifetime of these artifacts could have been long. Actual use-lifetime, in the Technomic sense, was most likely longer for the daggers, points, and sickles, than the knife and stemmed scrapers.

Much of the variation in the sickles, stemmed scrapers, and knives is isochrestic with some variation attributable to workability. The knife type has little variation, much of which is most likely isochrestic. The stemmed scraper type group has some variation with respect to angles of sides and proportions (Larsson 1985; Jensen 1982). Some of the variation in the stemmed scrapers is also probably derivative, due to their regional variations within Denmark. The sickle type group has a variety of forms of sickles, including crescent-shaped sickles like the ones in this collection (Juel Jensen 1988a and b, 1994; Steensberg 1943, 1979; Glob 1952). This variation may be temporal, and thus derivative and stylistic, or, perhaps due to workability.

The points can vary in size and proportions, as can the lanceolate daggers. However, there is considerable variation within the dagger type group as a whole. The variation within the dagger type group appears to relate to derivation and style, although there is some isochrestic variation and workability.

During the Dagger Period in Denmark, the form and attributes of the daggers changed considerably and relatively frequently. This can be seen by the considerable variation within the type group (Lomborg 1973; Kristiansen 1982). The form of the dagger originated as a lanceolate leaf shape, which is long and narrow, with both the proximal and distal ends relatively pointed, and the body somewhat wide. These were modeled after copper daggers (Green et al 1982). Through time, the shape of the daggers changed to what is called "fishtailed" , with a flat, wide butt,

and a finely worked, detailed handle. With these changes in form, the dagger replaced axeheads as the recurrent grave good. The fishtail daggers are similar in shape to European bronze daggers of the same time period. Detailed working on the handle has been interpreted as modeled after the seam lines on bronze daggers, which were produced with molds (Clarke et al 1985; Glob 1952; Jensen 1982; Midgley 1992). This mimicry and the considerable variation within types show strong evidence of stylistic variation.

Multifacial Artifacts

Chipped Axeheads
Pick
Whetstone
Chisels
Adzes

Compared to the previous categories, many of the Multifacial artifacts required a long length of time to manufacture. The manufacturing process included shaping by flake removal, as well as grinding and polishing of at least some of the surfaces of the artifacts. Generally, the axeheads and adzes would have required more time to make than the pick and chisels, in part because, they are more thoroughly polished. In comparison with the Unifacial artifacts, the lifetime of the Multifacial artifacts was considerably longer, but most likely comparable to the lifetime of most of the Bifacial artifacts. All of these type groups are represented in burials, and the axeheads and chisels are very common hoard items.

Much of the variation in the chipped stone axeheads is attributable to workability, derivation and style. The axeheads have strong temporal differences in form. The thin-butted axeheads are earlier than the thick-butted axeheads; and the

thin-butted are more thoroughly polished than the thick-butted. These differences generally have been interpreted as due to the workability of the axeheads (Olausson 1983a and b). The thin-butted and thick-butted axeheads as general types occur in many areas of Europe, and, therefore, they exhibit variation which can be considered derivative and stylistic. The later thick-butted axeheads, especially those with a flaring blade, are interpreted as modeled after bronze counterparts. Thus, this mimicry may be viewed as stylistic.

Most of the variation in the chisels, adzes, pick, and whetstone, can be interpreted as the result of workability. The whetstone and the axehead which was reworked as a whetstone also contain variation which is isochrestic. The axehead-turned-whetstone is an interesting artifact. It combines two very different type groups, with very different functions, into one object with conflicting attributes that mix. It contains some of the variation which the axeheads do, and some attributes which the whetstone does.

Miscellaneous Artifacts

Ground Stone Battle Axes
Netweight
Bronze
- Ring
- Pin
- Socketted Axehead

Hammerstone

Bracelet
Double-Button

Discussion of these artifacts is restricted to within the type groups.

Like flint axeheads, ground stone axeheads have relatively long lengths of time for manufacture, although their manufacture time is longer than the flint axeheads (Olausson 1983b:59). Ground stone axeheads also have comparable usable lifetime,

as well as being common grave items. There is considerable variation in proportion and angles of blades. Some of these axeheads have lines on their sides, which, like the daggers, may be modeled after the seam lines of bronze counterparts. Axeheads also can be faceted. Therefore, there is considerable stylistic variation within the groundstone axehead type group. Variation is also due to derivation, since many of these axeheads are modeled after bronze counterparts, and have attributes which mimic those of bronze axeheads.

The hammerstone would have been manufactured very quickly, but could have had a relatively long usable lifetime. Some hammerstones have also been found as grave goods. Most variation in hammerstones would be isochrestic.

The netweight would have a high manufacture time, and long lifetime. Some of the netweights, like the one in this collection, have designs on their surfaces. Therefore, there is a high degree of variation within the group which is stylistic. Some variation is derivative, but little variation is attributable to isochrestic or workability.

Most of these bronze items would have been quickly manufactured, with the bronze axehead taking the longest and being the most complicated. The lifetime of the artifacts would have been long, and most of these are types which could be found in burials, more likely so than in hoards (Janet Levy, personal communication). The ring type group has very little variation, while the other type groups have more variation within them. All but the bronze axehead is jewelry, and, therefore, they necessarily contain style (Wiessner 1983). The socketted axeheads may have some stylistic content, although most of the variation is probably isochrestic.

SUMMARY

As shown by the analysis of attributes and information from various sources, the artifacts used in this study represent an array of possible functions: e.g. chopping (axeheads), levering (picks), cutting (tanged points, burin, triangular points, microblades, transverse arrowheads, knives, daggers, points, sickles, stemmed scrapers), scraping (tanged points, microblades, daggers, sickles, adzes, chisels), and stabbing (daggers, points). There are more forms than there are functions. The variety of functions has been illustrated to exist both within and between the artifact groups.

Most of the Unifacial and Bifacial artifacts exhibit evidence of cutting and scraping soft and hard materials. The function of the transverse arrowheads is largely indeterminant in this analysis. Various literature sources have identified the functions of the axeheads as chopping or wedging, and the chisels were used for wedging and wood working.

In addition to variation attributable to function, there is, also, considerable variation with respect to form and attributes which has revealed the potential, if not the presence, of style. It has been shown that variation exists in lithic artifacts which cannot be explained by function alone. Variation can be attributed to workability, isochrestic, derivation, and style, as well as function. Workability and isochresticism are related to function. Variation which is stylistic is a discrete form of variation, as a concept. Stylistic variation is discussed further in relation to the artifacts in this collection.

DISCUSSION

Stylistic variation can be identified in various type groups which are represented in this collection. This has been seen with respect to daggers, flint axeheads, ground stone axeheads, netweights, and the bronze artifacts. This section discusses the diachronic trends of stylistic variation during Danish prehistory; the kinds of style represented; and the role of style in prehistoric Danish societies.

Diachronic Trends

A benefit of this study is its inclusion of long temporal sequences. Most studies of style in artifacts have been limited to synchronic studies, or comparison of synchronic studies (Gebauer 1987:228-229; see also Wiessner 1989:58; a recent example involving lithic artifacts is Rick, 1996). Gebauer argues for diachronic studies,

> "[s]tudies of temporal variation might provide further information on stylistic strategies in society. Various artifact groups showing different degrees of temporal variation might indicate normative/isochrestic variation versus stylistic variation or individual versus social stylistic variation." (1987:228- 229).

As shown by this thesis, Gebauer's prediction has been proven to be valid. The temporal significance of the evidence of style in artifacts during the Danish Paleolithic, Neolithic, and Bronze Age supports Gebauer's statement, and are discussed next.

For the Early and Middle Neolithic, the thin-butted and thick-butted axeheads exhibit some degree of stylistic content. While Olausson (1983a and b) has argued that the length of these axeheads is not a feature of workability, others have said that axeheads from hoards average a greater length than those found in graves (Midgley 1992); and, therefore, there was some social and/or ideological meaning to these

differences. The interpretation of the beginning of clear, identifiable stylistic content in lithic artifacts for Danish prehistory is supported by the changes in butt-thickness (from thin to thick), and subsequent modeling (mimicry) of the later thick-butted axeheads' blade on bronze counterparts. The changes in the degrees of variation in stylistic content in axeheads were relatively slow compared to changes seen in the artifacts discussed below, but faster than changes in other lithic artifact type groups, used before and concurrent with this type group (e.g. tanged points, triangular arrowheads). Therefore, the axehead type group variation is a hallmark of the beginning of the use of style in stone tools, in Denmark.

The styles of the Middle Neolithic Single Grave Culture battle axeheads, as well as the other items in graves at that time, changed considerably in a relatively short time period.

> "On the other hand, the Single Grave Culture in Jutland provides an example of fast temporal changes of the male status symbol, the battle axe, in relation to Eastern Denmark and Continental European Battle Axe Culture. This might be due to tense and competitive social conditions in Jutland. Also, the role of battle axes as male status symbol might be reduced in favor of metal objects during the late Battle Axe Culture in continental Europe (Glob 1944; Harrison 1980:68)" (Gebauer 1987:229, citations in original).

During the Middle Neolithic Single Grave Culture, the groundstone axeheads were the important grave item. The differences in ground stone axeheads were used stylistically to present information about the people being buried (Gebauer 1987). This information may have included status, "maleness", and/or social identity.

In the Late Neolithic, the high rate of change in the stylistic content of the daggers, and the considerable variation within a type, not just the type group, can be interpreted as a time of an explosion in the use of stylistic content. This can be seen in the contrast between Types I and II (Lomborg 1973:32, 44, figs. 9 and 21) and Types III and IV (ibid:48, 53, figs. 24 and 29). Wobst (1977:326) has argued that stylistic "messaging" within a type group is either absent or all-pervasive.

> "As the functional matrix of stylistic behavior becomes more complex, the different categories of material culture should reflect an off-on behavior in regard to stylistic form, with more and more categories switching in a step-like progression from stylistic neutrality (off) to stylistic ubiquity (on)." (Wobst 1977:326-327).

The previous examples coupled with the examples of the daggers illustrate this step-like progression, and the middle Dagger Period dagger Types III and IV represent stylistic ubiquity.

This status of "on" in stylistic content in lithic artifacts breaks down in the Danish Early Bronze Age. The new state of "off" is illustrated in the daggers, by the Early Bronze Age dagger forms which have become much less detailed. This can be seen in Types V and VI (Lomborg 1973:58, 61, figs. 35 and 40), and represented in this collection by two daggers (see Chapter IV, numbers 17 and unknown). This change is related to the increased use of bronze. From the middle part of the Early Bronze Age onward, stylistic messaging is apparently restricted to bronze items, as compared with stone tools.

During the Bronze Age, the utilitarian objects, such as bronze axeheads, swords, and the like, contained considerable stylistic variation (Levy 1982; Turner 1994). The bronze artifacts in this collection are predominantly jewelry. It is significant that during

this time, there was considerable investment of energy and time to include style in objects which had no utilitarian function, as well as including stylistic attributes in objects which were utilitarian (Lemmonier 1986:149). The interpretation is that there was considerable wealth in the Bronze Age, but that this wealth was unequal (Lemmonier 1986; Levy 1982).

Kinds of Style

Wiessner's (1990:107) criteria for the categorization of style, discussed in the introduction of this thesis, can be used to explore the changes in stylistic variation through these prehistoric sequences. These criteria are: the degree of activity of style (active versus passive), the specificity of referent of the styles (emblemic and/or assertive), and the levels at which stylistic comparison occurred (protocol and/or panache behaviors).

The changes in stylistic variation included changes in the emphasis on the group or individual. These are revealed through changes in material products of social processes. The material products include stone tools which contain stylistic variation which may be attributed to emblemic and/or assertive styles. Both emblemic and assertive styles can be found on the same artifact. The social processes which produced these forms of style may be identified as protocol and panache behaviors.

The Late Palaeolithic and Mesolithic artifacts in this collection (microblades, burins, triangular points, fishhooks, transverse arrowheads, stemmed scrapers, pick, and adze) are not likely to contain symbolically meaningful style (Plog 1990). As containing isochrestic variation, potential style might be viewed as an "ethnic stamp"

(Sackett 1990), and thus passive. The focus of social activity was not such that stone tools contained "active" style. The social processes of protocol and panache apparently did not utilize emblemic and assertive style in lithic material culture, at least as revealed in the artifact classes represented in this collection.

During the Early and Middle Neolithic, there were more permanent settlements and a greater population density. The social group was important. The communal burials in long mounds and passage graves, and increased ritual activities, as seen in votive hoards and causewayed enclosures required and reinforced group-cohesion. The styles of the thin- and thick-butted axeheads can be interpreted as emblemic. Protocol behaviors would have reinforced ties to the social group. These ties would have been along kin lines.

The Middle Neolithic Single Grave Culture signifies important changes in subsistence as compared to the Early and Middle Neolithic. The changes in the economy included the introduction of ard-ploughing, which created poorer soils, and an increase in importance of stock-raising, and the use of land for pastures. Settlements were more permanent and dispersed. With the shift to a more pastoralist economy, there was an increased importance on the individual and individualized status and power. This is evidenced in the change to single inhumations in round barrows.

Concomitant with the change to individualized burial practices, there is increased evidence for active style. Panache behaviors may be signified in the variety of burial goods. The typical male grave good was the groundstone battle axehead. The styles of these axeheads may have been emblemic and/or assertive (Wiessner 1983, 1985). The consistency of them in male burials, and their possible

association with "maleness", may signify that they were emblemic symbols of gender (male) and group identity (Gebauer 1987; Jensen 1982). Thus, as protocol behavior, the status and gender of the individuals buried may have signified wealth and power in this pastoralist society (Jensen 1982; MacDonald 1990). These protocols, and gender-based status, may have been used to re-focus attention on social bonds when burial activities were based less on group cohesion, and kin relations were narrow.

The main differences between the Single Grave Period and the Late Neolithic are in artifacts, rather than with respect to economy. The Late Neolithic Dagger Period involved technological changes with the development of the flat-flake technique (Liversage and Singh 1985) for the manufacture of daggers, lanceolate points, triangular points, and sickles. This change in technology may have enabled a greater inclusion of stylistic attributes in flint tools.

It is within the dagger type group that there is clear evidence for symbolically meaningful active style (Plog 1990). The considerable variation within this type group with respect to form and attributes is evidence of both protocol and panache behaviors, especially for the middle periods. The emblemic aspects of these daggers in the earlier forms may have served to identify gender and status, while the assertive aspects in the middle forms, the fishtail daggers, may have served to identify gender, as well as to focus on the individual's definition and expression of himself. Assertive styles relate more to socioeconomic change over time (Wiessner 1983) and may signify a change in importance of individuation of the members of a society at points of fluctuation in wealth and power (Earle 1990:75).

Technic Spheres

Therefore, there were periods in Danish prehistory which had considerable variation within stone tool type groups. In addition to variation attributable to function, the Technomic sphere, variation is, also, interpreted as representing times when stylistic variation was included in lithic artifacts. Objects bearing stylistic variation would have been important in the Ideotechnic and Sociotechnic spheres of prehistoric Danish societies.

The artifact type groups which have stylistic variation used in this study consistently are found in graves and hoards. These contexts signify the ideological and social importance of these type groups. Levy (1982) has argued that the shift form graves to hoards, in Period IV of the Bronze Age, signifies a change in the social system, where non-kin-related relationships become more important (see also Turner 1994). This shift can also be seen, earlier, in the Single Grave Culture (Damm 1991), and the Late Neolithic Dagger Period.

The differences with respect to kinds of artifacts deposited in hoards and graves, and the forms of burial (e.g. long mounds, round mounds, cremations) illustrate considerable changes which occurred throughout Danish prehistory. These changes included shifts in economy and social behavior (Hines 1989:203). Concomitant with these shifts, were shifts in the ideologies of the societies. The early ideologies would have served the purpose of group cohesion of small populations to enable group participation in subsistence activities and the construction of communal structures. During the Single Grave period and the early Bronze Age, the ideologies served to focus groups in the context of social inequality by supporting

group identities. And, in the late Bronze Age, the ideologies served also to focus groups in the context of social inequality, but by supporting more individualized identities. The role of symbols, such as artifacts with symbolic messages, would have reminded individuals of the ideologies.

> "First, much of religious activity is a kind of social communication (Linares 1977:60f.; Firth 1970:127f.; Turner 1965:81-82; Rapapport 1971: especially 62f.; Flannery and Marcus 1976:377), transmitting messages about ideology, ranking, kin responsibilities, community tensions, economic conditions, and numerous other social arrangements. Second, religious activity is a kind of adaptive mechanism, contributing to the maintenance of a community (Rappaport 1971; Turner 1969)." (Levy 1982:103, citations in original).

These objects would have been used in rituals, including those related to funerals and fertility (Damm 1992; Levy 1982). Religious rituals communicate through actions of the participants, and the iconography of objects which are used in the rituals (Levy 1982).

CONCLUSIONS

This study has illustrated a procedure for the identification of stylistic variation, contrasting stylistic variation with functional variation, workability, isochrestic variation, and derivation of variation. By analyzing the variation in artifacts in relation to the three predictions (Wiessner 1983), it is possible to identify style in lithic artifacts. In turn, this study has illustrated that the three predictions do enable the identification of the presence of stylistic variation.

In addition, this study illustrates that diachronic studies of degrees of variation in artifacts can be implemented, and enable the identification of stylistic content. Studies of style need not be restricted to normative/isochrestic variation (Young and Bonnichsen 1984:152; Rick 1996); but, rather should examine several forms, or realms, of variation.

This study also supports Edmonds and Thomas' (1987) argument that there is not a rigid division between isochrestic and iconographic variation: these concepts are not analytically separable. Isochrestic variation may best be viewed as the variation which is a product of Pelegrin's (1990) *schema operatoire,* as part of the *chaine operatoire* (Pelegrin 1990; Simek 1994; Inizan et al 1992).

Style is continuously updated and dynamic, while isochrestic variation is relatively stable through time (Wiessner 1985). On a social level, isochrestic variation, as well as workability, are individualized forms of variation. In contrast, stylistic variation is group-oriented variation, sometimes based on derivation, which has social and ideological meanings. Sackett's view of style is that "style is function writ small" (Sackett 1986b:630). I assert that when style functions in a non-Technomic manner, within the Ideotechnic and Sociotechnic spheres of societies, "style is function writ large" (Binford 1986:560). Its use within society has a powerful (Levy 1982) function in rituals and group cohesion.

Style is the representation of ideas that are significant to a society which needs the ideas to be communicated. These ideas are often related to group identity, as well as economic issues, such as fertility and resources (Childs 1991:353). Furthermore, "symbols for and symbolic acts of gender and social age do not just reflect the relations of power, they continually help actors to constitiute or negotiate their places

within varied social fields" (Larick 1991:326). Style enables the communication of ideas. These ideas can be subconscious and/or conscious. When it is conscious, there still could be an emic meaning that is subconscious. Larick (1991:327) states that archaeologists should not be concerned with the emic *meaning* of material symbols, but, "should attempt to infer the *meaningfulness* of formal traits within a specific social context". The symbolic meaningfulness of stylistic attributes is an important functional mechanism in social and ideological spheres of societies.

Many researchers have contrasted "style as passive" versus "style as active". In actuality, style itself is only passive (Hegmon 1992; Gebauer 1987; Conkey 1990). It is the individuals who use style to communicate ideas. In so doing, these individuals are actors. The objects with stylistic content are manipulated and employed as signals, or symbols, of an idea. Style is used within action by people who are expressing their identity, whether it be individual or group identity (Wiessner 1989:59), or to communicate messages relating to such things as ideology, kin relationships, group tensions, and economic issues (Levy 1982; Childs 1991; Damm 1992). If the issues are important to a whole society, than style is used, regardless of distance (Wobst 1977), to relay information.

SUGGESTIONS FOR FURTHER RESEARCH

The nature of this collection, including its small sample size, and the lack of provenience, restricts the ability to make definite conclusions about the use of style in Danish prehistory, and prehistoric societies, in general. It is important to recognize that, while symbolic style appears not to be present in some classes of stone tools represented in this collection, this thesis is restricted to a study of these classes for these

prehistoric periods. Further study of other classes of artifacts, e.g. ceramics and jewelry, for these periods of Danish prehistory may enable the identification of style. In addition, items of material culture which have the potential for stylistic content, such as basketry and clothing, would not have been preserved, at least in quantity. It can not be assumed that periods which do not appear to have stylistic variation in stone tools, would not exhibit stylistic behavior with other forms of material culture.

The procedure for the identification of stylistic variation as described in this thesis is based on an analysis of variation in relation to three predictions: the length of time required to manufacture an artifact, the length of the lifetime of an artifact, and the degree of variation in the artifacts within the type group. The fourth basis for the measurement of style in artifacts, the percentages of artifacts which have other forms of decoration than the one identified, could not be used for this analysis. The procedures which I have presented would be strengthened considerably by the inclusion of this prediction, in situations where this is feasible. In general, these procedures would be strengthened, also, by the use of larger sample sizes, a broader inclusion of artifact classes, and with materials which have good, clear proveniences.

The potential interpretive power of the diachronic approach presented in this thesis would enable studies of changes in technology. These studies would attempt to answer questions relating to such things as the place of technology in prehistoric societies, the social and ideological significance of the technology, the methods of manufacture, and the manufacturers of the technology.

The framework described in this thesis may enable archaeologists to better understand the significance of style-bearing technology, by asking the questions: "in what capacities were style-bearing technologies used?, what does it mean that

technology carried style?, what functions did the changes in technology serve for prehistoric societies?, and how did these changes impact the adaptive fitness of the populations involved?". The relationship between technology and style may have a great significance to the adaptive fitness of prehistoric societies (Hill 1985). By gaining a better understanding of the interrelationship of technology and style, it may be possible to interpret the development of new technologies and styles in relation to a population's ability to adapt to their social and physical environments.

