# THE NEOLITHIC - BRONZE AGE TRANSITION IN BRITAIN: A CRITICAL REVIEW OF SOME ARCHAEOLOGICAL AND CRANIOLOGICAL CONCEPTS.



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## ABSTRACT.

This thesis presents a study of the Neolithic - Bronze Age transition in Britain. It attempts a solution to the "Beaker problem" in that it sets out to ascertain the method by which the Beaker culture was introduced into Britain, whether it was by migration or by diffusion.

The first part of the thesis critically examines the case put forward for Beaker culture diffusion and concludes that its theoretical basis - that Beaker assemblages acted as either a symbol or as an agent of social change - is ungrounded. A structured model of long-distance migration seems better able to address the complex archaeology of the period.

In the second part, an original study of the morphologically dichotomous crania of the English Neolithic and Bronze Age suggests mechanisms of anatomical change other than the usual, genetically derived, models of population mixing and/or replacement. A large body of comparative data suggests that changes in the cultural or natural environments will induce correlative changes in cranial morphology, and a possible scenario is proposed. It is no longer credible to equate the brachycephalic crania of the early Bronze age with an immigrant "Beaker Folk".

Over the last twenty years interpretations of the Beaker culture have changed radically. Despite appearances to the contrary, however, these changes in interpretation did not arise out of any logical process of data analysis, hypothesis testing or rational argument. Instead, they seem to have occurred as secondary responses to changes in the dominant mode of archaeological explanation, in this case from culture-historical to evolutionist/processual.

CONTENTS.

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## INTRODUCTION.

This thesis presents a study of the the Neolithic-Bronze Age transition in Britain. It attempts a solution to the "Beaker Problem" in that it sets out to ascertain the method by which the Beaker culture was introduced into Britain, whether it was by migration or diffusion. Originally, it was envisaged that two, separate, studies of two, independent, bodies of data - archaeological and craniological - might converge upon a common conclusion. In the event, this did not occur. Different stories emerged, with largely unrelated themes. As a result the presentation of this thesis falls logically into two parts. Each part can be approached as an independent piece of work, each includes its own introduction and conclusion. At the end of the thesis, however, an overall conclusion is presented which attempts to draw together some common threads. It also enlarges the scope of the discussion, briefly and dramatically, by considering the different contexts within which explanations of the Beaker culture proceed: archaeological, philosophical and sociological. In so doing it tries to create a better defined environment for any further studies of the Beaker culture that might take place in the future.

Part One (Chapters 1-5) of this thesis reviews the different theoretical depictions of an archaeological culture which appear in the literature, and considers their impact upon interpretations of the Beaker culture. The case for Beaker culture diffusion, the method of spread currently favoured by most British prehistorians, is critically examined, and possible arguments for preferring an alternative, migrationist, explanation are developed. In Chapters Three and Four, analyses are presented which utilise the funerary archaeology of eastern Yorkshire. This area of the country often seems to be treated as the poor relation of Wessex, but its large and well documented series of late Neolithic and early Bronze Age burials is unique, and a profitable source of information.

In Part Two (Chapters 6-11), an original study of English Neolithic and Bronze Age crania is presented. It considers possible aetiologies of morphological change, and suggests how they might have effected, or contributed to, the transition from the dolichocephalic form of the Neolithic skull to the brachycephalic form of the Bronze Age one. For the first time, an accurate account of the provenance of each cranium is provided, thereby avoiding the archaeological imprecision of previous studies.

# Chapter One.

## THE BEAKER CULTURE: CHANGING INTERPRETATIONS.

### The Beaker Culture in Europe: Origins.

The existence of a pan-European archaeological culture was recognised by scholars in several countries at about the turn of the century (Mercer 1977, Harrison 1980). Ultimately christened the "Beaker Culture", it was characterised by a number of artefact-types including small copper daggers, barbed and tanged flint arrowheads, stone wristguards, v-bored conical buttons and, of course, the eponymous Bell Beaker pottery. These artefact-types were given cohesion as an assemblage by their frequent association with each other in funerary contexts, and the assemblage was held to represent the material signature of a distinct race, or folk: the "Beaker Folk". For a large part of this century there was much scholarly debate over the identity, and likely origins, of this putative "folk". The extensive European distribution of Beaker assemblages suggested them to be the archaeological residue of a nomadic people, metal prospectors perhaps, mounted warriors or wandering tinkers; the emphasis of description resting always upon mobility, a mobility which would explain the, apparently rapid, spread of the Beaker culture, and which would also explain the widespread discoveries of Beaker graves but seeming scarcity of settlements. In the absence of an absolute chronology however attempts to pinpoint the origin of the Beaker culture, and thus the homeland of the "Beaker Folk", were severely hampered. As a result complicated schemes evolved which called for a continent wide series of crosscutting migratory movements which would include all possible originating foci.