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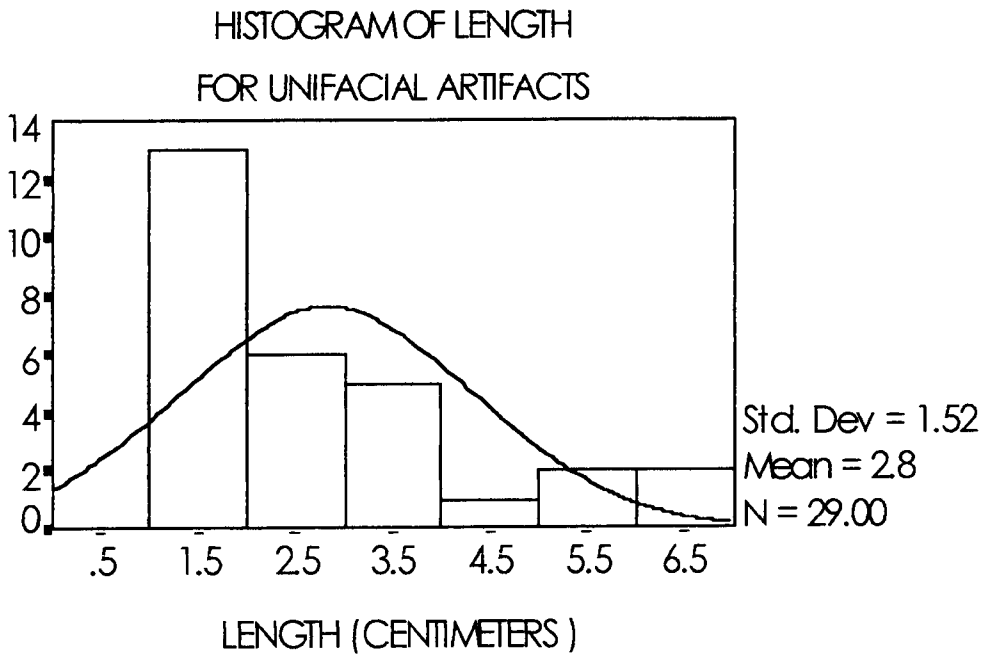
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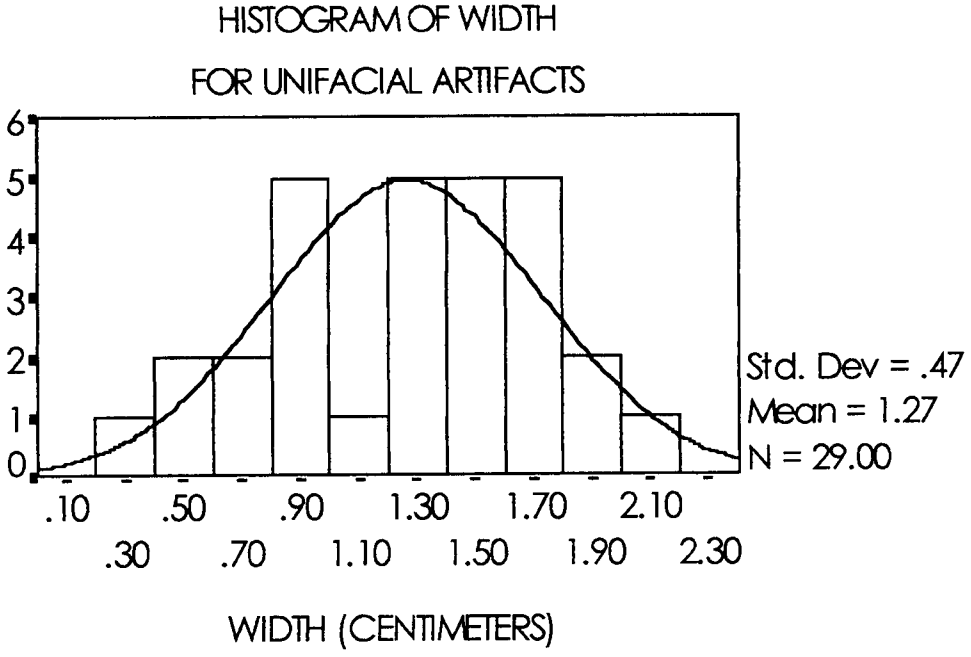
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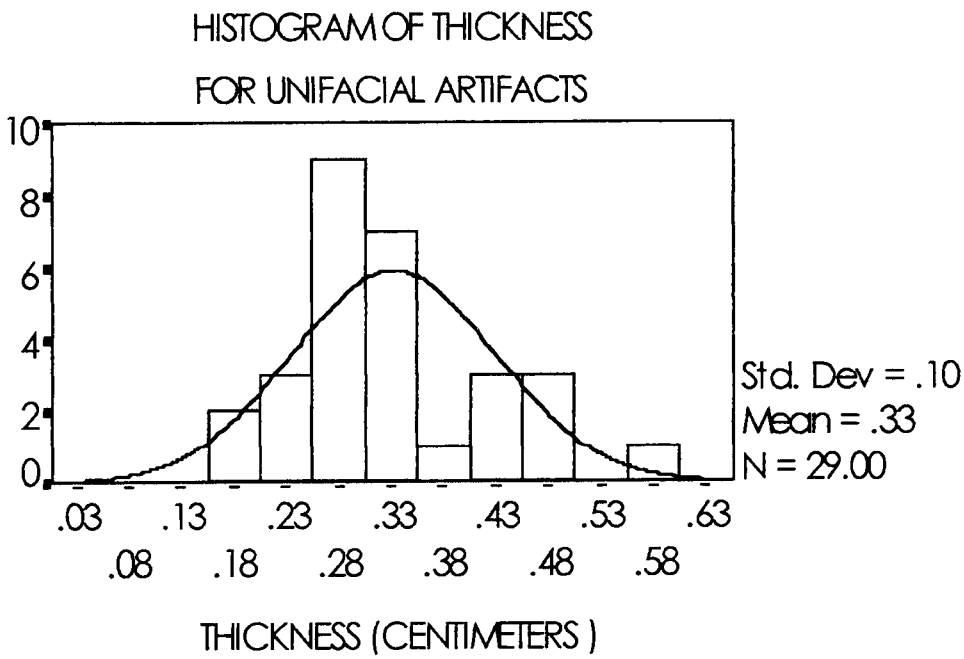
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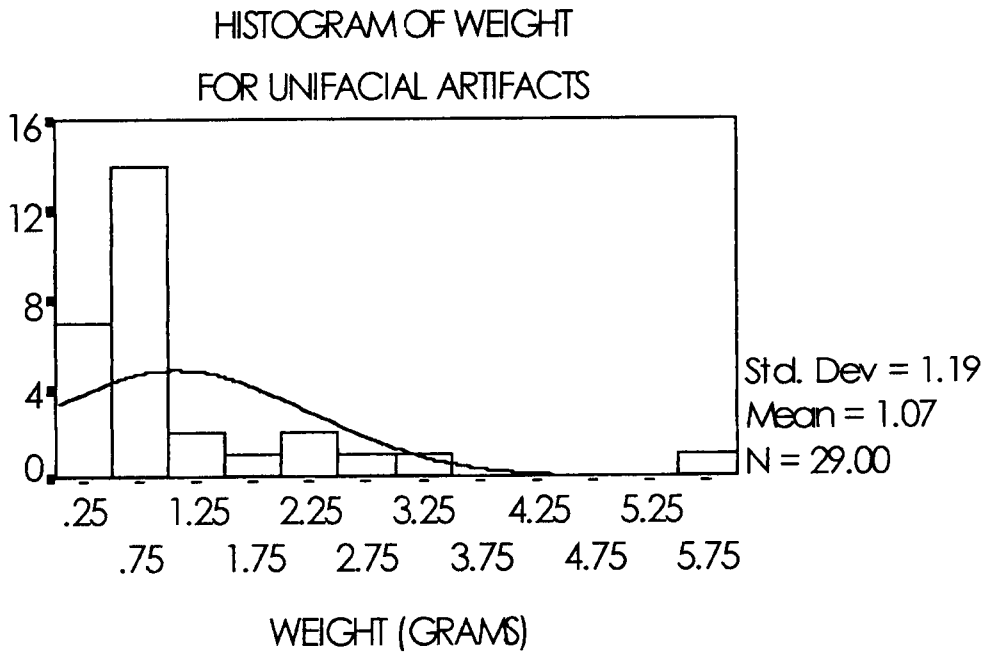
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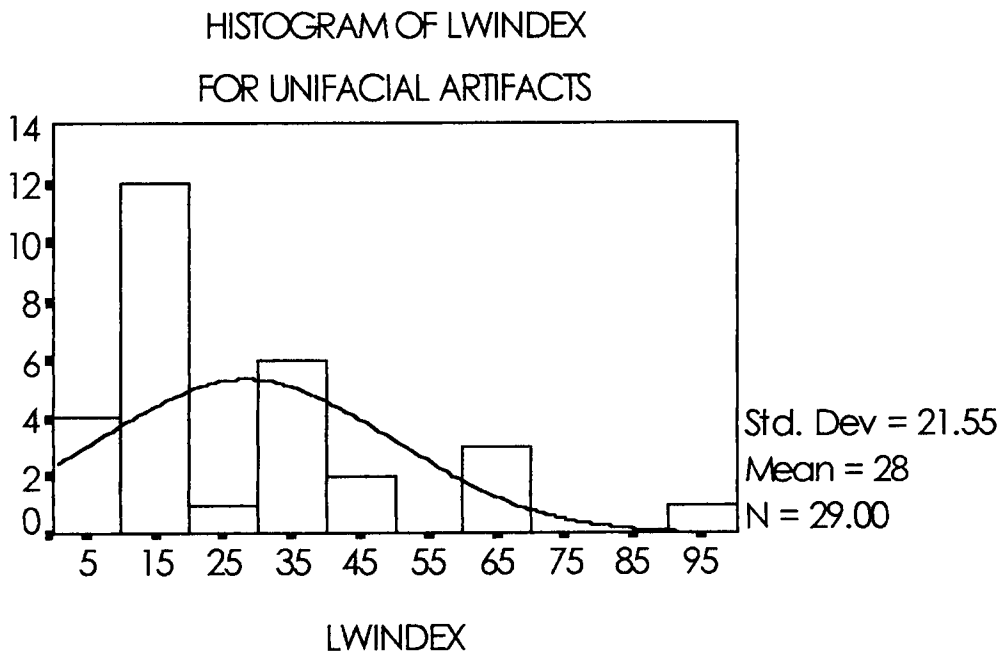
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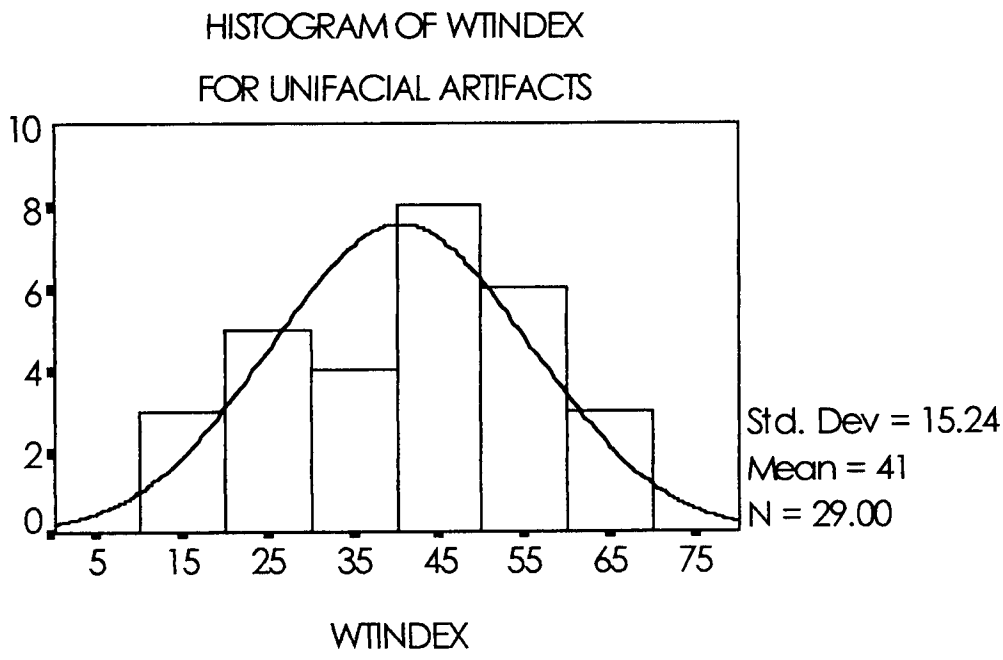





HISTOGRAM OF THICKNESS
FOR UNIFACIAL ARTIFACTS
10
8
6
4
2
0
.03
.08
.13
.18
.23
.28
.33
.38
.43
.48
.53
.58
.63
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Mean = .33
N = 29.00
THICKNESS (CENTIMETERS)

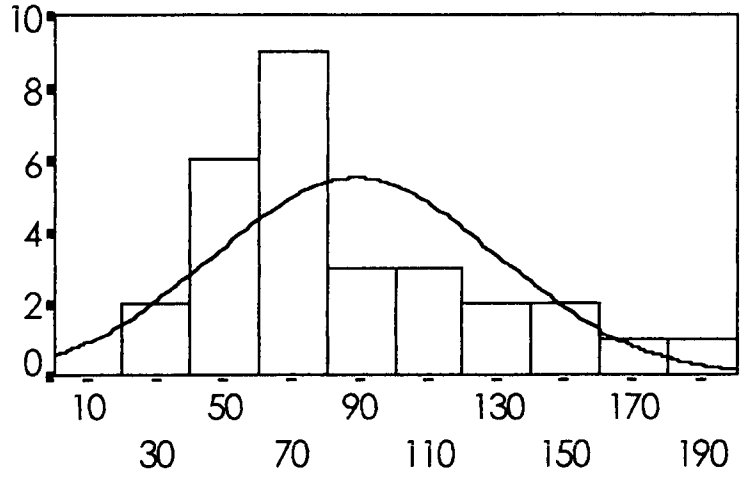

HISTOGRAM OF WEIGHT
FOR UNIFACIAL ARTIFACTS
16
12
8
4
0
.25
.75
1.25
1.75
2.25
2.75
3.25
3.75
4.25
4.75
5.25
5.75
Std. Dev = 1.19
Mean = 1.07
N = 29.00
WEIGHT (GRAMS)


HISTOGRAM OF LWINDEX
FOR UNIFACIAL ARTIFACTS
14
12
10
8
6
4
2
0
5
15
25
35
45
55
65
75
85
95
LWINDEX
Std. Dev = 21.55
Mean = 28
N = 29.00


HISTOGRAM OF WTINDEX
FOR UNIFACIAL ARTIFACTS
10
8
6
4
2
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5
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35
45
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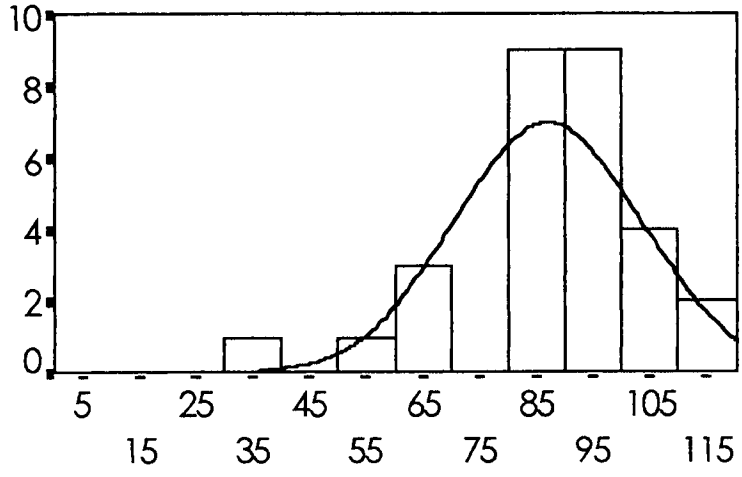
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LTINDEX

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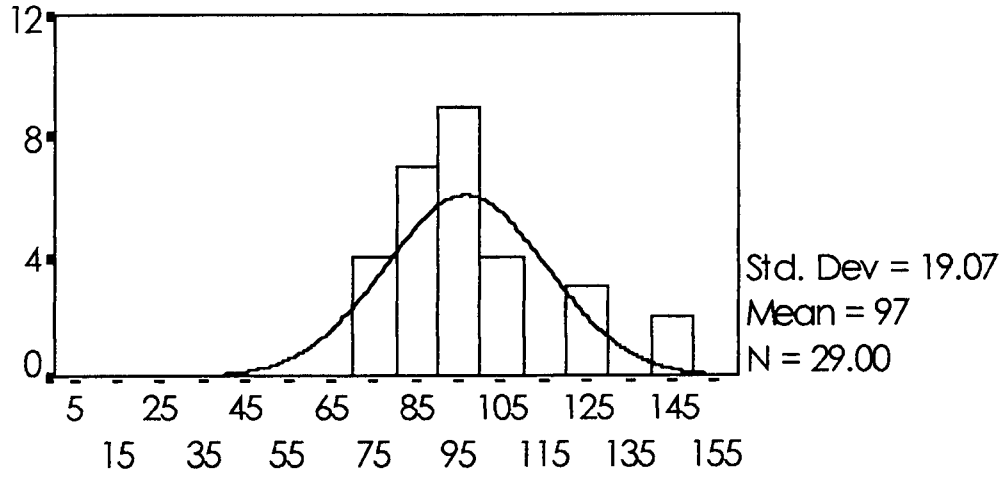
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RIGHT BASE ANGLE (DEGREES)

HISTOGRAM OF LEFT BASE ANGLE

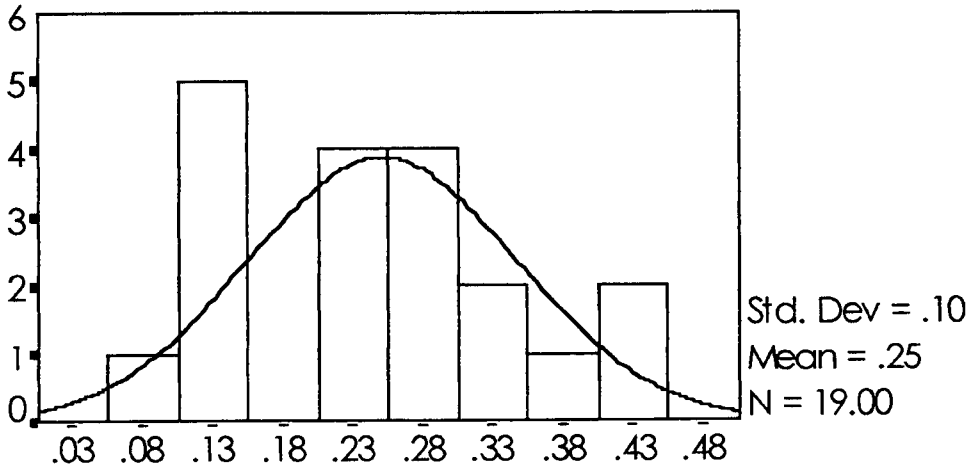
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LEFT BASE ANGLE (DEGREES)

HISTOGRAM OF RETOUCH LENGTH, SIDE 1

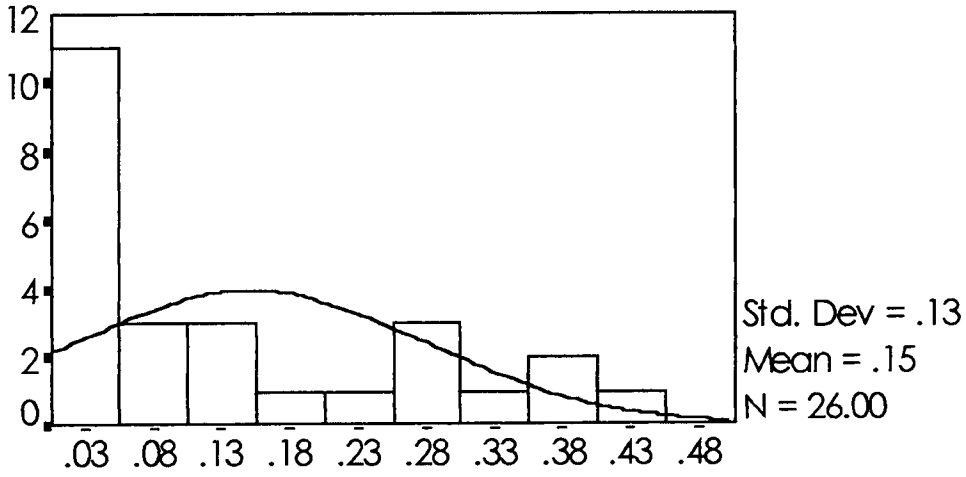
FOR UNIFACIAL ARTIFACTS



RETLTH1

HISTOGRAM OF RETOUCH LENGTH, SIDE 2

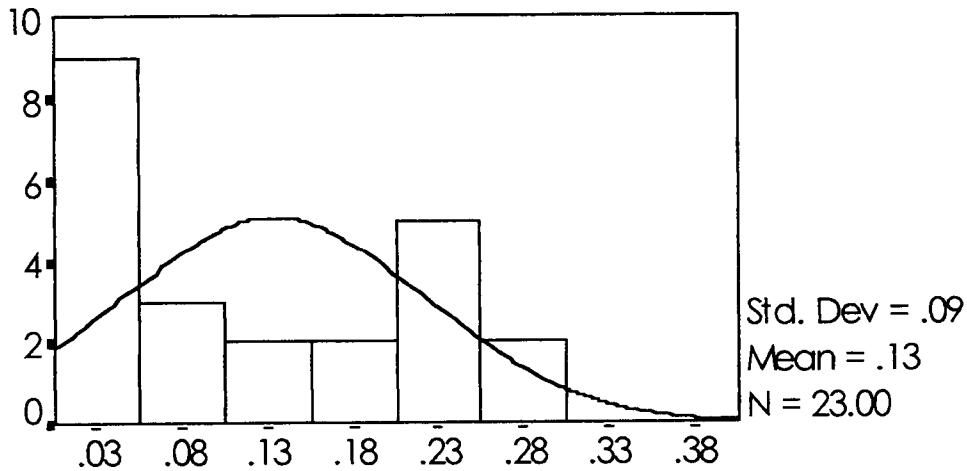
FOR UNIFACIAL ARTIFACTS



RETLTH2

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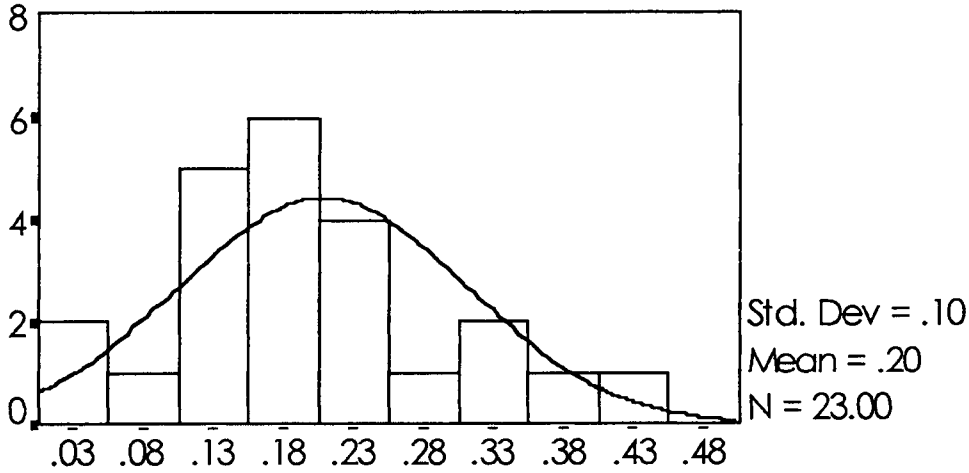
FOR UNIFACIAL ARTIFACTS



RETLTH3

HISTOGRAM OF RETOUCH LENGTH, SIDE 4

FOR UNIFACIAL ARTIFACTS



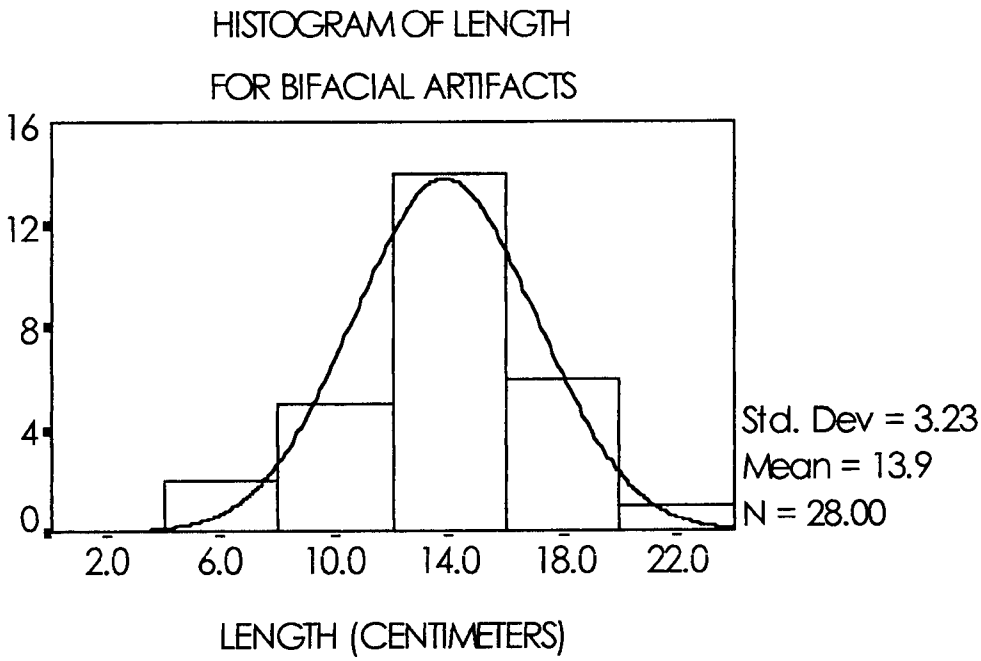
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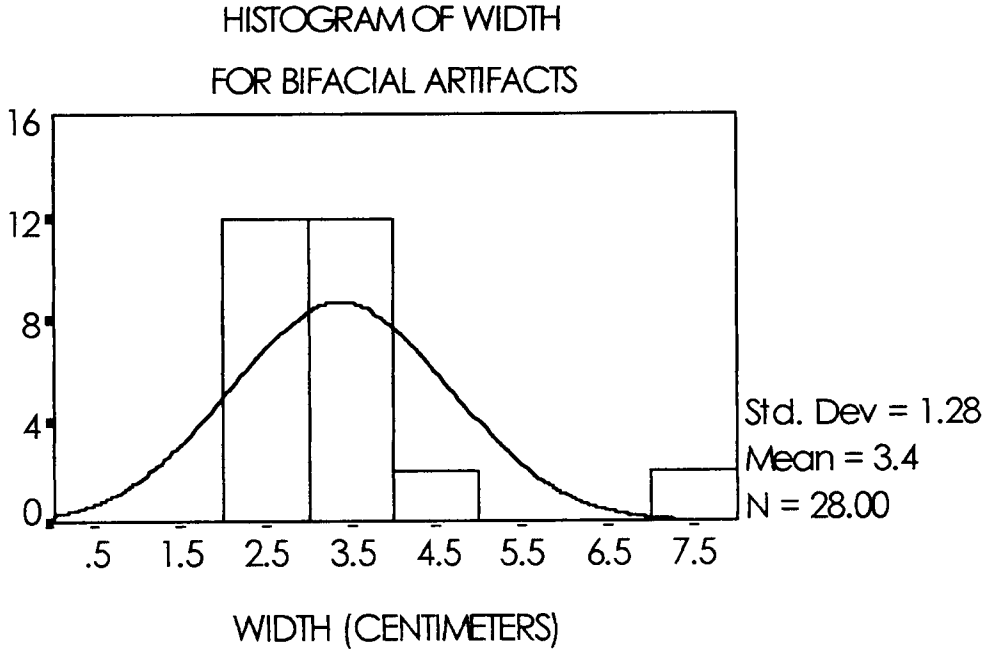
APPENDIX B

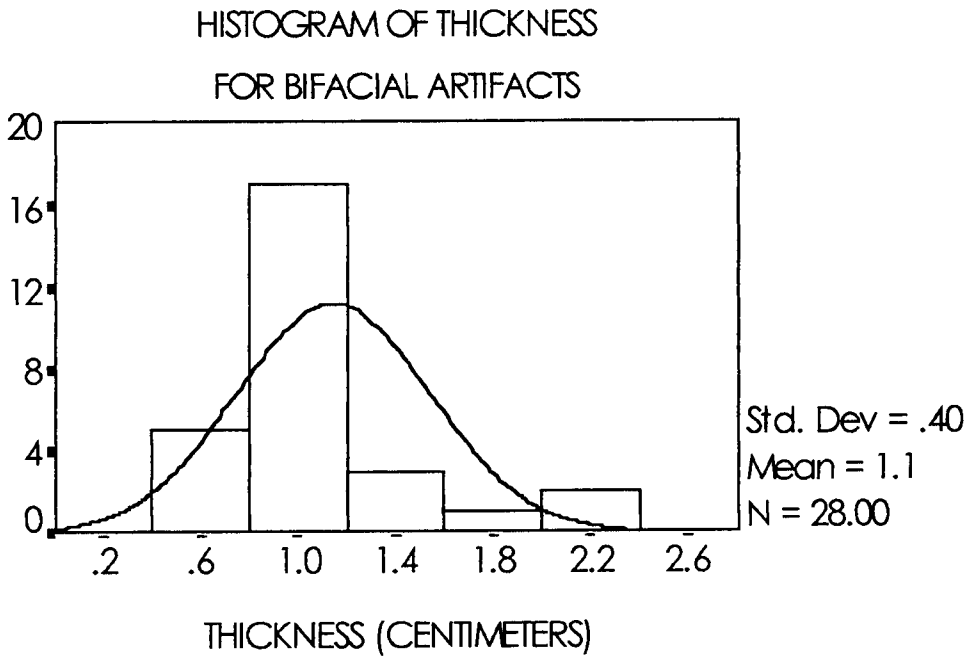
HISTOGRAMS FOR BIFACIAL ARTIFACTS

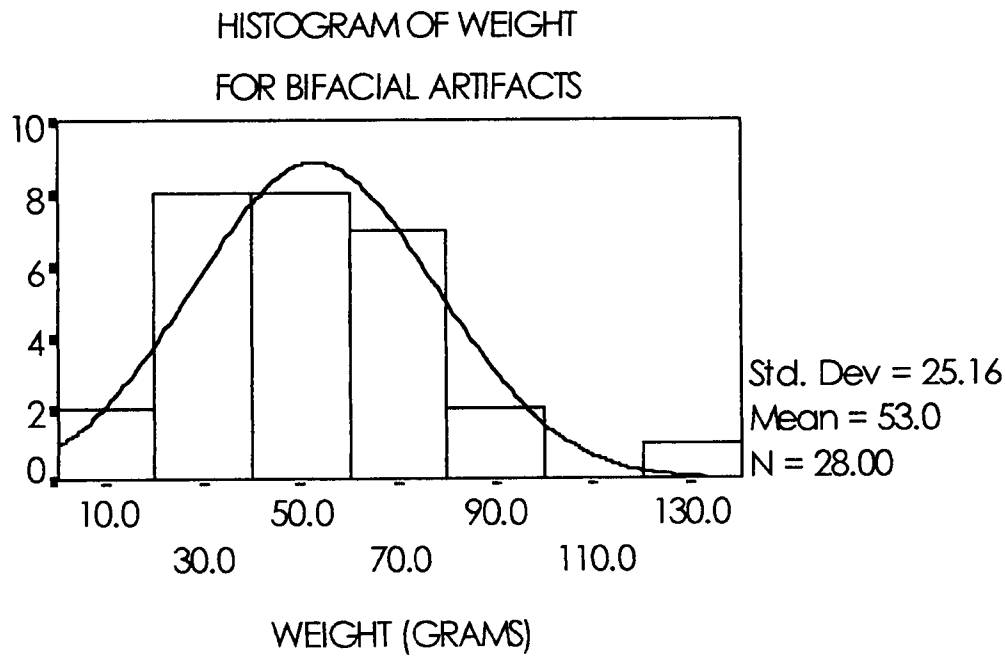
APPENDIX B

HISTOGRAMS FOR BIFACIAL ARTIFACTS



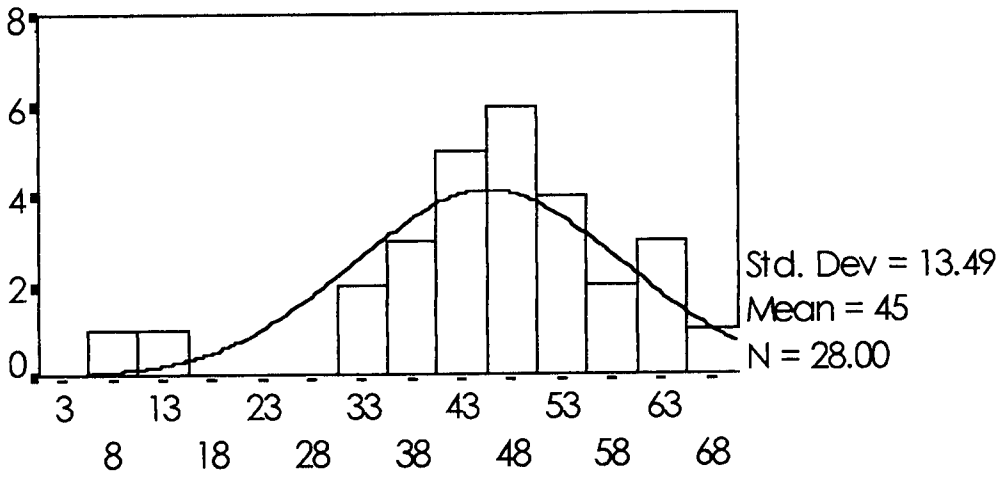



HISTOGRAM OF THICKNESS
FOR BIFACIAL ARTIFACTS
20
16
12
8
4
0
.2
.6
1.0
1.4
1.8
2.2
2.6
Std. Dev = .40
Mean = 1.1
N = 28.00
THICKNESS (CENTIMETERS)


HISTOGRAM OF WEIGHT
FOR BIFACIAL ARTIFACTS
10
8
6
4
2
0
10.0
30.0
50.0
70.0
90.0
110.0
130.0
Std. Dev = 25.16
Mean = 53.0
N = 28.00
WEIGHT (GRAMS)

HISTOGRAM OF LENGTH/WIDTH INDEX

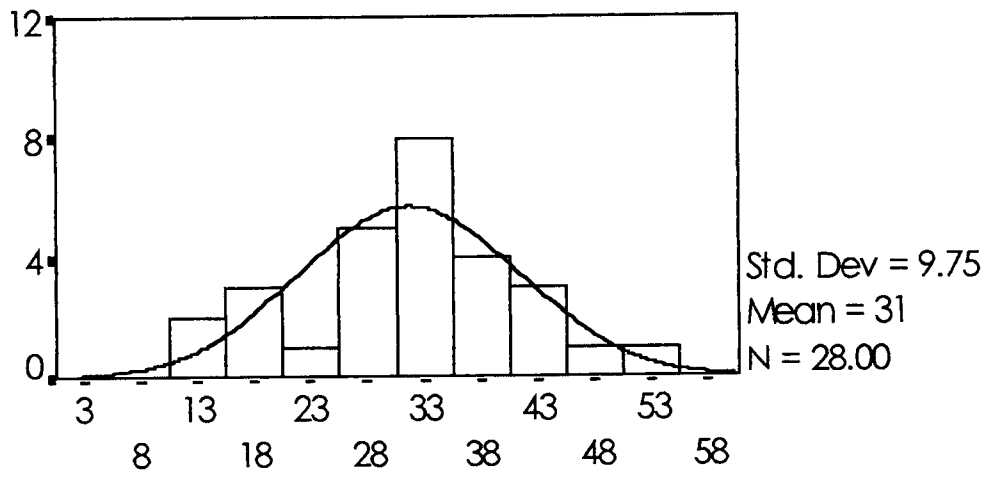
FOR BIFACIAL ARTIFACTS



LWINDEX

HISTOGRAM OF WIDTH/THICKNESS INDEX

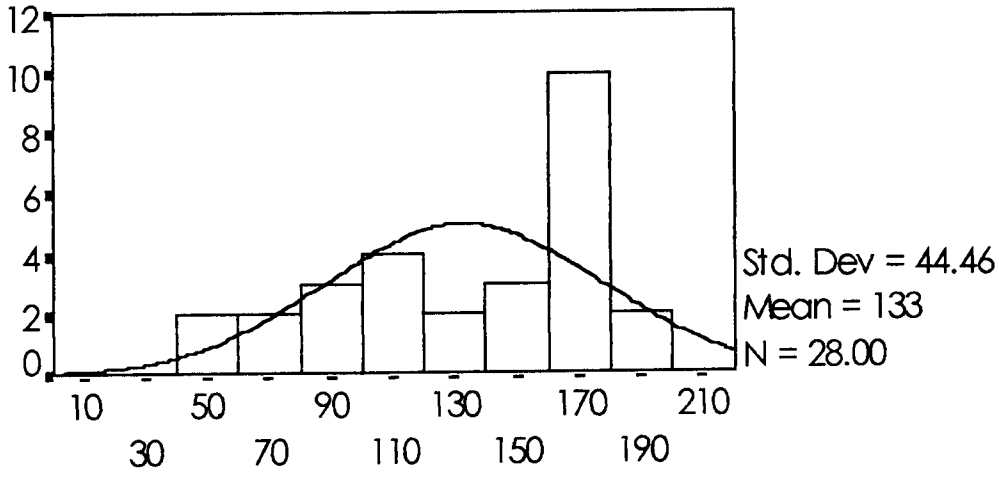
FOR BIFACIAL ARTIFACTS



WTINDEX

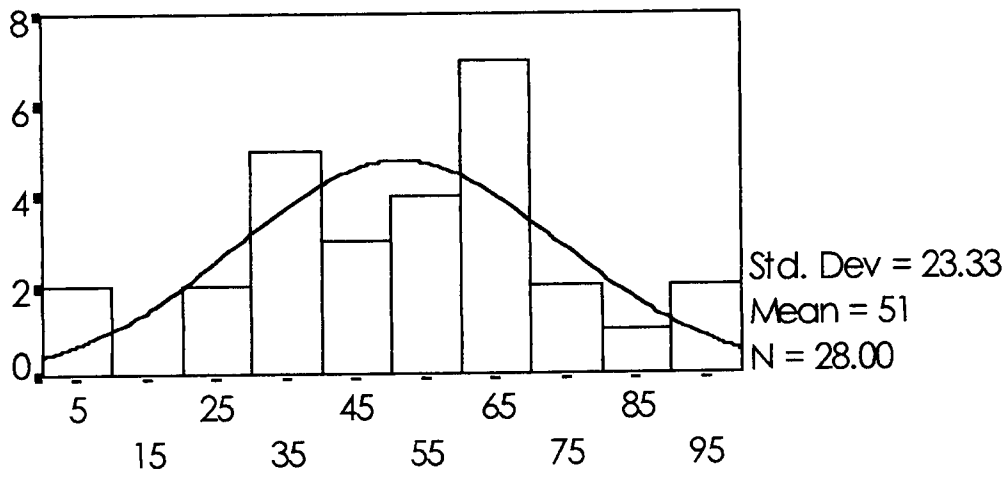
HISTOGRAM OF LENGTH/THICKNESS INDEX

FOR BIFACIAL ARTIFACTS



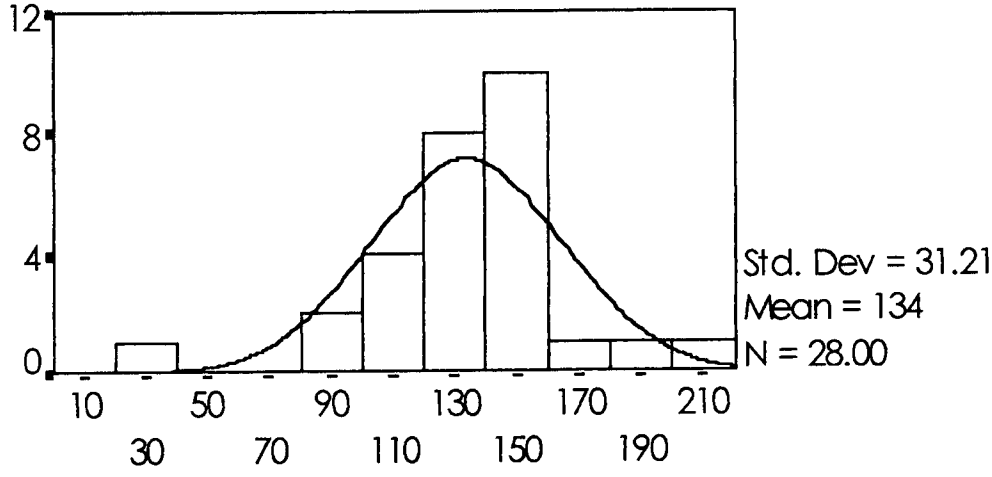
HISTOGRAM OF RIGHT BASE ANGLE

FOR BIFACIAL ARTIFACTS



HISTOGRAM OF LEFT BASE ANGLE

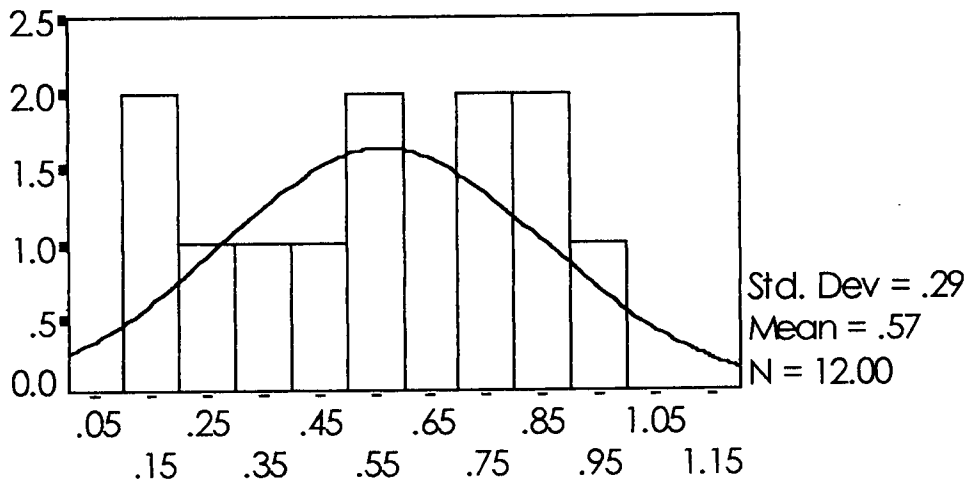
FOR BIFACIAL ARTIFACTS



LEFT BASE ANGLE (DEGREES)