The first synthesis was attempted by the Spanish archaeologist Castillo in 1927 who suggested an Iberian origin for the Beaker Folk. This made some sense of the ceramic sequence. Thus, the most widely distributed Beaker type - the comb impressed and zone decorated Maritime Beaker - was thought to stand at the head of several, diverging, regional sequences of ceramic development. It was thought to represent the earliest Beaker ceramic type, probably evolving from out of the general milieu of impressed wares present in Neolithic Iberia. While an Iberian origin for the Beaker Folk made some sense of the ceramic sequence, it made much less sense of other features of the culture. It was difficult to reconcile an Iberian origin with what seemed to be the central European antecedents of other components of the culture: the metalwork types, the wristguards and the buttons. It was also difficult to see why such large numbers of "Beaker Folk" should have decamped northwards from the Iberian peninsula to find new homes in Britain and the Low Countries, the areas of maximum Beaker density (Harrison 1980: 12). The general feeling, perhaps, was summarised by Childe who wrote in 1950:

> "I find this view quite incredible but having nothing better to offer I shall accept it."
> (Childe 1969: 76)

Something better was offered in 1963 by the German archaeologist Sangmeister who attempted to resolve the apparent dichotomy of origins by suggesting a migratory scheme of flow and counerflow, of "flux" and "reflux". According to this scheme an initial "flux" of "Beaker Folk" had emigrated from Iberia to central Europe, carrying with them their distinctive zoned pottery and possibly travelling via the Atlantic seaboards and the rivers Rhine and Rhone. Once in central Europe they adopted the practice of single grave burial from their Corded Ware neighbours, as well as their metal technology. Central Europe was also the location for the creation of a hybrid form of pottery which combined the shape of the Bell Beaker with the local practice of cord decoration, the resultant style being known as Overall Corded, or AOC. Equipped with the, now classic, Bell Beaker assemblage there was a second movement, or reflux, of "Beaker Folk" back through western Europe and on to Iberia. The colonisation of the British Isles took place with their passing.

While the "flux/reflux" theory of Sangmeister provided a more satisfactory explanation of the data then available than did the "Iberian origins" theory of Castillo, it was in itself not without problems, as enumerated by Clarke (1970: 45ff). The Beaker culture of the reflux did not, in itself, present as a coherent entity. It seemed, instead, to be an artificial construct of at least three separate archaeological entities and failed to explain the full range of spatial and temporal variation in a satisfactory manner. There was also no evidence to be derived from either stratigraphy or C14 dates which might confirm that the Maritime Beakers of the "flux" predated the AOC Beakers of the "reflux". Indeed, what evidence there was seemed instead to suggest the contrary.

Clarke's mention of C14 dating was significant. The difficulties encountered by early attempts to assign an origin to the Beaker culture were, in no small part, due to the absence of any independent mechanism of absolute dating. This archaeological lacuna has since been filled, in part at least, by the development of C14 dating. Dutch scholars were the first to take advantage of this dating technique when they demonstrated that the early stages of Beaker ceramic development had taken place in the lower Rhine basin (Lanting & van der Waals 1976). AOC Beakers were shown, by C14 dating, to be consistently earlier in date than either Maritime Beakers or their Veluwe derivatives. Furthermore, AOC Beakers shared some associations with the pottery of the local Corded Ware variant, the Standvoetbeker culture. Upon occasion AOC Beakers had been found within the same grave as a Corded Ware pot. Lanting and van der Waals stressed, however, that although a sequence of ceramic succession was apparent, it was not until during the currency of the more developed Veluwe Beakers that other artefacts typical of the Beaker culture appeared: the wristguards, v-bored buttons and objects of metal manufacture. It has since been suggested that it might prove possible to extend the Corded Ware-Beaker ceramic sequence to other areas of western Corded Ware, particularly around the middle Rhine and the Saale (Neustupný 1984).

## The Beaker Culture in Europe: Variability.

The current watchword of Beaker scholars appears to be variability, a variability that finds expression in both the spatial patterning of the Beaker culture and also in its development through time. There is also some realisation that the processes underlying this variability must be complex.

The spatial variability of the Beaker culture has been described by Clarke (1976: 472), who identified two levels of expression:

Type 1 regional presence: a high density of Beaker findspots, many domestic sites, considerable local Beaker continuity and time depth (300-500 C14 years).

Type 2 regional presence: a low density of Beaker findspots, few domestic sites, considerable local, non -Beaker, continuity and little Beaker time depth (100 -300 C14 years).

Type A domestic presence: a high proportion of decorated Beakers in domestic assemblages, accompanied by recognisably Beaker domestic wares.