HISTOGRAM OF RETOUCH LENGTH, SIDE 1

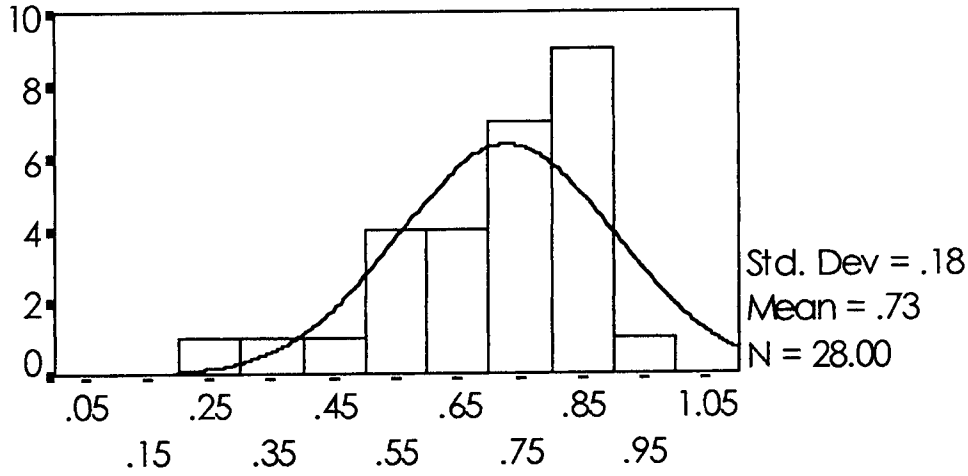
FOR BIFACIAL ARTIFACTS



RTLNGTH1

HISTOGRAM OF RETOUCH LENGTH, SIDE 2

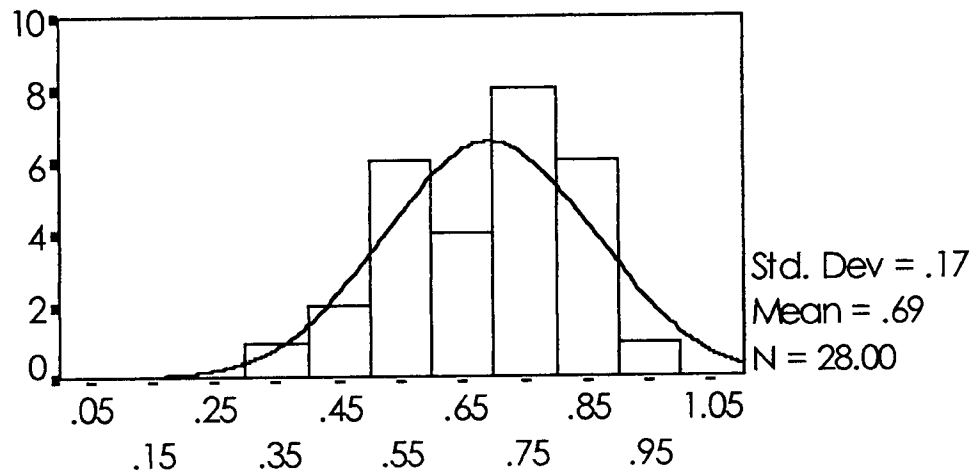
FOR BIFACIAL ARTIFACTS



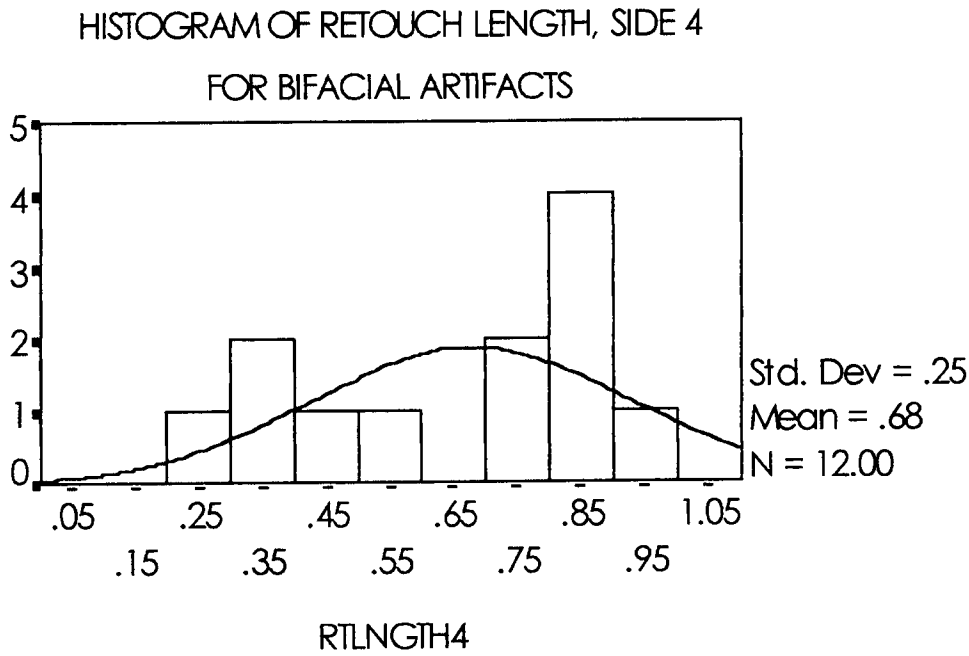
RTLNGTH2

HISTOGRAM OF RETOUCH LENGTH, SIDE 3

FOR BIFACIAL ARTIFACTS



RTLNGTH3

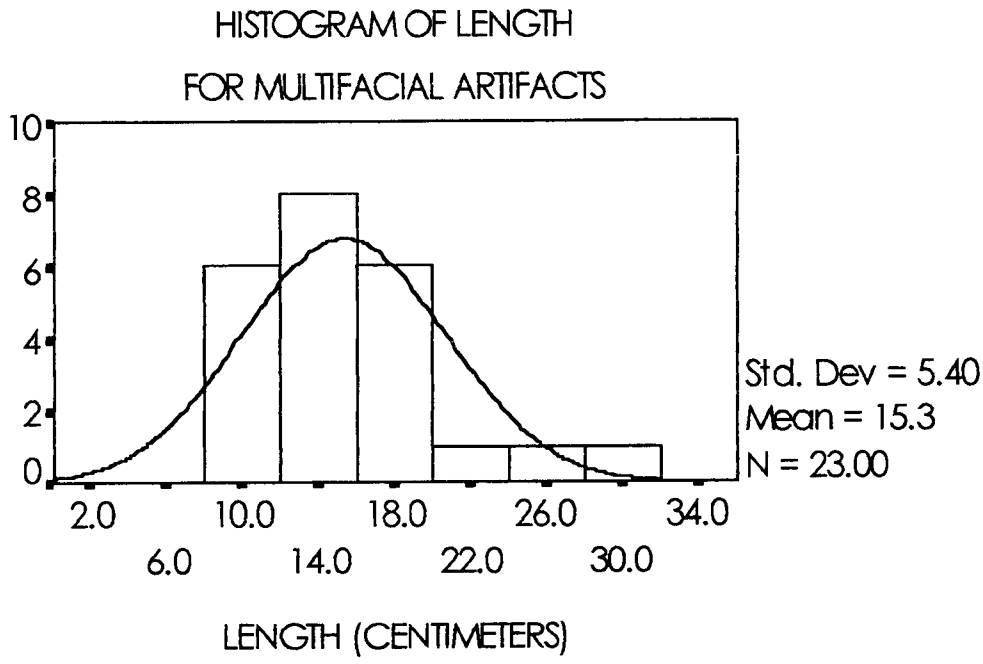

HISTOGRAM OF RETOUCH LENGTH, SIDE 4
FOR BIFACIAL ARTIFACTS
5
4
3
2
1
0
Std. Dev = .25
Mean = .68
N = 12.00
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
1.05
RTLNGTH4

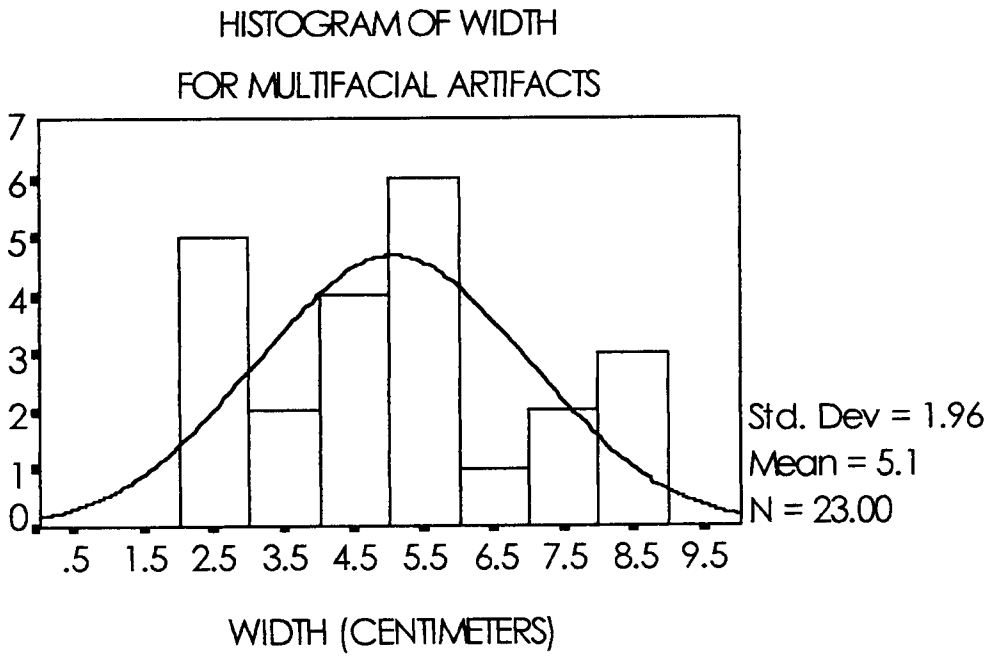
APPENDIX C

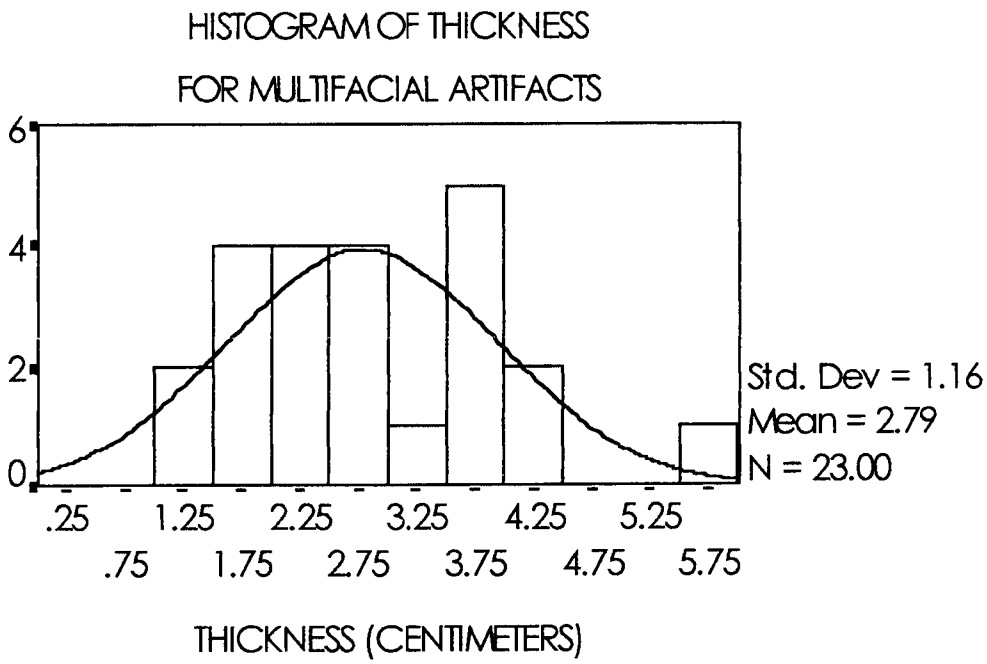
HISTOGRAMS FOR MULTIFACIAL ARTIFACTS

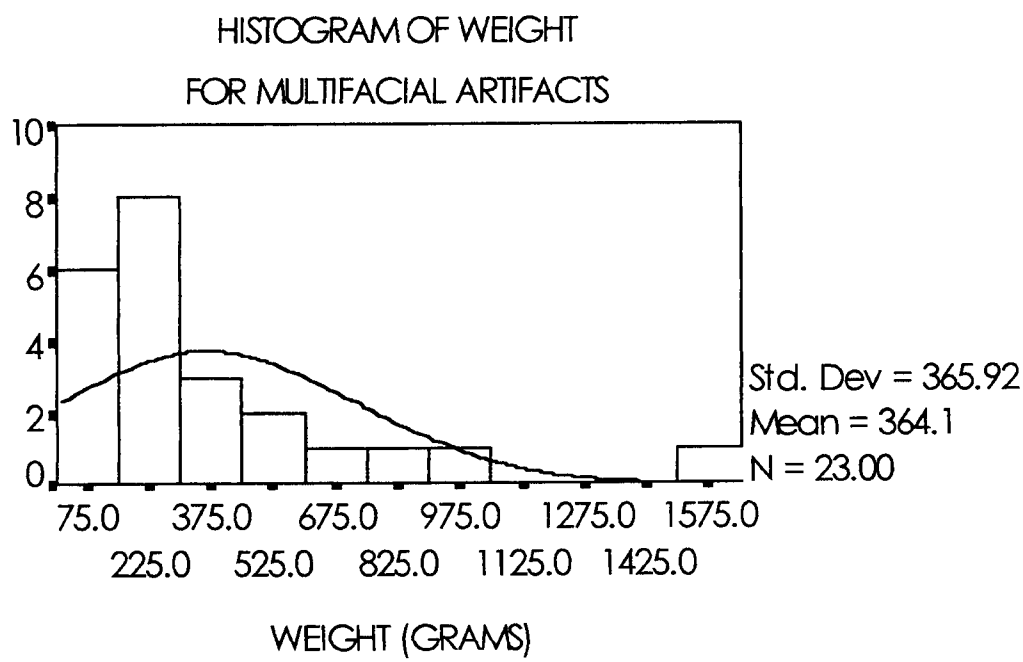
APPENDIX C

HISTOGRAMS FOR MULTIFACIAL ARTIFACTS



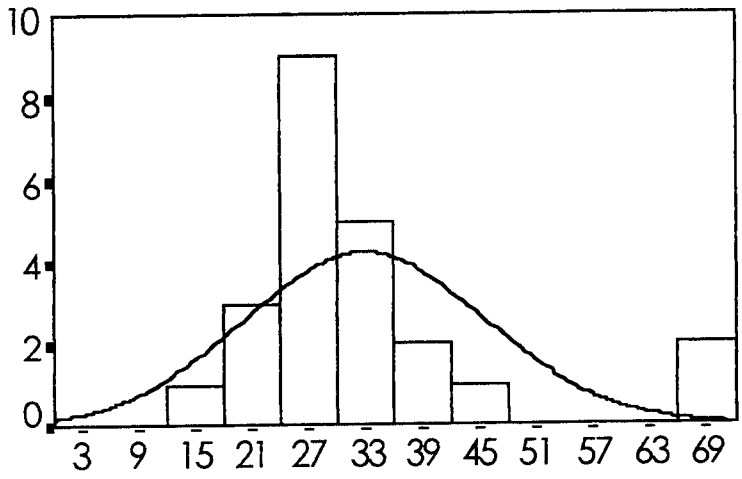



HISTOGRAM OF THICKNESS
FOR MULTIFACIAL ARTIFACTS
6
4
2
0
Std. Dev = 1.16
Mean = 2.79
N = 23.00
.25
1.25
2.25
3.25
4.25
5.25
.75
1.75
2.75
3.75
4.75
5.75
THICKNESS (CENTIMETERS)


HISTOGRAM OF WEIGHT
FOR MULTIFACIAL ARTIFACTS
10
8
6
4
2
0
Std. Dev = 365.92
Mean = 364.1
N = 23.00
75.0
375.0
675.0
975.0
1275.0
1575.0
225.0
525.0
825.0
1125.0
1425.0
WEIGHT (GRAMS)

HISTOGRAM OF LENGTH/WIDTH INDEX

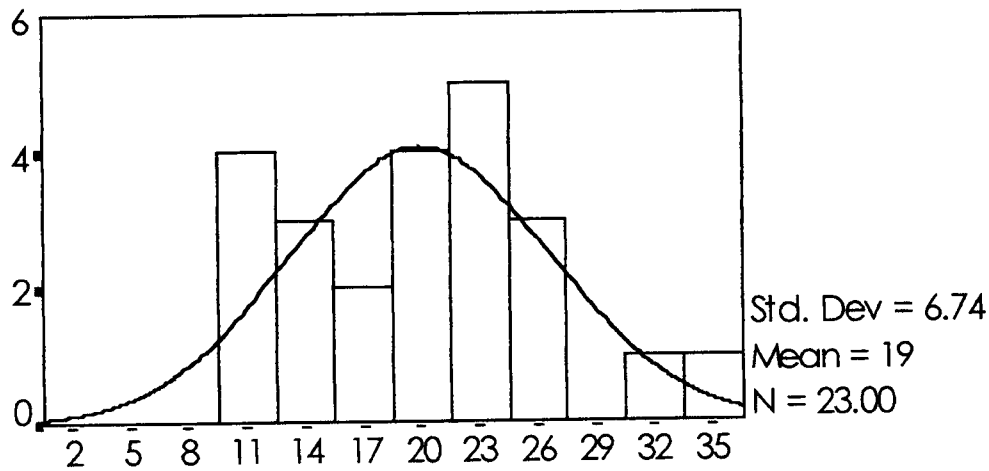
FOR MULTIFACIAL ARTIFACTS



LWINDEX

HISTOGRAM OF WIDTH/THICKNESS INDEX

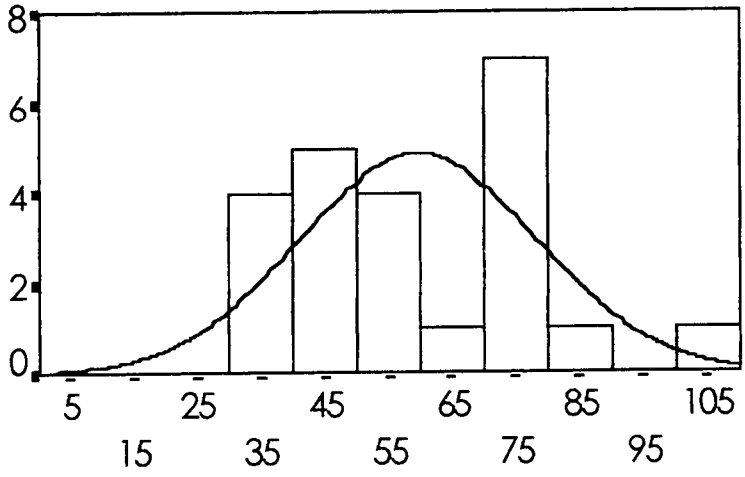
FOR MULTIFACIAL ARTIFACTS



WTINDEX

HISTOGRAM OF LENGTH/THICKNESS INDEX

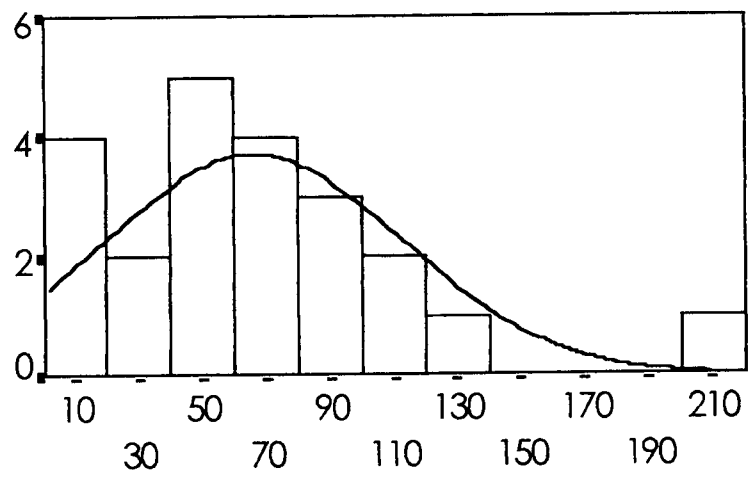
FOR MULTIFACIAL ARTIFACTS



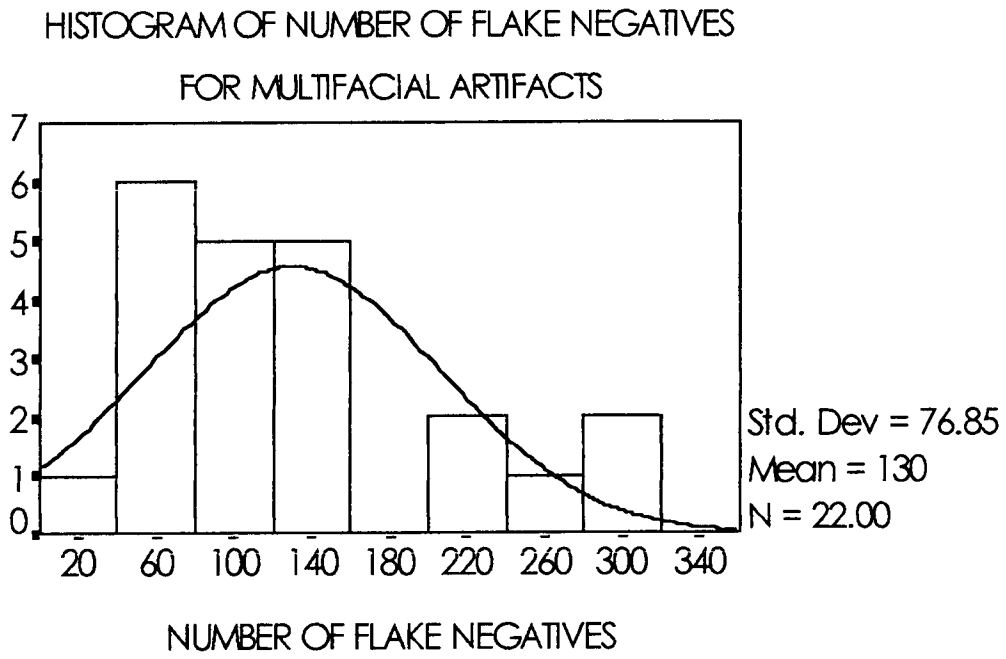
LTINDEX

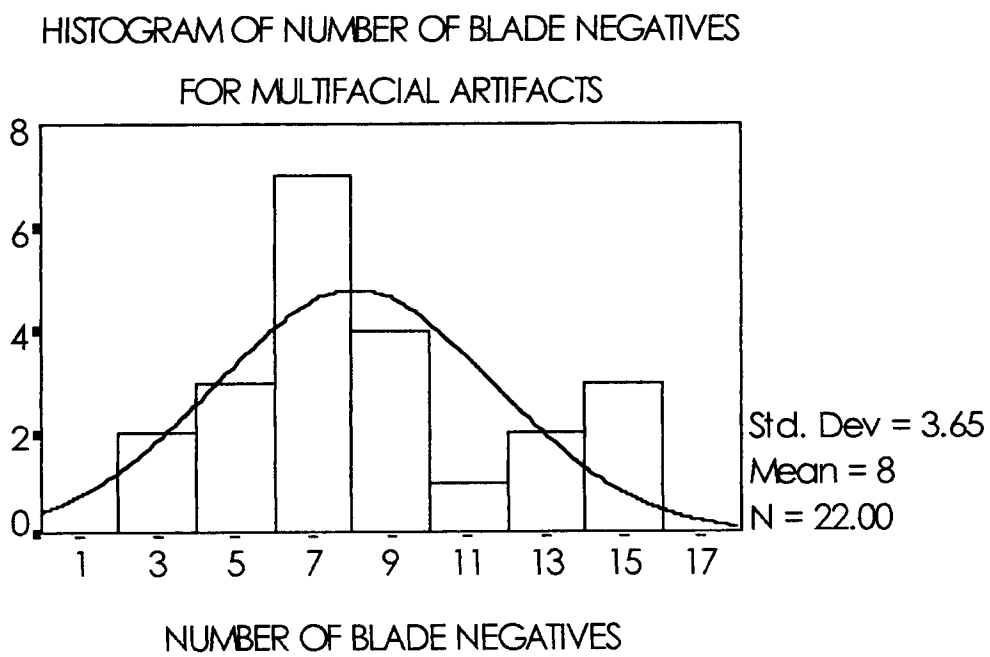
HISTOGRAM OF NUMBER OF PLATFORMS

FOR MULTIFACIAL ARTIFACTS



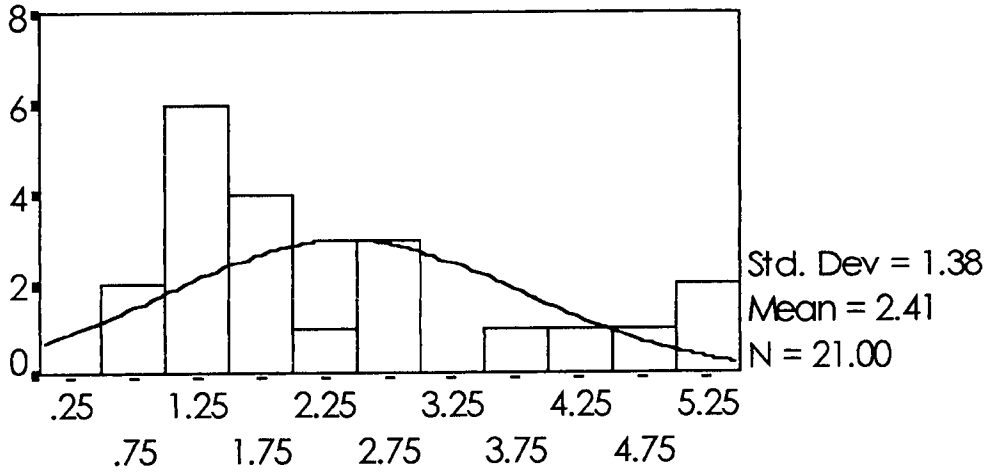
NUMBER OF PLATFORMS


HISTOGRAM OF NUMBER OF FLAKE NEGATIVES
FOR MULTIFACIAL ARTIFACTS
7
6
5
4
3
2
1
0
20
60
100
140
180
220
260
300
340
Std. Dev = 76.85
Mean = 130
N = 22.00
NUMBER OF FLAKE NEGATIVES


HISTOGRAM OF NUMBER OF BLADE NEGATIVES
FOR MULTIFACIAL ARTIFACTS
8
6
4
2
0
1
3
5
7
9
11
13
15
17
Std. Dev = 3.65
Mean = 8
N = 22.00
NUMBER OF BLADE NEGATIVES

HISTOGRAM OF LENGTH OF LARGEST NEGATIVE

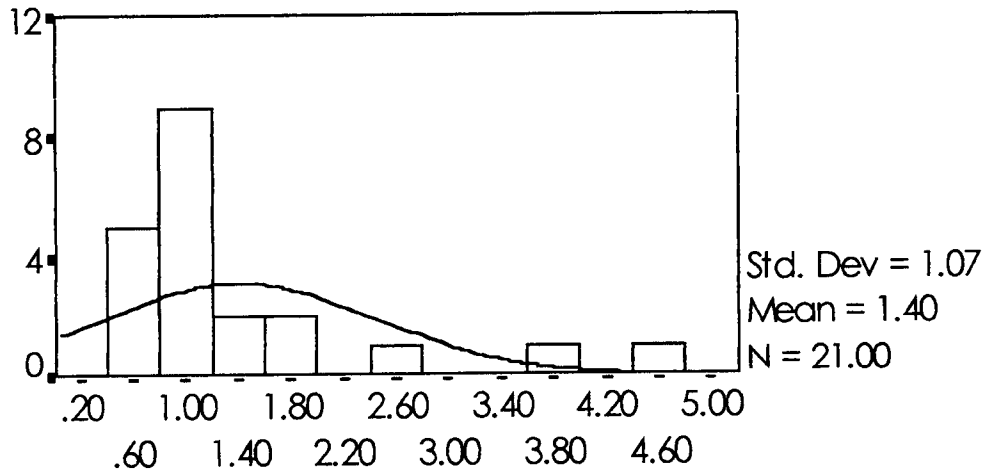
FOR MULTIFACIAL ARTIFACTS



LLARGNEG (CENTIMETERS)

HISTOGRAM OF WIDTH OF LARGEST NEGATIVE

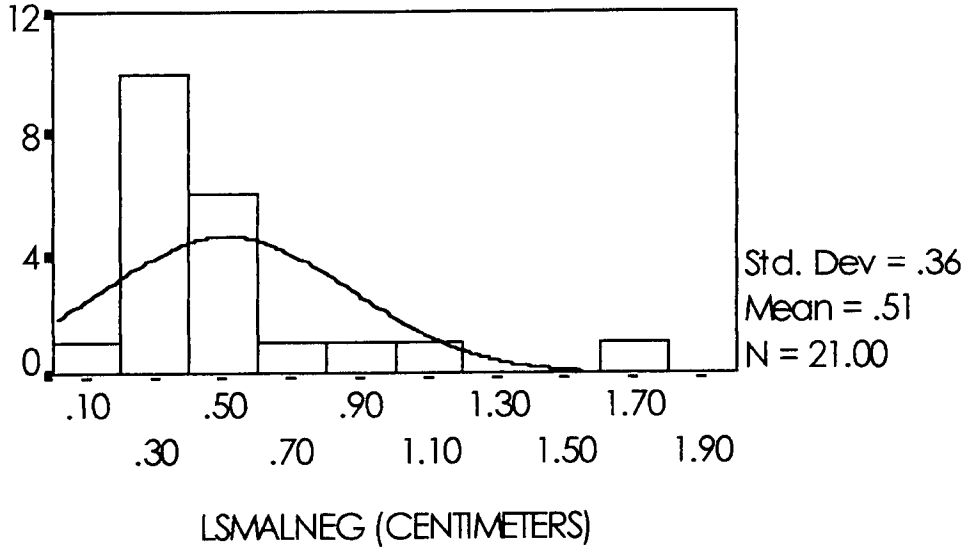
FOR MULTIFACIAL ARTIFACTS



WLARGNEG (CENTIMETERS)

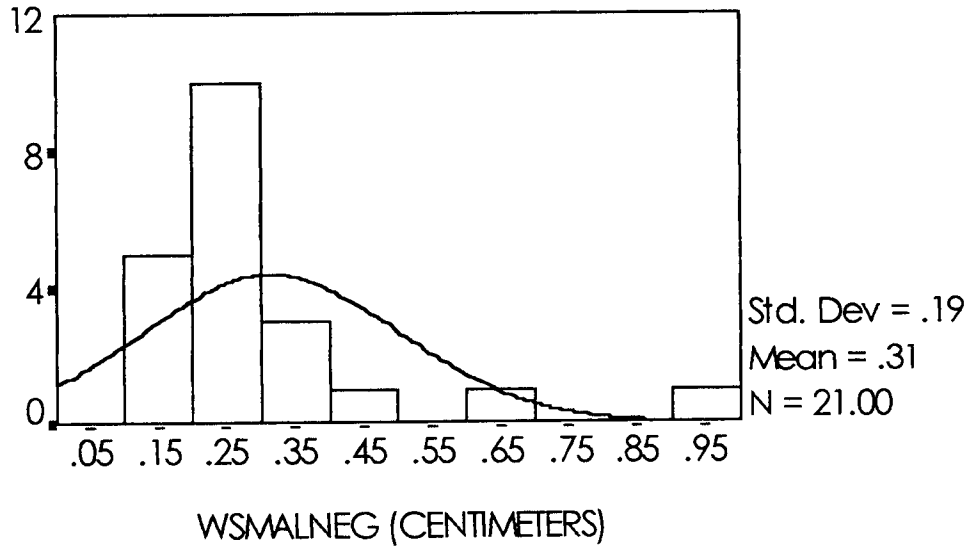
HISTOGRAM OF LENGTH OF SMALLEST NEGATIVE

FOR MULTIFACIAL ARTIFACTS



HISTOGRAM OF WIDTH OF SMALLEST NEGATIVE

FOR MULTIFACIAL ARTIFACTS

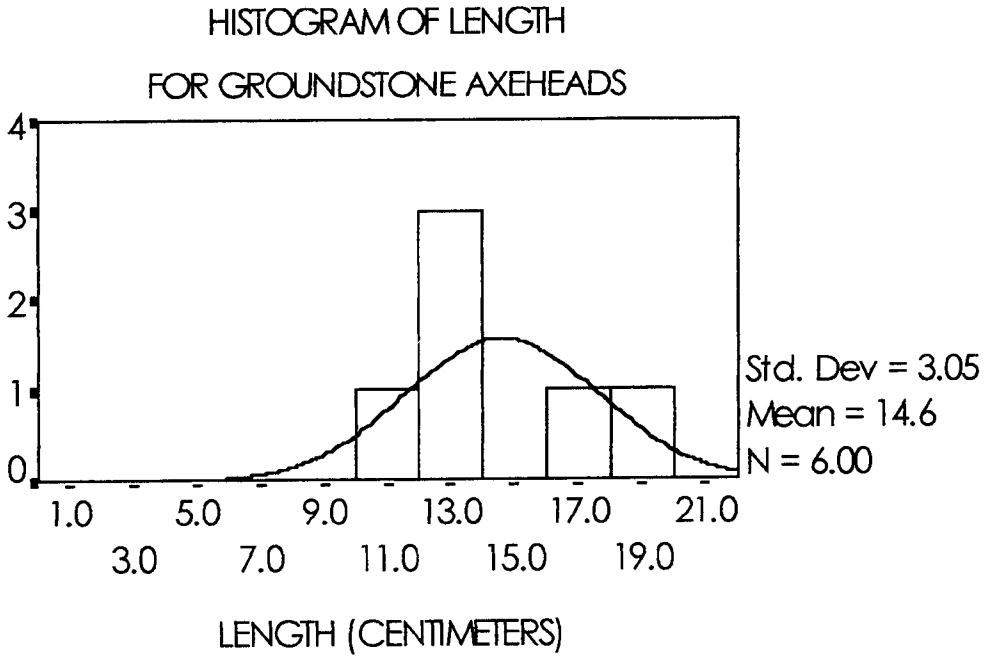


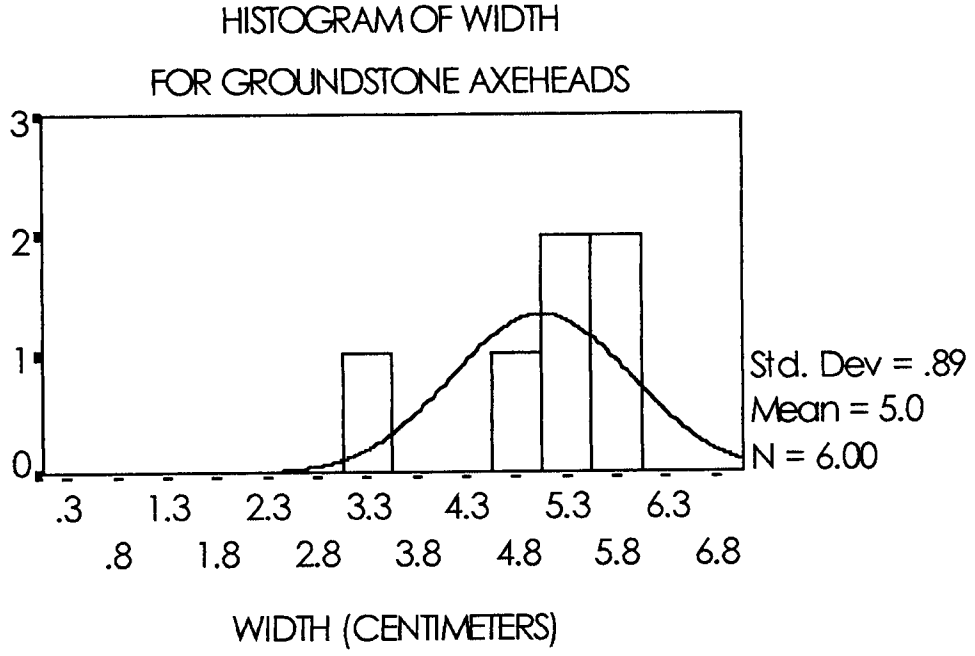
APPENDIX D

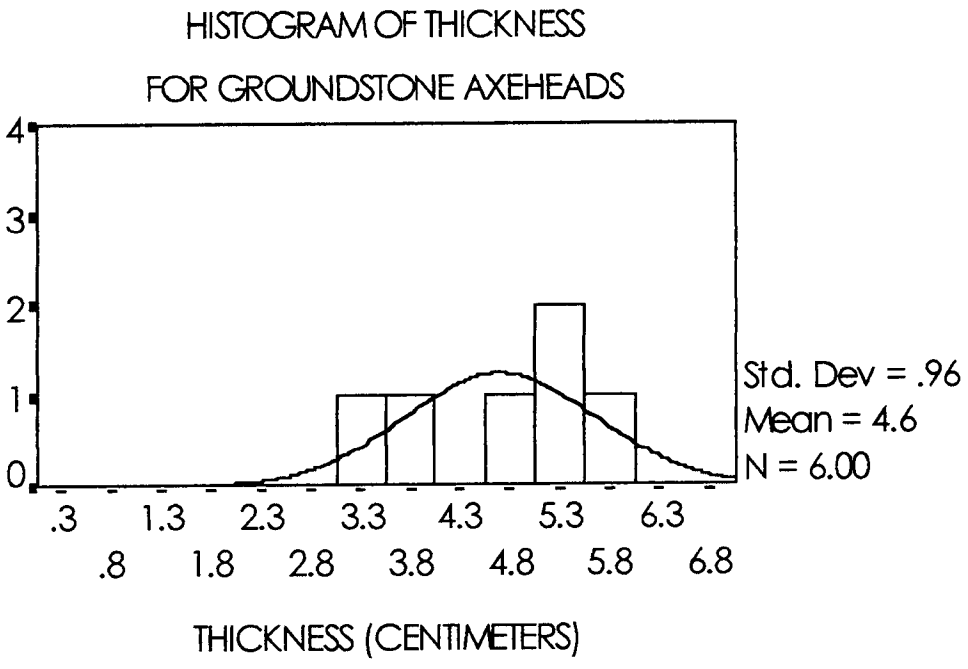
HISTOGRAMS FOR GROUNDSTONE AXEHEADS

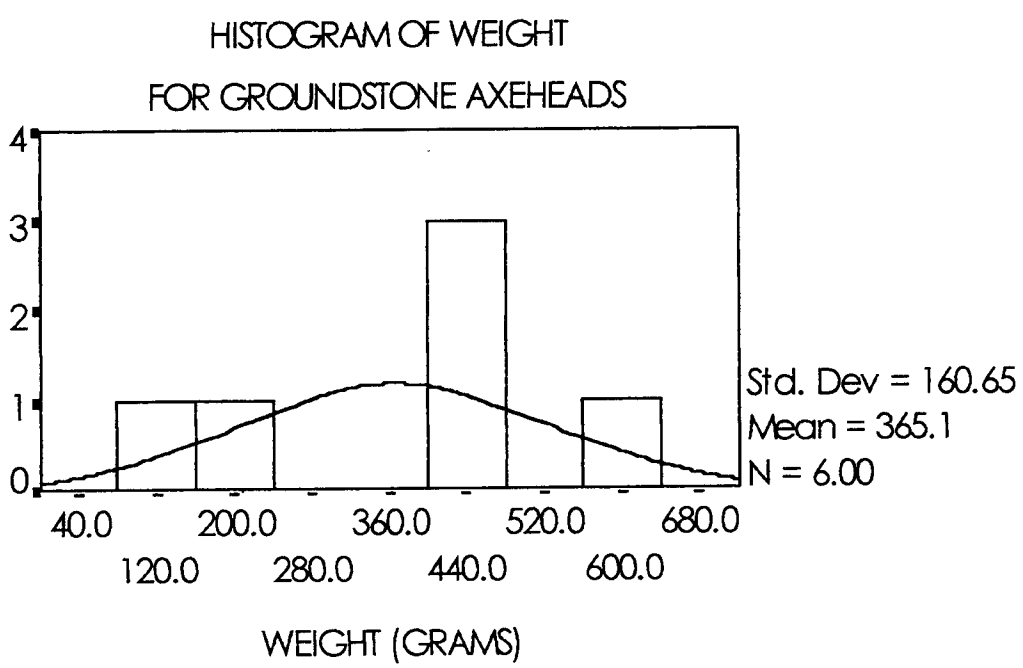
APPENDIX D

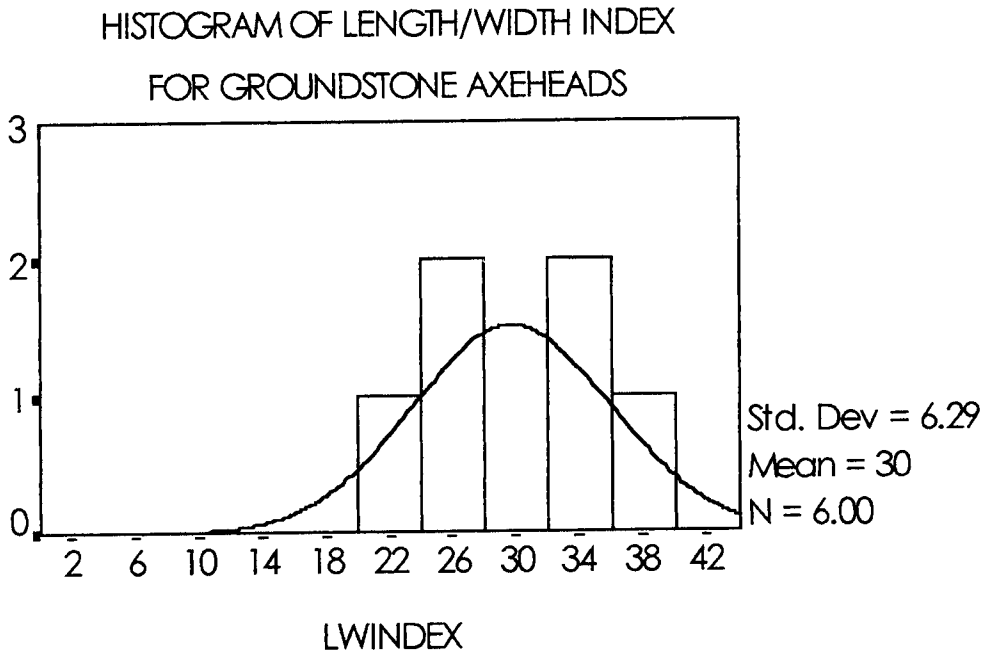
HISTOGRAMS FOR GROUNDSTONE AXEHEADS

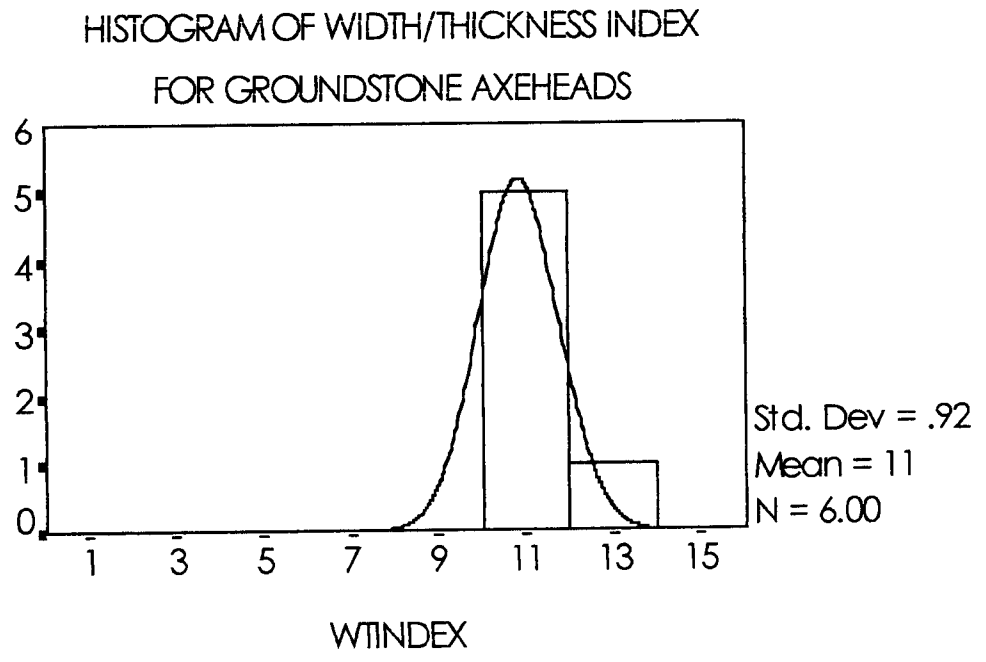


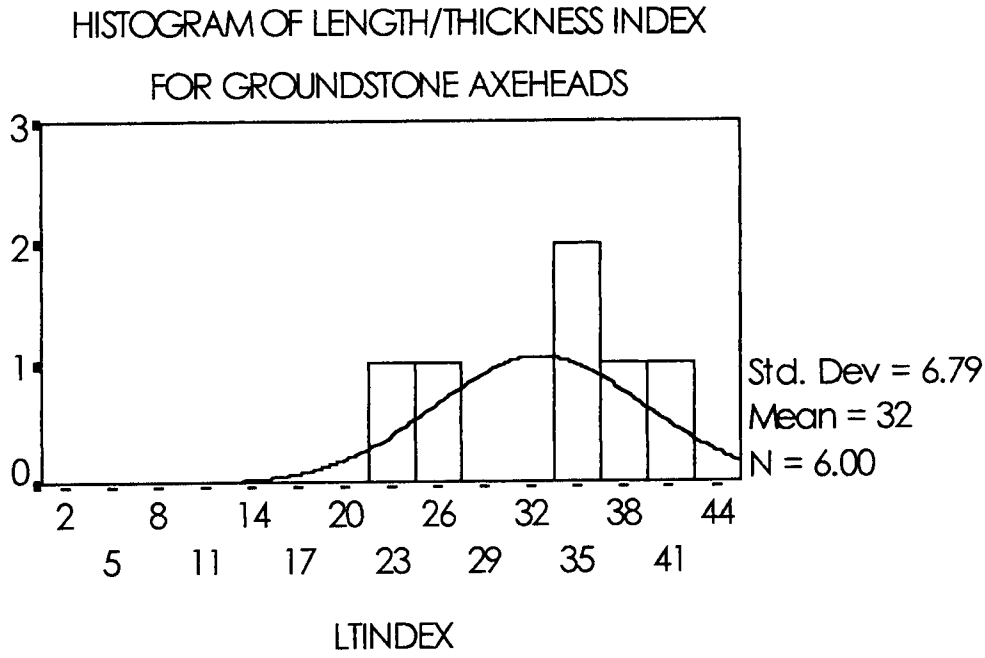



HISTOGRAM OF THICKNESS
FOR GROUNDSTONE AXEHEADS
4
3
2
1
0
Std. Dev = .96
Mean = 4.6
N = 6.00
.3
1.3
2.3
3.3
4.3
5.3
6.3
.8
1.8
2.8
3.8
4.8
5.8
6.8
THICKNESS (CENTIMETERS)


HISTOGRAM OF WEIGHT
FOR GROUNDSTONE AXEHEADS
4
3
2
1
0
Std. Dev = 160.65
Mean = 365.1
N = 6.00
40.0
200.0
360.0
520.0
680.0
120.0
280.0
440.0
600.0
WEIGHT (GRAMS)


HISTOGRAM OF LENGTH/WIDTH INDEX
FOR GROUNDSTONE AXEHEADS
3
2
1
0
2 6 10 14 18 22 26 30 34 38 42
LWINDEX
Std. Dev = 6.29
Mean = 30
N = 6.00


HISTOGRAM OF WIDTH/THICKNESS INDEX
FOR GROUNDSTONE AXEHEADS
6
5
4
3
2
1
0
1 3 5 7 9 11 13 15
WTINDEX
Std. Dev = .92
Mean = 11
N = 6.00


HISTOGRAM OF LENGTH/THICKNESS INDEX
FOR GROUNDSTONE AXEHEADS
3
2
1
0
Std. Dev = 6.79
Mean = 32
N = 6.00
2
5
8
11
14
17
20
23
26
29
32
35
38
41
44
LTINDEX

APPENDIX E

DANISH ARCHAEOLOGY AND PREHISTORY

APPENDIX E

DANISH ARCHAEOLOGY AND PREHISTORY

The purpose of this appendix is to describe, in a general way, the sequences of archaeological cultures that developed from the early settlement of Denmark through the Late Bronze Age. In Scandinavia, Denmark has a different research tradition than Sweden, and Norway, as well as other parts of the world (Myhre 1991:163). Therefore, it is appropriate to summarize the background of the development of Danish archaeology, before presenting a summary of modern interpretations of Danish prehistory.