Type B domestic presence: a low proportion of decorated Beakers in domestic assemblages, accompanied by domestic wares of local, non-Beaker, tradition.

Clarke suggested that there were correlations between his Types 1 and A, and Types 2 and B. Although these correlations might be interpreted as being indicative of a Beaker "core" area with a more dispersed periphery, he emphasised that, in reality, the situation would have been more complicated, with an "interfingering" of the different types (Clarke 1976: 474). This variability of types within a region has been well illustrated by Barfield's excavations in northern Italy (1987). Case (1987) retained Clarke's notion of differential presence, albeit with a rather looser definition of core, which he considered to include all areas which betrayed any presence of the Beaker culture proper - that is Beakers found in association with copper knives, wristguards and buttons, regardless of whether the domestic ware was Beaker in form or not. However, Case presented a more resolved description of the periphery, suggesting that it was possible to differentiate between:

Beaker presence: elements of the Beaker culture found in association with material which is fully characteristic of local, non-Beaker cultures.

Beaker influence: non-Beaker cultural assemblages showing evidence of Beaker culture influence.

Clarke's use of chronological depth as a criterion of spatial differentiation is symptomatic of the increased chronological resolution now available for Beaker studies. It is thought that the Beaker culture spread over a large area of central and western Europe around 2600 calBC and persisted in most areas until 2000 calBC, although it had largely disappeared from central Europe by 2300 calBC and lingered on in Britain until about 1800 cal BC. The composition, or nature, of the Beaker culture also appeared to have changed through time (Harrison 1980: 10; Lewthwaite 1987 :36). Thus, in its initial, expansionary, phase it seems to have been largely a ceramic phenomenon, with the spread of AOC and Maritime Beakers. It was only in its later stages that the fully integrated and characteristic artefact "package" of the Beaker culture emerged as a material entity.

Many scholars have chosen to explain this variability of expression as reflecting the operation of multiple causes, thus moving beyond the deployment of simple, unitary, migrationist explanation. Thus it is envisaged that trade and the diffusionary movement of technologies, or ideologies, may have joined migration in providing vectors for cultural spread. Clarke specifically warned that:

> "A universal, Pan-European, single factor explanation is unlikely to be a realistic hypothesis to account for the variability in local densities, settlement and domestic contexts, association and distribution patterns and varied time depths."
> (Clarke 1976: 461).

## The Beaker Culture in Britain: Migration or Diffusion?

Towards the end of the 19th century Darwin's new theory of biological evolution was used to provide scientific respectibility for emerging theories which proposed the existence of genetically based differences between classes and between races. The alleged superior intellectual endowment of Europeans, particularly that of the middle and upper classes, was claimed to be the outcome of thousands of years of natural selection. In contrast, the "noble savage" was portrayed as having the mentality of a child and being in need of paternal protection - a justification for the tightening grip upon the world of European colonialism.

These theories of intellectual inequality necessitated the denial of humankinds universal capacity for innovation. It was argued instead that complex technologies or sophisticated forms of social organisation would only be invented or developed by the mentally more evolved races and would then need to be passed on to "inferior" races by processes of migration or diffusion. For a while it was fashionable to suggest that all innovations had been carried from a central civilising hearth to the four corners of the earth by a migrating super-race, whether it be Aryan, Egyptian or Atlantean. Outside of Nazi Germany however these theories were discarded as the archaeological record became better known. It was proposed instead that cultural novelties would have been disseminated from an innovatory centre by a series of localised migrations and secondary diffusion processes.

During the first half of the 20th century, the classical or historical education of British archaeologists gave them no reason to doubt such a view; the early texts were replete with references to migration. It was a view which also accorded well with the narrative of the Old Testament. (Adams et al 1978: 497ff; Trigger 1989: 161). The poor state of knowledge of the archaeological record reinforced this theoretical disposition to interpret cultural discontinuities as being indicative of immigration. As a result of varying intensities of fieldwork, the evidence of archaeology was often spatially or chronologically intermittent and emphasised cultural discontinuity at the expense of continuity. Furthermore, in the absence of any absolute dating technique an unrealistically short chronology was adopted whereby whole periods of cultural change were compressed into small intervals, too short for any possible process of internally generated change or evolution to have taken place. The models of migration used varied. Sometimes they envisaged the movement of entire peoples but often had more of a diffusionist nature whereby a small number of people would transmit a superior culture to more backward, but grateful, recipients. Megalithic missionaries and Mycenaean traders joined putative Beaker metal prospectors in such an endeavour. Early syntheses of British prehistory made much use of migration models, to the almost total exclusion of any other models in fact, but such an approach was essentially negative. It credited indigen ous peoples with neither the wit nor the vision to better their lot and was in any case academically sterile, archaeology was written as history in the simplest possible sense.