Background of Danish Archaeology

The origins of modern archaeology lie in interpretations of Danish prehistory. Scandinavian archaeology, as with European archaeology in general, developed its foci and methodologies separately and along a different path than New World archaeology. The New, or Processual, Archaeology of North America was not adopted as quickly or as completely in Europe as in the United States. There was no Processual phase for many of the European countries (Hodder 1991:11). Therefore, "... we cannot write the history of European archaeology in simple culture-history-processual-post-processual terms" (Hodder 1991:22). The history of archaeology is different for each European country, with different interests and concentrations developing different ways and at different speeds.

The Three Age System was developed by Christian Thomsen when he was director of the Royal Danish Museum. However, the concept of three stages was actually a scholastic tradition dating back to classical antiquity (Graslund 1987:13). In 1813, Vedel Simonsen suggested a stone age, copper age, and iron age (Graslund 1987:17). But it was Christian Thomsen who applied it to artifacts, examining large collections of artifacts in order to attempt to construct sequences of changes in raw material, form, and style.

The Three Age System was developed in Scandinavia due to the establishment and growth of the national museums in Denmark and Sweden. The interest in national museums in Scandinavia was related to the recognition for the need of scientific archaeology (Graslund 1987:16). Because of these national museums, there was less emphasis on local collections compared to national. This made it possible to examine the collections on a regional scale. Therefore, general trends could be identified for larger areas than local collections would allow (Graslund 1987:14).

Because Scandinavia was not occupied by the Romans, there is a greater unity of occupation through time in Scandinavia, and, thus, more homogeneity in occupations (Graslund 1987:15). External populations, such as the Romans settled in other areas of Europe. There is greater disunity in the sequences of the occupations in Europe, where archaeological studies have emphasized the Roman monuments over sites and evidences of earlier and less obvious peoples (Graslund 1987:15).

The Royal Danish Museum was first conceived of by Frederick Munter (Klindt-Jensen 1975:45). The national museum was to house artifacts, as well as excavate, record, and interpret sites. Many forms of the museum were proposed, one of which was Rasmus Nyerup's, who based his idea on the museum of French Monuments, located in Paris, and established in 1801. While there already existed a public collection of artifacts in Christiansborg, the volume of the material made it difficult for visitors to interpret, and a series of thefts meant significant losses of important finds. Because of these thefts and concern about the destruction of archaeological sites, a commission was established to protect sites, and oversee the museum. The first secretary of the Commission was Frederick Munter, who found the project too overwhelming. Munter replaced himself with Christian J. Thomsen.

Christian Jurgensen Thomsen (1788-1865) was the founder of archaeology as a discipline in Denmark (Jensen 1993c:8). Thomsen developed archaeology as an empirical science. It was Thomsen who organized, classified, and exhibited the collections in the Royal Museum of Nordic Antiquities (Klindt-Jensen 1975:45). He developed a popular classification system for prehistoric materials, which used a series of stages as the framework: a Stone Age, a Bronze Age, and an Iron Age (Klindt-Jensen 1975; Jensen 1993c:9). This classification system was based on raw material, the materials used for manufacture of the items, as well as the function, form, and style of them. Thomsen's Ages were described in a culture-historical schemes in Ledetraad til Nordisk Oldkindighed in 1836 (Klindt-Jensen 1975:45).

Through the comparative scheme and the development of an artifactual taxonomy, Thomsen's stages were able to incorporate all of the data relating to prehistory known at the time, and which developed into the system

implemented by most European archaeologists (Jensen 1993c:8-9). These developments have been seen as an intellectual and perceptual breakthrough, impacting archaeology everywhere. Thomsen's work was based on evolutionist ideologies of the 19th century. Also, through his work, Thomsen established an early collaboration for archaeology with the Natural Sciences. Thomsen's successor at the Danish Museum, J. J. A. Worsaae (1821-1885), continued the development of evolutionary ideologies (Jensen 1993c:8-9).

In 1848, a new Constitution for Denmark was established; the Commission was dissolved; and the Ministry of Culture was established (Klindt-Jensen 1975:45). The Royal Museum was placed under the Ministry, as was the Inspector for the Conservation of Antiquarian Monuments. J. J. A. Worsaae was the Inspector, and replaced Thomsen in 1865, after Thomsen's death (Klindt-Jensen 1975:45).

Both Thomsen and Worsaae supported the notion of a national and international survey of artifacts (Graslund 1987:15). Worsaae implemented a survey and recording of archaeological structures and materials in 1873, which would develop into the Danish National Record of Sites and Monuments of the National Museum of Denmark (Jensen 1993c:9). Worsaae is considered the founder of comparative archaeology (Graslund 1987:15). His work was the first comparative form, investigating external forces for the development of Danish prehistory.

In Worsaae's Danmarks Ikdrud oplyst ved Oldsager of Gravhoje (1843), the need for a Three Age System for analysis of artifacts was clarified. Worsaae was a leader in recognizing a period in Europe's past where humans made and used tools of stone (Daniel 1967). One of Worsaae's students, Sophus Muller (1846-1934), was the dominant archaeological theorist for over fifty years (Jensen 1993c:9). He supported inductive methods, with a strong positivist stance, and played down the development of theories. To Muller, archaeological explanations spontaneously emerged from comparison and contrast of archaeological materials.

Archaeology in Denmark was next dominated by the research of Johannes-Bronsted (1890-1965). He published a series of volumes entitled Danmarks Oldtid from 1938 to 1940. This work continued the same positivism, and lack of theory building, as before, but did demonstrate the variety of artifactual materials of Danish prehistory (Jensen 1993c:9). Like archaeology in the New World, research in the late 1940s and 1950s was largely a reconstruction of lifeways, settlement development, and culture history. Scandinavian archaeology involved mapping distributions and compiling inventories (Myhre 1991:163).

Carl Axel Moberg was a visiting professor at the University of Chicago in 1963, where he worked with Lewis Binford and Robert Braidwood. Moberg took the American concepts of typology, attributes, and quantitative methods to Scandinavia, as well as Processual concepts (Myhre 1991:166). Along with the introduction of typological methods, the 1960s also saw the introduction of the concept of "culture" from the anthropological perspective. Influenced by Moberg's works, Mats P. Malmer argues for a hypothetico-deductive approach in archaeological analysis (Myhre 1991:166).

Modern Archaeology in Denmark

In Denmark, the archaeology of the 1970s was based on the development of settlement archaeology in the 1960s (Jensen 1993c:10). Settlement archaeology grew as a result of salvage archaeology (Myhre 1991:169). This brought an emphasis on environmental studies, and how humans adapted to their environments. From these developments, as well as the influences from the New Archaeology of North America, statistical analysis, and objective, quantitative techniques were developed or adopted in the 1970s and early 1980s (Jensen 1993c:11).

An emphasis on ecological, economic and geographic analyses continued into the 1980s. There developed an

> "ecological-systems-neo-evolutionary approach. ...Within this paradigm a reductionist systems theory based on ecological, economic and social subsystems came to dominate Scandinavian archaeology for nearly a decade...which also came to dominate more popular review books...and museum exhibitions, especially in Denmark" (Myhre 1991:171).

Analyses moved from the inductive, positivist approach to deductive ones.

While actual changes in methods and techniques occurred, there was little development of overlying theories (as in New World archaeology) (Myhre 1991:169). More recently, in Europe as well as in the New World, some archaeologists have rejected the Natural Sciences' approaches to archaeological analyses, and have worked towards symbolic or linguistic interpretations in archaeology (Jensen 1993c:11). They view archaeology as a subjective social science, rather than a objective natural science; archaeology is not an objective science, but a social science and humanistic (Myhre 1991:171, 176). However, Danish archaeologists, for the large part, have continued the emphasis in analysis on ecological and economic interpretations (Jensen 1993c:11).

Danish Prehistory

There is some difference in time between the prehistoric sequences in Denmark and other parts of Europe. These differences relate, in part, to geographic position and resource availability. Probably since megalithic construction began along the west coast of Europe, this kind of construction began, and climaxed, in Denmark later than in western Europe. Similarly, the manufacture of bronze was considerably delayed in Denmark compared to other areas, since there are no natural sources of copper or tin in Denmark (Clarke et al 1985; Kristiansen 1991).

Therefore, terms such as Palaeolithic, Mesolithic, Neolithic and Bronze Age are regionally specific. They are convenient for discussion within an area, such as Denmark, especially when well defined by characteristics and dating information. The artifacts used in the analysis of this thesis largely represent Neolithic settlement, but, to some degree, also represent the Mesolithic and Bronze Age. Since there is some possibility that the Palaeolithic is also represented, that period will also be discussed.

Chronological Terms

Sir John Lubbock first defined the terms Palaeolithic and Neolithic (Clark 1980:1). He distinguished the Neolithic from the Palaeolithic using three criteria. The first is that the Palaeolithic Age was inhabited by non-modern humans, or, in later times, non-modern humans and modern humans coexisting. In Europe, the boundaries of the Palaeolithic extend back to the times of Homo erectus (Klein 1989:191), and end approximately 10,000 years ago at the end of the Late Glacial Period (Petersen 1993). In contrast, Neolithic traditions began after the beginning of the Holocene. The second criterion is based on subsistence: Palaeolithic peoples relied on (large scale) hunting, gathering, and fishing for food resources; while Neolithic peoples subsisted on, in part, domesticated plants and animals (Clark 1980:2). The final point of contrast between these two periods and lifeways is in their technologies. Neolithic peoples manufactured and used pottery, and, also, polished flint and stone axes, while Palaeolithic peoples did not.

At the end of the Pleistocene, by 10,300 BP, the earth's environment changed, first the temperature rose, the glaciers receded, and the Pleistocene was replaced by the Holocene, a warmer environment, with rising sea levels, and the freeing of land from glaciers (Evans 1975:71). The break between these periods is considered to be gradual, lasting several thousand years (Dennell 1983). Humans had to adapt to this new post-glacial state. Their adaptation in the early Holocene, and before the development of plant and animal domestication, is called the Mesolithic, or "middle stone age" (Zvelebil 1986a).

The Mesolithic was first identified by Hodder Westropp in 1866, and A. Brown in 1893. V. Gordon Childe's identification of the Mesolithic in 1947 emphasized an identification of the Mesolithic based on chronological criteria (Zvelebil 1986a:5). Mesolithic cultures vary considerably, having adapted to grassland hunting, deep forest lifeways, or shellfish and marine resource exploitation which was combined with hunting (Deetz 1967:124). Marek Zvelebil (1986a:6-7) presents three criteria for the concept of Mesolithic. First, the Mesolithic is an historical development interpreted from archaeological finds; it is different from the pre-Homo sapiens sapiens condition, as well as different from modern-day hunter-gatherers. Second, the cultural adaptations which constitute the Mesolithic occurred in Northern Old World temperate areas and from a hunter-gatherer lifeway. And, in some area of boreal and temperate Eurasia, the Mesolithic developed simultaneously with agro-pastoral farming. In these areas, the Mesolithic was not replaced by the Neolithic, but by Bronze Age and Iron Age, or more recent lifeways. Therefore, the Mesolithic is both the predecessor of and the alternative to Neolithic farming societies.

An important characteristic of the Mesolithic is the decreased mobility of people when compared to the Palaeolithic cultures (Deetz 1967:125). The less mobile societies promoted the spread of ideas. These complex hunter-gatherers were sedentary, and employed logistic strategies (Zvelebil 1986a:8).

The Bronze age was first identified in Ledetraad til Nordisk Oldkyndighed, (1836), by Christian Thomsen when he presented arguments for a unilineal sequence of prehistoric progression through stages of Stone, Bronze, and Iron Ages. The technologies of metalworking were brought in by immigrants from other parts of Europe or the Near East (Trigger 1989:78-79). For him, these sequences were the result of an evolutionary sequence that occurred elsewhere.

Climate And Environment

Since "culture" is the human form of adaptation to environment, interpretations of the archaeological past often rely on an understanding of the characteristics and changes of past environments. This is especially important when discussing long lengths of time. In presenting this sketch of Danish Prehistory up to the end of the Bronze

Age, it is first necessary to outline the changes in climate, environment, and topography that occurred at the end of the Pleistocene and the beginning of the Holocene for the Danish peninsula.

A series of at least four ice sheets covered parts of Northern Europe during the Pleistocene. In between these periods of arctic conditions, there were periods of warmer climate, which caused the ice to recede. The two warmest recedations were, perhaps, warm enough for humans to live in Denmark, but finds are very scarce (Petersen 1993:49). Human occupation in Denmark can be dated as far back as 200,000 years, based on tools found in Vejstrup Forest, Jutland (Jensen 1982:11).

During the Late Glacial, the final shift of climate, which eventually would result in the modern form, began around 13,000 years ago. There were a series of climatic fluctuations from this time up to around 8,300 BC (Jensen 1982; Christensen 1993:20). The ice receded and returned repeatedly, and with it followed a fluctuation in flora and fauna. Initially, Denmark simply became more exposed, presenting a barren landscape of open tundra. Tundra animals moved into the new clearing, including reindeer, wolverine, wolf, bison, wild horses, lemmings, and blue hares (Jensen 1982:13).

In the Bolling oscillation, around 10,500 BC, the temperature increased enough so that a park tundra would developed: there were some forests of birch mixed with open tundra (Jensen 1982;12). Denmark was freed of ice, at least for awhile. The fauna became varied and mixed. They included tundra and steppe animals such as reindeer, wild horse, bison. There were, also, forest animals: Irish elk, common elk, brown bear, and lynx. Another cold period developed, known as the Older Dryas, around 10,000 BC, which meant the return of the open tundra, and the restriction of fauna to tundra animals. The Older Dryas continued for several hundred years before the ice receded again, and then the Allerod period started.

During the Allerod, the park tundra developed, which was dominated with birch, and included aspen, rowan, juniper, bird cherry, and possibly pine. There was considerable contrast between different parts of Denmark during this period: southeastern Denmark developed a temperate climate, while northeastern Denmark remained sub-arctic (Jensen 1982:12). Again, the forest fauna returned to create a variety of animals on the landscape.

The Late Dryas, around 9,000 BC, was another period of colder temperatures that brought a sub-arctic environment back to Denmark (Jensen 1982:12). During this period, there was an ice sheet on the Scandinavian peninsula, and tree growth was greatly diminished. There was park tundra in the south, and open tundra in the north-west of Denmark.

Then, around 8300 BC, the temperature rose, which created climatic conditions for an open birch forest, eventually including pine. This warm period, the Pre-Boreal, was followed by a short cold period, and then the warmth returned. Big game animals disappeared, and more localized species became more abundant. Elk, aurochs, and red deer were common during this period, and became an important source of food for humans (Jensen 1982:16).

Average summer temperatures rose, so that, about 7,000 BC, the birch and pine forest was replaced by a forest of pine, hazel, oak, elm, aspen, and lime. Because of the hazel trees of this Boreal Phase, nuts were ample as a food resource for various animals (Jensen 1982;17). Animals included aurochs, elk, red deer, roe deer and wild boar. In addition, this forest provided a great variety of food for humans and animals, including roots, mushrooms, fruits, bark, and bulbs.

By 6,000 BC, a mature, stable forest had developed. It was more humid, and was a typical Atlantic oceanic climate (Jensen 1982:19). The most common tree was lime, and the dense canopy meant that food resources, overall, would have been less varied and fewer in number, overall. The coast would have been much more suitable for animals and humans. There were many inland lakes, swamps, and streams which contained a more varied fauna and flora; the extensive coastline and warm water temperatures created a very productive coastal zone. By around 5,000 BC, the dense stable forest created a mature, dependable ecosystem for resources for both animals and humans.

Topographic Changes

At the beginning of the Late Glacial period, the ice sheet was still extensive. The topography at that time was a result of the ice sheet weighing down the Danish peninsula, and the absorption of water by the creation of the ice sheet. This resulted in Denmark being much lower and closer to sea level than it is today (Jensen 1982:13; Christensen 1993:20). The sea was extended farther east than today, south to what is now the north coast of Zealand. At that time, northern Jutland was a series of islands.

In both the warm-weathered Pre-Boreal and Boreal periods, sea level rose quickly, more quickly than land level (Jensen 1982:13,17). This was a result of the melting of ice. During the Pre-Boreal, Denmark was part of a

larger European continent, in which most of Britain and Ireland were also part of the mainland (Jensen 1982:16). However, during the Boreal period, the North Sea flooded the area between Denmark and Britain, which created the English Channel, and the Baltic Sea became a very large lake (Jensen 1982:17). As in the Pre-Boreal, the Danish Peninsula was larger than now; it was more than one-fourth greater in size. The coastline of the Boreal period is now largely submerged.

During the Atlantic period, while the Scandinavian Peninsula remained covered by glaciers, the southern part of Scandinavia became wetter, warmer, and the coastlines increased due to the melting of the ice and the increased sea level (Jensen 1982:19; Christensen 1993:20-21). This increased sea level is call the Litorinal transgression; during the transgression, the coastlines of Denmark became submerged: Denmark's area decreased. and became approximately one fourth the size of present day Denmark (Jensen 1982:19; Petersen 1993:47). There were large numbers of small islands off the coast, and the coastlines developed coves and deep fjords which created an extremely long coastline (Jensen 1982:19). High summer and water temperatures, and a sea rich with minerals that were brought in by coastal erosion, meant that the coastal zone was high in resources (Jensen 1982:20).

Late-Glacial Cultural Complexes

Traditional interpretations of the early settlement of Denmark and other Nordic countries have been that Late Glacial peoples followed reindeer that were migrating northward as the ice sheets melted (Fischer 1993a). However, it is now clear that peoples settled Denmark during different times due to the general amelioration of the climate. In the Late Glacial, there were four general techno-complexes which settled Denmark. These are: Hamburg, Federmesser, Bromme, and Ahrensburg (Fischer 1993a; Petersen 1993:46). The later complexes developed out of the earlier complexes as a result of the changing environments.

The Hamburg complex has its origins in the Magdalenian of Central Europe and France (Jensen 1982:36). The first bands of this culture appeared, in Denmark, in the Bolling Period. These peoples followed the migration of reindeer in the spring and winter (Jensen 1982:36). The Hamburg and the Magdalenian coexisted during the Bolling and continued into the Early Dryas Periods. The Hamburg is interpreted as an adaptation to the lowlands of northwestern Europe as the Ice Age began to decline (Fischer 1993a;53). The last phases of the Hamburg are known in southern Denmark (Fischer 1993a:53); it only reached into the southernmost part of Denmark, next to Germany (Clarke 1975). The flint industry for the Hamburg is complicated, and involves an extensive exploitation of raw materials. (Fischer 1993a:55).

The Hamburg and Magdalenian eventually developed into the Federmesser. Like the Hamburg, the Federmesser has only been found in southern parts of Denmark (Fischer 1993a:54). Subsistence information for the Federmesser is scanty, but it is known that elk was an important food resource. Early in the Federmesser, the Bromme complex developed.

The Federmesser and Bromme are interpreted as adaptations to different environments (Fischer 1993a:54) . The Federmesser is viewed as an adaptation to the pine forests of Europe, largely south and southeast of Denmark. The Bromme is viewed as an adaptation to the birch forest of Denmark, and is common in Denmark. The flint industry of the Bromme complex is much more simple, and more wasteful, than the Hamburg, probably due to an abundance of raw material (flint) in the moraine deposits left after the recedation of the glaciers (Fischer 1993a:55). Information about subsistence during the Bromme is very limited.

Like the earlier cultures, the Ahrensburg developed from an earlier culture. In this case, from the Bromme (Fischer 1993a:54). The Bromme is distributed over the northwestern European lowlands, and is interpreted as a response to the deterioration of the environment. The Late Dryas had the harshest environment of the Late Glacial Period (Fischer 1993a:54). This complex may have been an expansion southward of the adaptations which occurred in the northern harsh environment. Even though the climate deteriorated, the Bromme culture remained in Denmark; there is evidence that it expanded northward into Norway and Sweden.

The Ahrensburg is popularly called the "Reindeer-hunter's Period", because there are sites that have extensive finds from the one species (Fischer 1993a:54-55). The Ahrensburgh and the Hamburg both exploited reindeer, but, for both, this exploitation was seasonal. When the Hamburg and Ahrensburg cultures did hunt the reindeer, humans did not actually approach the edge of the ice, but remained many hundred kilometers from the ice edge. It is unclear what food resources were used in other seasons, but may have included coastal resources. The shore line that the Ahrensburg culture used is below the present sea level, so that it is difficult, if not impossible, to study coastal occupations of this time period (Jensen 1982).

Mesolithic Cultures

The end of the Pleistocene and the beginning of the Pre-Boreal, approximately 10,000 years ago, involved the expansion of the boreal forests in Europe (Fischer 1993b). These forests were diverse, and coniferously based. The change in vegetation resulted in a change in the resource base for the people of the Mesolithic. The Mesolithic people went from a reliance on seasonal game food resources, to extensive use of seasonal plant and aquatic resources.

Several chronological schemes have been developed for the Danish Mesolithic (see Jensen 1982:63-64, Figures 19 and 20). Generally, the Mesolithic in Denmark can be divided into three temporally-based cultures: Maglemose, Kongemose, and Ertebolle/Ellerbek. This series of cultural developments is clearly sequential, based on pollen analysis and Carbon 14 dating (Fischer 1993b:59). As many as ten stages have been identified based on microlithic morphologies and frequencies for these three cultures (see Jensen 1982:65, Figure 21). The extent of Mesolithic settlement is uncertain. Much of the coastline from that period is now under sea-level, so that many sites are now submerged (Skaarup 1993).

The Maglemose began in the middle of the pre-Boreal phase and extended into the early Atlantic (Petersen 1993:46). Microlithic points and triangles characterize the Maglemose (Jensen 1982:66). Maglemosian culture extended, geographically, from England to southern Scandinavia, and northern Germany to northwestern Poland (Jensen 1982:39). In Denmark, Maglemose sites occur frequently in inland areas; however, this may be a result of biased sampling, since coastal settlements from this period would today be under sea lever (Jensen 1982:39).

There is evidence for reliance on hunting, fishing, and hazelnuts. Hunting included elk, aurochs, roe deer, red deer, beaver, badger, marten, and wild pig (Jensen 1982:39-40). While fishing was an important resource for most of the year, there is not yet evidence, of fishing inland in the winter (Fischer 1993b:59). The Maglemose people practiced some kind of seasonal migrations, but, due to paucity of winter-occupied sites, the degree and characteristics of settlement organization is unclear. In the summer, the Maglemose lived in small, nuclear base camps, near freshwater lakes and streams (Jensen 1982:40). It is assumed that, in the winter, settlements were larger in order to practice co-operative hunting, and that coastal zones were occupied in the autumn and spring.

From the Middle Early Atlantic to the Middle High Atlantic Periods, the next culture group in Denmark was the Kongemose (Jensen 1982:19; Johansen 1993:50). Rhombic arrowheads typify the Kongemose (Jensen 1982:66). During these Periods, sea level rose and the landmass shrank. A stable primeval forest developed (Jensen 1982:19). Inland settlements may have only been very seasonal and short-term, for the hunting of large forest animals (Jensen 1982:43; Fischer 1993b:59). The Kongemose is interpreted as having a strongly coastal focus for settlement. There is mostly evidence of summer-season settlement, which is still very limited information (Jensen 1982:43). Summer exploitation of coastal marine resources, including fishing, hunting of sea mammals, coastal birds, and the gathering of shell-fish; and inland fresh-water fishing; hunting/catching of small animals and inland birds. There is evidence for an increasing population for this time (Fischer 1993b:59), and settlements appear to be larger and more intensively occupied than the Maglemose.

The Ertebolle/Ellerbek culture began south of Denmark in Schleswig-Holstein, at about 5000 BC, and lasted until about 4500 BC (Midgley 1992), and, in Denmark, around 5500 BC until about 4200 BC. This culture developed during the Middle High Atlantic to the Sub-Boreal. Ertebolle settlements are rare in inland areas, and are mostly found in estuaries and fresh-water areas (Jensen 1982:44; Andersen 1993a:65). The Ertebolle is also called the Kitchen-Midden Period (Andersen 1993a:67-68). Kitchen middens are found on the coasts; the earliest date to the late Kongemose, ca. 5700-5600 B.C. These sites are large, dense concentrations of shells. The Ertebolle site is one example of a kitchen midden.

During the Ertebolle, there appears to have been a considerable increase in population density, and increased sedentism. This may be a result of the decrease in land-mass (Jensen 1982:43). Settlements may have been occupied on a much more permanent basis, possibly with semi-permanent base camps, and some very short term seasonal occupation of camp sites. Longer term occupations had water-based food resources including various species of fish (Engoff 1993:69), birds, and, most importantly, mollusks. Short-term camp sites would have been inland, with food resources including red deer, roe deer, wild pigs, and smaller animals (Jensen 1982). In addition, there were a variety of plant resources, including edible plants, fruits, berries, nuts, bulbs, herbs, bark, shoots, and insects (Jensen 1982:47). The seasonal camps would also have been for acquisition of seals, boars, or fur-bearing animals.

Evidence for technological equipment is more varied than earlier times, partly, perhaps, due to better preservation (Jensen 1982:47). This includes bone and wooden axes, harpoons, wooden spades, wooden spear clubs, boomerangs, as well as the bow and arrow (Jensen 1982:47; Midgley 1992). Hunting and gathering equipment also included animal and fishing traps, nets, and fish hooks. Evidence for boats is seen in the preservation of wooden paddles.

Heavy flint implements are very characteristic of the Ertebolle, and include flake axes and scrapers, and core axes (Midgley 1992). There was also a fine-blade technology of end-scrapers, burins, tanged blades, and transverse arrowheads (Midgley 1992). The transverse arrowheads are characteristic of the Ertebolle (Jensen 1982:66). Danubian shaft-hole axes have been found in Denmark dating to the Ertebolle (Fischer 1993b:62-63).

Pottery, for the first time in Denmark, was made and used during the Ertebolle (Jensen 1982:48-49; Midgley 1992). Pots, with pointed bases, were used for the preparation and storage of food, and "lamps" of pottery may have been used with blubber, apparently for light (Jensen 1982:49). The development of the manufacture and use of pottery was a result of the spread of pottery-making technology from agricultural societies. The Ertebolle people and the agriculturalists in northern Germany and Poland probably first encountered one-another around 4700 BC. (Jensen 1982:49; Midgley 1992).

Neolithic Cultures

Neolithic lifeways began in Denmark around 4200 BC (Price 1991). During the late Mesolithic, inland settlement increased. This intensity of occupation and population density may have been a catalyst for the adoption of food production (Jensen 1982:44). When agricultural practices and practitioners were introduced into Denmark, they encountered the Mesolithic peoples already there. These people most likely came to the new areas in small numbers, and, co-existed with the Mesolithic hunter-gatherers (Price 1991; Jensen 1982; Rowley-Conwy 1985). The Neolithic was a way of life utilizing material culture and traditions developed from continental European societies.

The beginnings of the agricultural settlement of northern Europe lie in central Europe, with the Linearbandkeramic (LBK), or "Danubian" (Midgley 1992:19). Archaeological evidence of the LBK has been found in central Europe, at the southern part of the north European plain. The Mesolithic hunters and gatherers and the LBK were in contact during the fifth millennium BC at the northern edge of the distribution of the LBK (Midgley 1992:30; Price 1991). LBK settlements were most likely
semi-permanent, with periodic movement of settlements for better cultivation or grazing fields, as soil and grazing areas were depleted. The first LBK houses were rectangular, and later ones were more trapezoidal. They were long and narrow, measuring about 30 meters by 6 meters. Evidence for this style of house structure has been identified over much of Europe, starting in the LBK, and continuing through the Neolithic (Midgley 1992; Milisauskas 1978; Keeley 1992).

The major cultivation crops of the LBK were emmer, einkorn, and barley, with lesser crops being legumes, flax, and millet (Midgley 1992). The major domesticated animals were cattle, sheep, and goats. For the early LBK economy, livestock was most important, and cultivation of plants was most likely restricted to small gardens. The degree of utilization of wild animals and plants varied from site to site, with some sites much more reliant on wild food sources than others (Milisauskas 1978:143).

Neolithic Chronology In Denmark

There are several possible ways to divide the Neolithic into chronological and geographic categories for discussion and interpretation (see discussion of the schemes of Montelius and Becker in Midgley 1992:100). Traditional divisions are those by Oscar Montelius and C. J Becker:

Montelius	Becker
I Pre-Dolmen Period	Early Neolithic (A-C)
II Dolmen Period	" " "
III Passage Grave Period	Middle Neolithic (I-V)
IV Dagger or Stone Cist Period	Late Neolithic

Both schemes use one characteristic as the key definer of the divisions. Montelius based his divisions on burial form. Becker based his divisions on ceramic types, which he assumed to represent chronological sequences. However, both methods have proved to be inadequate, in particular, many of Becker's types are now viewed as synchronous, in the light of radiocarbon dating.

More recently, the Neolithic of Denmark has been divided into four chronological periods, as typified by Kristiansen (1982, 1984; see also Nielsen 1993a). In addition, Midgley (1992) divides the Neolithic into

chronological periods in relation to Trichterbecherkultur (TRB) settlement of Denmark. There is some concurrence and some overlap with these two schemes (EN=Early Neolithic, MN=Middle Neolithic, LN=Late Neolithic, SGC=Single Grave Culture):

Neolithic	Kristiansen	TRB	Midgley
EN-A	4100 - 3800 BC	Early	4000-3500 BC
EN-B-C	3800 - 3400 BC		
		Middle	36/3500-31/3000 BC
MN-A-B	3200 - 2300 BC	Late	31/3000-2700 BC
		SGC	2800/2700-2300 BC
LN (Dagger Period)	2300 - 1900/1800 BC	LN	2300-1800 BC

These divisions use various criteria, not a single characteristic. They use artifact types as well as changes in subsistence patterns, settlement strategies, and environmental changes. Nonetheless, the points of division are largely arbitrary. They obscure, to some extent, the continuity of the settlement of Denmark. These divisions are largely used for discussion purposes.

Trichterbecherkultur (TRB)

In central Europe, the Trichterbecherkultur (TRB), succeeded the LBK (Midgley 1992:30). In English, the name is the literal translation of the German, "Funnel-Necked Beaker Culture"; the name is after a distinctive pottery vessel form common on the sites of this period. In Denmark the TRB is known as Tragtbaegerkultur (TBK), and there are various other names in different languages.

In traditional literature, the TRB is also known as the "Megalithic Culture" or Passage-Grave Culture. However, this is a misnomer, since these monuments were built by different archaeological cultural groups in different areas of Europe; the forms of monuments had considerable variation; and these monuments were not constructed uniformly throughout the TRB (Midgley 1992:39). Megalithic burial monuments were constructed in western and northern Europe during most of the Neolithic. Initially, the burial monuments were very large rectangular structures. In Denmark, this construction reached a climax between 3600 and 3200 BC (Thomas 1988). However, after 3200 BC, there was a marked decline in the construction of these monuments. From 3200 BC to 2700 BC, burials began to be interred in more individualized burials in round mounds.

Midgley (1992: 219-220) divides the TRB of Denmark into three phases. During the Early Phase, 4000 to 3500 BC, the TRB culture was established throughout Denmark. The Middle Phase, 3600/3500 to 3100/3000 BC, was the first profusion of ceramic styles, and the differentiation of rituals, which then became more uniform and consolidated. The Late Phase, 3100/3000 BC to 2700/2650 BC, was stable and uniform, and ceramic styles decrease in decoration and quality.

Early Neolithic A and B/Early to Middle TRB

The Early Neolithic A dates to 4100 to 3800 BC; the Early Neolithic B 3800 to 3400 BC. The Early TRB dates to 4000 to 3500 BC; and the Middle TRB dates to 3600/3500 to 3100/3000 BC.

The incipient agricultural practices in Denmark were a mixed, wide-spectered economy (Jensen 1982:87; Midgley 1992). The economic basis of these Early Neolithic peoples consisted of domesticated animals and agriculture. In the Early Neolithic, the predominant cultivated plants were emmer and einkorn wheat (Andersen 1993b). Pigs were important domesticated animals, as well as some goats, sheep, and cattle. These practices were, at first, a supplementation of a diet based on wild plants and animals (Midgley 1992; Jensen 1982; Kristiansen 1982, 1984).

At this point, population densities were considerably small (Jensen 1982; Kristiansen 1984). The first settlements for the Neolithic period were dispersed homesteads in the inland areas, rather than the coastal areas. This was probably because the coastal areas were very productive for hunting and gathering; and the additional work input that comes with agriculture was not necessary. In the fourth millennium BC, the northern part of Jutland and Zealand was lower than today, so that there were many wide fjords, and many small islands (Jensen 1982:85). The southern part of Jutland was higher, so that present day islands were part of the peninsula.

It was during the Early Neolithic that the TRB culture was established throughout Denmark. Within

Denmark, there were three co-existing regional culture groups: the Oxie, the Svaleklint, and the Volling. These divisions are based on ceramic styles (Midgley 1992; Larsson 1985).

The Oxie, from 3800 to 3350 BC, is defined by A-Group ceramics, which include relatively short-necked beakers, with finger impressions, and rim-thickening bands (Midgley 1992). The flint tool inventory shows signs of continuity with the Ertebolle. Small tools were made with a blade technique. These tools included transverse arrowheads. The axes included flake axes and point-butted polished axes. Its distribution includes the east coast of Jutland, Zealand, Bornholm, and smaller islands (Midgley 1992; Nielsen 1993a:84).

The Svaleklint, from 4000 to 3500 BC, is defined by non-Megalithic C-Group ceramics from Zealand (Midgley 1992). These ceramics include beakers which have short, straight, or slightly splayed necks, and sharp shoulders. Decorations include rows of pits, strokes, or twisted cord impressions, under the rims, as well as horizontal and vertical whipped-cord patterns.

The Volling, 4000 to 3400 BC, is defined by non-Megalithic C-Group ceramics found in north and central Jutland (Midgley 1992; Nielsen 1993a). Decorations include two-strand cord and stab-and-drag impressions. A distinctive feature is that decoration is absent from the rims.

Middle Neolithic A and B/ Middle to Late TRB

The Middle Neolithic A and B date to 3200 to 2300 BC. The Middle TRB dates to 3600/3500 to 3100/3000 BC, and the Late TRB dates to 3100/3000 BC to 2700/2650 BC.

During the Middle Phase of the TRB, ceramic styles became greatly varied. In addition, rituals became more differentiated, and the ceramic styles were specialized for ritual and domestic purposes. By the end of the Middle Phase, the ceramic styles were more uniform across Denmark.

At the beginning of the Middle Neolithic, there were two concurrent regional culture-groups, defined by ceramic forms and decorations: the Fuchsberg and the Virum (Midgley 1992; Nielsen 1993a:85). These ceramic forms include similar styles and decoration, which may be interpreted as the product of contact between these two groups. The Fuchsberg, from 3600 to 3200 BC, is defined by ceramics with chevron bands. Most ceramic forms are funnel-necked beakers, but approximately ten percent of each of the assemblages are lugged beakers or bowls with the chevron band design. These are found in east Jutland, and on Fyn and smaller islands. The Virum, from 3600 to 3350 BC, is defined by Megalithic C-Group ceramics of southern Denmark. Forms include funnel-necked beakers of type C-I and lugged beakers of C-III. Decoration is largely whipped cord impressions.

During the Middle Neolithic I (A and B), from 3400 to 3100/3050 BC, there were a wide variety of regional vessel forms and decorations (Midgley 1992). At the transition from the Early Neolithic to the Middle Neolithic, there were decreases in the amount of decorated pottery at settlements when compared to Early Neolithic pottery. Specifically, less of the surface of the vessels were decorated, and there was a decline in the variety of motifs and techniques used. The functions of the vessels became more specialized, with ritual and funerary forms becoming most important.

As the Middle Neolithic progressed, there was an abandonment of lugged jars and collared flask forms, and a decline in the number of pedestalled bowls and clay ladles, which were important in burial contexts in the Early Neolithic (Midgley 1992). Shouldered vessels increased in number in Middle Neolithic II. Starting with the Middle Neolithic II, or Blandebjerg, 3200/3150 BC to 3000/2900 BC, and continuing to the end of the Middle Neolithic, material culture in general was more uniform throughout Denmark. By the beginning of Middle Neolithic III, funnel-necked beakers disappeared. In Middle Neolithic IV, there was an increase in hanging vessels.

During the late phase of the Middle Neolithic, the predominant cultivated plants were emmer and einkorn wheat, and barley increased in importance (Andersen 1993b). Pigs were replaced largely by cattle, but, also, sheep and goats, as important domesticated animals. Goats were used for meat and milk. Sheep were also used for meat, as well as for hides. Higham (1969:206) argues that wool was not sheared for clothing, based on the young mortality patterns. The few adults (predominantly female), would have been used for milk and cheese. Cattle would have also been used for meat, but probably not used as draught animals (Higham 1969).

Culture groups of the Late TRB were Bundso/Late Forslev, Lindo, and Store Valby/Final TRB (Midgley 1992). During the Store Valby/Final TRB, 2950 to 2700 BC, regional variation increased (Midgley 1992:488).

Settlements of the TRB

Settlement in the Early TRB was largely on the coasts and along rivers and lakes in inland areas (Midgley 1992:305; Jensen 1982:88; Larsson 1985). During the Middle TRB, inland settlement intensified along the major rivers(ibid.; Nielsen 1993b). Settlements were usually on lighter sandy soils, in areas were there was ecological and topographic diversity in the proximity around the sites. The natural habitats in the areas around settlements included forests, pasture, and arable areas. Early settlements were most likely short term, inhabited by small,

single extended families. Settlements would habe been moved periodically to new areas for fresh farm and grazing land (Nielsen 1993b). Later settlements were more permanent and larger, including larger houses, storage structures, and evidence of domestic and industrial activities. Initially houses were small, horse-shoe shaped, with about ten houses in one area. Later, houses were large, rectangular, with about three houses in one area.

There were also temporary sites for specialized activities, such as hunting, fishing, mining of flint, and flint working. In the Middle Neolithic, causewayed enclosures were constructed, apparently for ceremonial purposes. Causewayed enclosures were located in peripheral, woodland areas, not centers of social territories (Midgley 1992; Jensen 1982; Kristiansen 1984). These were areas of seasonal aggregations for feasting, exchange, and the exposure of the dead. Human and animal bones have been found in these causeways (Kristiansen 1984). These enclosures were built to cut off a promontory. Segmented ditches were dug; timber palisades were placed either along or inside of these ditches to enclose an area. Activities within the enclosed area may have been for the manufacture of ritual pottery.

Pitted Ware

Another Neolithic culture group in Denmark is the Pitted Ware, or Pittware, Culture (Rasmussen, L. 1993:114-115). The name is derived from pots with pit designs. The Pitted Ware Culture coincides with the late TRB and the early Jutlandic Single Grave Culture. The thick-butted axeheads of the TRB are common in the assemblages of this culture. There is also a clear connection with the Pitted Ware Culture of southwestern Sweden. This can be seen in tool-types, such as tanged arrowheads, and pottery with pit decorations.

Sites of this culture are coastal: along the fjords and on the islands (Rasmussen, L. 1993). There is evidence for a very mixed economy, with at least half of faunal material being from wild sea and land animals. Wild animals include shellfish, fish, red deer, bear, and elk. Domesticated animals include cattle. There is also evidence of gathering of plant foods, and some cultivation.

Single Grave/Corded Ware

The Corded Ware Culture in Denmark is called the Enkeltgravskultur or Single Grave Culture. It dates from 3000/2800 to 2300 BC. In Sweden it is called Stridsyxekultur, or Battle-Axe Culture; and, in Holland, the Standvoetbekercultuur, or the Foot Beaker Culture.

Midgley (1992) argues that the transition from TRB cultures to Corded Ware was a development within the TRB, and was not the result of the introduction of new people. The extension of the Corded Ware Complex in Europe is along the North Sea, southern Scandinavia, central Europe to the Alps, and central Europe.

After about 3000 BC, there was a marked decline in settlement in inland areas (Jensen 1982:88). There were also changes in the agricultural system. Early Neolithic agriculture was slash-and-burn, and required a high degree of mobility. Gradually the ard-plough was introduced, and there was an expansion of stock-raising, especially cattle. Both the ard-plough and stock-raising required more sedentary settlement (Jensen 1982:99). Also, around this time, forests declined, as the land was required for pasture land. Ard-ploughing resulted in the deterioration of the soil, so that cattle-raising grew in importance.

The defining characteristics of ceramics of this period are cord decoration on beakers and other vessels. Battle-axes of this period were also different. In Denmark, they were asymmetrical in form. The settlement patterns were dispersed. Burials were inhumations under small round barrows.

Late Neolithic

The Late Neolithic, or Dagger Period, began around 2300 BC, and lasted to about 1900/1800 BC (Jensen 1982; Midgley 1992). After the initial changes which occurred in the Single Grave Period, there was stability in artifact types. This stability was accompanied by intensification of settlements and subsistence economies throughout the Late Neolithic and during the Bronze Age.

The main differences between the Single Grave Period and the Late Neolithic are in respect to artifacts. During the Late Neolithic, the dagger replaced the battle-axe as the typical grave good (Vandkilde 1993:147), and hoard item (Ebbesen 1993:125). In the Late Neolithic, some axes and daggers of copper were imported from western and central Europe (Vandkilde 1993:147). These were models for flint and ground-stone artifacts. During Late Neolithic I, northern Jutland was the location of production and distribution of lanceolate flint daggers, which were modeled after copper daggers of the western European Bell-Beaker Culture. Therefore, the sociological and ideological meaning of the flint daggers may have been the same (Vandkilde 1993:147). During the Late Neolithic I and II, metal artifacts were made predominately of copper, with some impurities. After Bronze Age IA, bronze made with copper and tin is the common metal for objects.

Bronze Age Cultures

The Late Neolithic (2400-1800 BC) in Denmark is coincident with the Early Bronze Age in other parts of Europe. The Bronze Age begins in Denmark around 1900 BC. As a result, the Early Bronze Age in Denmark is coincident to the Middle Bronze Age for Europe (Flemming Kaul, personal communication). The temporally delayed adoption and development of bronze technology is due to Denmark's "peripheral" geographic position, and because there are no raw materials for bronze in, or even near, Denmark (see Milisauskas 1978:209, Figure 8.1).

The Bronze Age can be divided into an Early and Late Bronze Age, with both divided into three periods each (Levy 1982). Worsaae first separated the Bronze Age into Early and Late, in 1859, and Montelius divided the Bronze Age into six periods, in 1917. Current dates are compiled from various sources: Vandkilde 1993; Jensen 1982; Levy 1982; Coles and Harding 1979.

	Montellius	Current
Early Bronze Age:	Period I 1800-1550 BC	1800-1500 BC
	Period II 1550-1300 BC	1500/1400-1300 BC
	Period III 1300-1100 BC	1300-1000 BC
Late Bronze Age:	Period IV 1100-950 BC	1000-900
	Period V 950-750 BC	900-700 BC
	Period VI 750-600 BC	700-500 BC

Randsborg (1987, 1990, 1993) points out that these periods are typologically defined, and that the lengths of time that these periods lasted varied from one part of Denmark to another. There have been only a few finds of bronze dating to Period I (Levy 1982). Some, especially in northern Denmark, are substantial. Period II and Period V are considered the "florescent" periods of the Early and Late Bronze Ages, respectively. During these periods, the amount of bronze increased, the technical quality and the artistic quality were very high (Levy 1982). Sometime around 500 BC, there was a significant drop in the importation and production of bronze objects in Northern Europe. This was apparently the result of political problems and disruptions occurring in the Mediterranean around that time (Jensen 1982).

Burial practices changed considerably in the Bronze Age, with a shift from inhumations to cremations (Levy 1982; Jensen 1982). There was also a marked decrease in grave goods. Instead, objects were placed in hoards as votive offerings. The burial customs of the Neolithic and Bronze Age, and the nature of hoards in the Neolithic and Bronze Age are discussed below.

The Bronze Age economy was based on agriculture and stock-raising (Levy 1982). Evidence for the utilization of wild food sources is rare. Cultivation of plants focused on naked barley, but also included hulled barley, einkorn, emmer, and club wheat, and, to a lesser extent, peas, beans, millet, and spelt. The domesticated animal was, first and foremost, cattle, with, also, pig, sheep, goat, horse and dog. For wild resources, fish and shellfish were common.

Settlement of the Bronze Age included more substantial villages than previously (Levy 1982). In the Early Bronze Age, like the Neolithic settlement, was largely restricted to light, fertile soils. However, in the Late Bronze Age, settlement expanded into areas of poorer soils. During Periods II and III, northwest Jutland was densely settled. In the Late Bronze Age, settlements concentrated in south-central Jutland. Houses were long and rectangular, with two rows of internal posts (Rasmussen and Adamsen 1993; Jensen 1982). The walls were daub or turf, and the corners were rounded.

Evidence for Early Bronze Age pottery is scarce (Levy 1982). A few pots found in graves are largely undecorated, with two opposing handles. Late Bronze Age ceramics are better known. The ceramics are of two general categories. A finer ware, with thin walls, is usually decorated with fluting, engraved lines, and finger impression. The coarser ware has thick walls and a roughened exterior. Both of these wares are found in settlements and graves. The forms of vessels are double-conical, S-profiled, and terrine jars.

The manufacture of bronze objects was largely a home industry (Levy 1982). Casting of objects involved the use of one and two piece molds, made of stone and clay, using a lost-wax method (Levy 1982, 1991; Ronne 1993:153). Decorations were stamped into wax, and then bronze was poured over the wax. Evidence for forging is very slight. At some sites, fragments of crucibles and molds have been found, as well as drops of smelted metal. The end-products of bronze working were tools, weapons, and ornaments. Bronze tools included sickles and axes of various types. Weapons included swords, shields, and spearheads. Ornaments included rings, arm-rings, neckrings, two-piece fibulae, belt ornaments, pins, razors, and tweezers. Decoration of objects such as swords involved a fine-punch technique.

During the Late Neolithic and Bronze Age IA, the raw materials of copper and tin came from central Germany and the eastern Alps (Vandkilde 1993; Liversage 1993:146). Starting in the Bronze Age IB, raw materials came from southeast of Denmark, such as Hungary and Transsylvania (Vandkilde 1993:147-149). This shift coincided with the decline of the Unetice Culture in central Germany, which probably interrupted the sources of exchange. Raw materials were probably brought into Denmark in the form of finished bronze pieces, and then melted down for the making of new objects (Levy 1982; Liversage 1993:146). Amber, salt, and other items were exchanged for the bronze (Shennan 1982; Jensen 1982).

Tools were also made of flint and other stone (Levy 1982:11-12). These tools were largely utilitarian domestic tools, and included coarse flint scrapers, knives, sickles, and daggers, as well as, shafthole axes and grinding stones. Flint daggers and axeheads decreased in frequency as bronze objects increased (Vandkilde 1993:147). Unfortunately, Bronze Age stone tools have not been extensively studied, possibly due to the dirth of settlement excavation, in particular for the Early Bronze Age (Vandkilde 1993). In addition, there is evidence for woodworking of carts and boats, as well as weaving for clothes, which have been found in burials. Roads made of brushed logs, or stones have also been uncovered (Jorgensen 1993:114).

Burials In Danish Prehistory

The burial customs in Danish prehistory were considerably varied (Jensen 1982; Midgley 1992; Nielsen and Petersen 1993). Mesolithic burial customs included cremations and inhumation burial within settlements. Neolithic burials involved, first, the construction of large monuments for communal internment, and then later, individual internment. Bronze Age customs involved the construction of monuments, and, later, cremation of remains.

Mesolithic Burial Customs

From the late Kongemose to the end of the Ertebolle, graves could be either cremations or inhumations (Nielsen and Petersen 1993; Jensen 1982) Cremations have been found in mass burials, with various ages and sexes represented. Inhumations were often placed in the central areas of the settlements. These burials could contain one, two, or more individuals; up to eight have been found in one area. It is more typical that only one person would be placed in a grave. Adults, children, and newborns were buried in graves.

Many individual inhumations would be covered with a log boat over the body before the grave was filled with dirt (Nielsen and Petersen 1993). Some inhumations were put in bogs with boats over them. Some of the graves would be marked with stones.

Grave goods could vary considerably in kind and amount, from grave to grave (Nielsen and Petersen 1993). Differences were not only based on age and sex of the deceased. Therefore, there may have been some social differentiation.

Neolithic Burial Customs

The Neolithic involved the construction of megalithic and earthen burial mounds and ritual structures. These mounds were of a monumental scale, many requiring thousands of hours of labor to construct them. Soon after the beginnings of agriculture in Denmark, the construction and use of long mounds, or barrows, began (Jensen 1982). Starting around 3500 BC, long mounds were constructed. In the course of the Early Neolithic, there was a diversification of monumental constructions, such as bank barrows, oval barrows, and cursus monuments. The constructions of megalithic monuments climaxed, for a relatively short time, between 3400-3100 BC (Skaarup 1988). Estimates are that a total of 25,000 monuments were erected in Denmark during this period. Around seventy-five percent of these monuments were constructed on the Danish Islands and in eastern Jutland (Skaarup 1988).

In the Late Neolithic, around 3000 BC, there was the beginnings of the construction of round burial mounds with the internment of remains in "single" burials, as well as the construction of passage graves, and cursus monuments, causewayed enclosures, bank barrows, and henges (Jensen 1982). Long burial mounds were gradually being replaced by, and/or reconstructed to be, round burial mounds, which included "single" burials. This custom was fully developed by about 2800 to 2700 BC. These lasted to about 2400 BC in Denmark, although round burial mounds were also constructed later in prehistory during the Late Bronze Age and Iron Age.

Origins of Neolithic Burial Monuments

Early interpretations of the origins of burial/tomb monument construction were that they began in the eastern Mediterranean, where early Cycladic rock-cut tombs have been argued to be prototypes of western European megalithic monuments (Clark 1977). Radiocarbon dating has shown that passage-graves in Brittany, and long barrows in the British Isles, pre-date these supposed prototypes. It is now generally accepted that these kinds

of collective tombs originated along the west coast of Europe, and are the result of seaborn diffusion. Grahame Clark argues that fishermen spread this general form of burial rite (Clark 1977:136).

A west-coast origin for these kinds of tombs is supported by related distributions of early impressed ware pottery, and these collective tombs (Clark 1977). The earliest users of impressed ware pottery used caves for burials, prior to 4500 BC. However, Clark interprets the continuity of grave goods, particularly in southern Scandinavia and the north European Plain, as representing continuity. Therefore, the spread of these collective tombs is not the result of a large-scale ethnic movement (Clark 1977:136). By 4000 BC, collective burial in mounds, cairns, or platforms was widespread (Whittle 1996:243). In Brittany and the Paris Basin, the earliest form was individual cists within long mounds. In Denmark, timber built graves were covered by long mounds starting in the early part of the Neolithic; and soon afterward, in the Early Neolithic II period, both long and round mounds were constructed.

Whittle (1996) argues that the round/circular collective forms of mounds originated in the passage-grave traditions of Denmark, Brittany, Ireland, and northern Scotland. In most places where collective tombs were constructed, both long and round mounds were constructed. The longhouses of the Danubian agriculturists were used as models for the long mounds. In Denmark, long shell middens may have been early models. Some have argued that the longhouses were actually mortuary structures (Madsen and Juel Jensen 1982). The round monuments were supposedly modeled after the round huts of forager occupations of areas (Whittle 1996; Kristiansen 1984).

Alternatively, Chapman (1981) argues against broad interpretations, in support of regionalistic ones. To him, the development of burial monuments was the result of the loss of frontiers. Agriculturists had moved to the western limits of the continent. Once there, independently in the various areas of Western Europe, they created territorial markers at points of critical resources to lay claim to the land and its resources. The uniformity of form and construction of these monuments is down-played as an extension of "Danubian traditions". Therefore, the development of collective monuments in long mounds and round mounds was the result of a series of many independent inventions.

Earlier Neolithic Long Mounds

There is a great deal of variety in the characteristics of the long mounds (Madsen 1993b). Generally, they were rectangular or trapezoidal, although they could be more square shaped. Burials could be inhumations, with structures built over the remains, and then mounds built over them (Madsen 1993b). Or, burials could be disarticulated remains placed in tombs. These two kinds of burial, or disposal, could occur, in different orders, within one long mound. The remains placed inside could be de-fleshed, and disarticulated, or, the remains could be entombed whole, without having been de-fleshed (Thomas 1988). For those with tombs, entrances would be at either or both ends of the mounds, or at the sides (Madsen 1993b; Skaarup 1993).

In many parts of Europe, the domestic structures were long houses, with similar dimensions to long mounds. They would have required about the same amount of construction time as the long mounds (Thomas 1988). In Denmark, however, the long-houses may have been communal structures, and/or mortuary structures, since the domestic structures which have been excavated were small U-shaped huts (Madsen and Juel Jensen 1982; Kristiansen 1982, 1984; for an alternative view see Larsson 1985:119). This may reflect the continuity of occupation of hunter-gatherer-fisherers in Denmark, and may be regionally specific.

Long mounds were often constructed with a stone or rubble foundation. Larger stones were laid to create chambers off of a long passage. Long mounds could have one or two smaller tombs with fewer chambers (Skaarup 1993). The chambers of these tombs were nooks or cubby-wholes that would hold the bones of, usually, a previously de-fleshed skeleton. Therefore, one long mound held several individuals. Dirt was then piled on top of the stone tombs.

Each chamber of a long mound may have been assigned a distinct identity, such as to hold a certain family's remains, clans or kinship groups, different age or sex groups, or different body parts (Kristiansen 1982, 1984, 1991). At the same time, it is probable that not everyone's remains from a community were placed in the tombs, but, rather, selected individuals.

Later Neolithic Round Mounds

Circular or round mounds were constructed at various times throughout Western Europe. Passage-graves were circular mounds built over tombs (Skaarup 1993). Newgrange, Knowth and Dowth are prime examples of these kinds of monuments (O'Nuallain 1994). These were constructed around 4000 BC. While these sites have very large passage-grave mounds, encircling these mounds are smaller mounds. The origins of this kind of mound is probably Brittany (Whittle 1996; Hansen and Rostholm 1993). The passage graves were collective burials of

disarticulated remains of probably selected individuals, in a similar manner to the long mounds. They were not single, individual burials (Mizoguchi 1993).

Later, round mounds of single burials were built from about 3000 BC and onward, over inhumations and cremations. These were most popular around 2000 BC (Whittle 1996; Hansen and Rostholm 1993). The round mounds of this time were of a much smaller scale than earlier. These mounds were more like family plots. They would have required much less labor, and were probably constructed by the family members, rather than broader lineage groups. Round mounds were built in areas which could be visible from the surrounding areas. The round shape of the mounds is also supposedly more visible.

An individual was placed in a cist of stone and/or wood, and then the mound was constructed over it. Later, burials could be re-opened, and new remains put in with the first. Burials of children and cremations were often placed on the periphery of the mounds.

Chronologically, there are three levels for the Single Grave mounds: Bottom Graves, Ground Graves, and Upper Graves (Kristiansen 1982, 1984). The Bottom Graves were placed below the ground surface, and the dirt was placed as a mound over the area. For the Ground Graves, the remains were placed on the original surface of the ground, and the mound was constructed over them. The Upper Graves are secondary burials placed in mounds already constructed. Grave goods were placed within each of the graves. There is considerable standardization among the graves goods: most men's graves have a battle axehead, although some have thick-butted axeheads. In addition, men's graves can have pottery and/or flint tools. Women's graves usually have bead necklaces, pottery, and some flint tools (Kristiansen 1984:83, Figure 7). Therefore, the construction sequence reveals evidence of chronology as well as social relationships.

Bronze Age Burials

Burial practices changed considerably in the Bronze Age, with a shift from inhumations to cremations (Levy 1982). In Periods I and II, burials were strictly extended inhumations of single, fully clothed, individuals in wooden coffins. Grave goods included stone, metal, and wooden objects, such as axeheads, daggers, armrings, and other objects. These coffins were then covered by a circular mound of dirt, which was surrounded by stones along the circumference.

During Period III, there were both cremations and inhumations (Levy 1982). Cremations could be placed in full-sized coffins, and then circular mounds were built over them. In Periods IV through VI, all burials were cremations. The remains would be placed in small cists or pottery urns. During Periods IV and V, grave goods were placed in the grave, and not included in the funeral pyre. Overall the size and number of grave goods declined. In Period VI, at least some of the grave goods were included in the funeral pyre. In the Late Bronze Age, construction of burial monuments decreased. In Period VI, most of the cremations were put in the upper levels of Neolithic and Early Bronze Age burial mounds, although there were some new mounds built. In the Early Bronze Age, metal grave goods were placed with the burials. But, in the Late Bronze Age, there was a marked increase in the placement of metal objects in hoards, coincident with a marked decrease in the placement of metal objects in burials.

Interpretations of Burial Customs

Kristiansen (1982, 1984, 1991) bases his interpretations of Neolithic and Bronze Age burial customs on Renfrew's (1974) and Earle's (1991) models of chiefdoms. Collective chiefdoms are based on staple finance, and individualizing chiefdoms are based on wealth finance. Kristiansen describes the Early Neolithic of Denmark as representing collective chiefdoms. He argues that individualizing chiefdoms developed in the later Bronze Age and Iron Age. Kristiansen (1984) interprets the Megalithic Cultures, the builders of long mounds, and round Passage Graves, 4000 to 2800 BC, as territorial chiefdoms. The interpretation of the Megalithic Cultures as collective chiefdoms is based on the construction of these monuments, votive offerings and communal feasting, as expressions of wealth and surplus. The Single Grave/Battle Axe Cultures, the builders of the "single" round mounds, 2800 to 2400 BC, are considered to be segmentary tribes.

In Early Neolithic Denmark, the long mounds often held interments buried in a pit, with a long mound built over them. Kristiansen (1982, 1984) interprets these long mounds as holding a single chief and his family. This reflects ascribed rank and leadership. Later, tombs were constructed within long mounds, and, eventually round mounds, with disarticulated remains. This change is interpreted as a significant change in burial rites, associated with the spread of Passage-Graves. These burial rites were associated with causewayed enclosures and cult houses. Kristiansen interprets these monuments as holding several chiefs and their families, and reflects a wider settlement area of several chiefly lineages, and a central religious focus. Megalithic mounds symbolize the collective efforts of the constructors, and the heroic leadership of the ancestor chiefs (Kristiansen 1984). Ancestor

worship was used to legitimize and sustain the power of the successors. Megalithic ritual ritualized the communal lineage, and kept the dead amongst the living, in their own houses.

The Single Grave Culture was likewise a ranked society, but the individual and his property was the focus of the burial rites (Kristiansen 1984). The single, round mounds separated the dead from the living, so that they were in a different world. Religion was subordinated. There were alliances for women, cattle, and prestige items. Agriculture was practice on a small scale, so that the Single Grave Culture was partly a pastoral society, with the general characteristics of African pastoral societies. There was autonomy of the households, as can be seen in the individualization of burial in round mounds, as family plots. These societies were warlike, and there was the use of livestock in marriage alliances, and during rituals, such as at death. This pastoral society also had male partnership, which can be seen in double male burials in some of the round mounds. The social structure of the Later Neolithic lay the foundations for the development of a more fully pastoral economy in the Bronze Age.

Larsson (1985) argues that areas of optimum resources resulted in the localization of settlement, and the competition for resources. From the clustering of settlements and resources, there developed ranking and hierarchization of the societies. The monuments were constructed to symbolize the "right of possession" of a group, and the tombs were for the leaders of a lineage, older men, and their families. Rituals involved in burial and use of monuments were a way for the societies to regulate the social relations.

Randsborg (1975) interprets the Early Neolithic long mounds as representing an acephalous society, since there is little evidence for the accumulation of wealth in grave goods. Late Neolithic monuments were used for elites. The concentration of megalithic graves in an area is interpreted as a product of the density and clustering of populations around productive resources.

Hoards

Midgley (1992:281) defines hoards as "...collections of simultaneously deposited objects which show no apparent association either with settlement activities or with burial rituals." In contrast, Levy (1982), and others, include small multiple finds deposited in or near burial monuments and settlements as hoards. For this review of interpretations of hoards both views will be discussed.

The objects included in hoards can vary considerably through time (Jensen 1982; Midgley 1992). Hoards were deposited in western and northern Europe during the Neolithic (Ebbesen 1993) the Bronze Age (Levy 1982), and into the Iron Age (Ørsnes and Ilkjær 1993). Hoards are usually restricted by researchers as having at least two objects in one small area, such as a whole in the ground (Olausson 1983b). Therefore, single isolated finds are usually excluded from analyses of hoards, even though there is a strong possibility that many isolated finds were deposited for similar reasons as multiple finds.

There is less variation in the placement of hoards through time, than in their contents (Midgley 1992). Through the Neolithic and Bronze Age, hoards were most often placed in boggy areas near rivers and lakes. During much of this time, there were often some kind of deposition of multiple finds near burial mounds as well; except when, during those periods of the Bronze Age when cremations were common. During this time, there was a considerable rise in the number and size of hoards, which were usually placed near settlements.

Hoards dating to the Danish Neolithic TRB most often contain two to four axeheads (Midgley 1992:281). Some hoards can be mixed, with both flint and stone axeheads, as well as amber beads, pottery, animal remains, food remains, and some copper axes (Midgley 1992:281; Nielsen 1987:77). There is considerable homogeneity of axeheads within many hoards (Midgley 1992:182). The axeheads are often uniform in raw material and form. They can represent all of the stages of production, from pre-forms to polished finished artifacts. It is rare for hoards to contain different types of axeheads, such as thin-butted and thick-butted types.

Olausson (1983a and b) has found that there are different averages in the lengths of thin-butted axeheads from hoards and graves. Hoard axeheads average 25.8 cm, and grave axeheads average 15.2 cm. There is no relation between the lengths of the axeheads and their distance from the source of raw material. She also studied wear and breakage patterns of hoard and non-hoard axeheads, and found consistent wear patterns. Therefore, the prestige value of axeheads rests in their potential as work tools: there is no specialization of axehead form with respect to technological function or prestige function. These tools have both social and practical functions. In contrast, Rech's (in Larsson 1988) study of edge damage showed that axeheads from hoards were unused, and, therefore, were votive offerings with symbolic meaning (Larsson 1988:73).

Ebbesen (in Midgley 1992) has studied the relationship between hoards, megalithic graves, and the natural environment. Hoards are usually found in boggy river and, low-lying, marshy areas. About fifty percent of hoards in Denmark are within 500 to 1500 m of megalithic graves (Larsson 1988). The megalithic graves are located on high, well-drained areas over rivers and lakes. The locations of the hoards are in areas that are marginal, and, therefore, are not valuable for agriculture or grazing (Midgley 1992:282).

At the transition from the Late Neolithic to the Early Bronze Age, daggers and axeheads of flint were gradually replaced by metal equivalents as hoard items (Vandkilde 1993:149). Some Bronze Age hoards contain weaponry and ornaments (Levy 1982). Weaponry includes bronze daggers, swords, and shields. There are a wide range of ornaments, which include pins, bracelets, armrings, double-buttons, and rings. These hoards are often associated with food remains, and frequently were placed within a pot. They are found in wet areas, in groves, possibly under a stone, or near grave mounds. Other hoards, with different find contexts and conditions, include tools such as axeheads. These hoards are found in dry areas, often next to a stone, rather than underneath.

Interpretations of Hoards

Rech (in Larsson 1988) states that the interpretations of prehistoric hoards can be categorized in five general ways: first, as a cache placed by craftsmen or traders (Bradley 1985); second, as the storage of raw material; third, as the storage of an object of value; fourth, as an offering to some power (Ebbesen 1993; Bradley 1987); and fifth, as a representation of a religious figure. These last two ways of interpreting hoards have been the most common interpretations in Danish archaeology, although many recent interpretations would fall into the first two categories (Madsen 1993a; Midgley 1992).

Levy (1982) identifies two general categories of hoards: ritual and non-ritual hoards. Levy (1982) characterizes ritual hoards as those with weapons and ornaments. Those with tools as non-ritual hoards. Ritual hoards are viewed as a reinforcement of socio-political organization and the creation of social connections. For the Neolithic, hoards deposited in wet areas, near graves, and in causewayed camps, are interpreted as part of periodic rituals to create social ties and marriage alliances (Jensen 1982; Midgley 1992).

The marked increase in hoard deposition from the Late Neolithic to the Bronze Age apparently signifies a change from a group-oriented hierarchy to a more individualized status based on the positions of dominant elite families (Vandkilde 1993; Ebbesen 1993). Subsequently, during the middle periods of the Danish Bronze Age, ritual hoards were used as sumptuary goods, to reinforce the status of chiefs and chiefly power (Levy 1982). In Periods IV to V, there was a marked shift in the location of hoards from in or near graves to areas near settlements. There was, also, a considerable rise in the number and size of hoards, when cremations were common. Levy (1982) interprets the significance of this change as moving from kin-related social relationships to non-kin-related ones; and, thus, to a more complex social organization. This increased emphasis on ritual behavior supported chiefly power; and was, perhaps as a result of environmental degradation.

Raw Material Resources

There are no sources of copper or tin in Denmark. However, there is an abundance of flint in northern and eastern Denmark (Madsen 1993a; Midgley 1992; Jensen 1982). The original source of flint material cannot be identified, as it can be in France, Poland, and the Low Countries. "The Danish occurrences are also too homogenous. The archaeological value of provenancing is particularly limited by the muddled nature of morrain flint deposits " Madsen 1993a:126). Flint was acquired as a raw material in two ways. From shaft-mining; and from the surface, where flint is found in moraine deposits.

Four types of flint can be found in or near Denmark (Midgley 1992). Kristianstad flint is found in eastern Scania and Blekinge. It is matte grey with white spots, and is of a poor quality, only suitable for small tools (Midgley 1992:233). Danian flint is found on the surface, in eastern Zealand and northern Jutland. It is light or dark grey, and can be clear or matte. Both the clear and matte can be used for large tools, but the matte is of an inferior quality. Zealand Senonian flint is found in eastern Zealand and Scania. It is found around the cliffs, and was mined. This flint has a very thin cortex, with a uniform interior. The colors are shiny black or dark grey. Jutland Senonian flint cannot always be distinguished from the Zealand variety. It is found on the surface and was also mined.

VITA

Rebecca Jane Emans was born in Chicago, Illinois on January 26, 1965. Subsequently, she lived in Pennsylvania, Ohio, and Maryland. In 1976, she moved to Williamsburg, Virginia, where she attended public schools. She graduated from Lafayette High School in June 1983, and then attended the College of William and Mary in Virginia for a year. In August 1984, she transferred to the University of South Dakota, Vermillion, and received the degree of Bachelor of Science, with a major in Anthropology and minors in Biology and Classical Humanities, in June of 1987. She attended graduate school at Florida State University, and was a Research Assistant for the Department of Anthropology, from August 1987 to January 1990. In August 1992, she began graduate study at the University of Tennessee, Knoxville, and received a Master of Arts degree in Anthropology, with a minor in Statistics, in May 1998.

Her fieldwork includes trench supervisor at Kamenska Chuka, Bulgaria; a crew position at Mackinaw State Historic Parks; and contract work in South Dakota and Tennessee. She has attended several graduate and undergraduate fieldschools: Slievemore Village, Achill Island, Ireland; San Pedro Y San Pablo de Patale Mission, and Lake Jackson Mounds, near Tallahassee, Florida; two seasons for the Middle Missouri River Survey, Arbor Hill, South Dakota; and, Mitchell Indian Village, South Dakota. She has also volunteered at sites in South Dakota and Virginia.

Ms Emans is currently pursuing a doctorate in Anthropology, at the University at Buffalo, State University of New York. Her research interests are in the Neolithic and Bronze Age of northern and western Europe, and the diachronic study of technology as object and praxis.