In 1966, Clark called attention to the increasing sense of unease being felt by a "younger school" of archaeologists when asked to contemplate the invasion ridden interpretations of British prehistory. He emphasised instead that there were many aspects of continuity to be found expressed in insular traditions, and suggested that cultural developments could be adequately explained without recourse to hypothetical invaders or immigrants. The "Beaker Folk" were a notable exception to his general theme however, not surprising perhaps as, in their case, there seemed to be an overwhelming amount of evidence in favour of immigration. This evidence has recently been summarised by Burl as including:

> "...the Beaker itself, a form of pottery and decoration unkown previously in the British Isles, and fired by an unprecedently skilfull technique, has to be added the novel barbed and tanged arrowheads, the bracers, copper knives and small articles of gold, the emergence of a round headed people, a preference for single burial in flat graves or under very low round barrows, the deposition of grave goods, the brewing of beer, a knowledge of metalworking, the domestication of the horse and the herding of a smaller breed of cattle,

Bos longifrons, unlike the bigger indigeneous Bos frontosus of the British Neolithic."
(Burl 1987: 110)

The foreign origins of many of these cultural and economic innovations are disputed, but it is not intended to become embroiled in such disputes here. In any case, the existence of Beaker domestic sites would appear, on the face of it, to present irrefutable proof of an immigrant "Beaker Folk". These sites are small households or farmsteads from which not only was the distinctive Beaker fineware recovered but also a complementary range of Beaker-type domestic wares - including rusticated or plain Beaker shaped vessels with sometimes also larger, possibly storage, vessels similar to the Dutch potbekers.

Recent interpretations of Beaker immigration vary and are often based on historical analogy. Thus Case (1977) suggested that the "Beaker Folk" may have been comprised of small groups of mixed farmers who, once established, would have established relations (both peaceable and warlike) with the indigenes by engaging in feuding and seasonal raiding, and trade and marriage. The analogy of Viking society as described in the Icelandic sagas was invoked to add colour to his outline sketch. Taylor (1983) on the other hand thought that, in absolute terms, the number of immigrants would have been small, but with a disproportionately large cultural influence because of their economic domination of native societies and their continuing links with the continent, much as would be the case with the later spread of the La Tène Celts. Ashbee (1978: 137) looked to the arrival of the Saxons in late Roman Britain for his analogy and suggested that, on account of their martial qualities, the "Beaker Folk" may have been invited into Britain to act as mercenaries for the insular late Neolithic societies.

The structuring of the immigration process is also a subject that has attracted some attention. It is thought likely that any large scale movement of people would have been preceded by a period of intensified contact between the indigeneous communities of late Neolithic Britain and their Beaker counterparts across the North Sea. This "contact phase" would have seen the establishment of exchange links, or alliances, across the sea and an increase in the frequency of seasonal visits (Clarke 1976: 474, Case 1977: 74). Lewthwaite has suggested that this might have been a period of "familiarisation" (1987: 48) during which time the incipient "Beaker Folk" would have availed themselves of the technologies and skills of maritime travel and transport. It would also have been a period of exploration as the opportunities for settlement were discovered and their possible benefits evaluated.

Although some scholars still choose to view the introduction of Beakers into Britain as an event, or series of events, with a human, migratory, vector it is probably true to say that this is no longer the mainstream, or orthodox, view. More recent treatments of the Neolithic-Bronze Age transition in Britain have emphasised the role played by indigen ous development and have chosen instead to characterise the Beaker introduction as a process of diffusion (Burgess 1980, Gibson 1982, Bradley 1984, Clarke et al 1985, Thomas 1991). These works take their lead from the keynote papers of Burgess & Shennan (1976) and Whittle (1981). In these two closely argued papers it was proposed that the Beaker culture did not constitute a culture in the original, Childean, sense; it was instead an artefact assemblage without any uniform or consistent associations of housetype, subsistence economy or burial ritual. To further weaken the characterisation of the Beaker culture as a representation of an immigrant folk the supposed continental origins of what had traditionally been considered to be the non-artefact components of the culture were closely scrutinised. Thus the novelty of the Beaker single grave tradition was questioned and the straightforward interpretation of the settlement evidence was also challenged.

Burgess (1976: 311) pointed out that in Britain single grave inhumation under a round barrow is not necessarily a Beaker introduction. In southern England for instance there were, apparently, Neolithic round barrows at Linch hill and Handley Down 26 while a larger series of such barrows were known from eastern Yorkshire. Burgess expanded upon this by pointing out that large numbers of round barrows are known which cover unaccompanied burials, they are generally assigned a Bronze Age date solely by virtue of their round mound. It is perhaps possible that a substantial number of such monuments may in fact have been constructed during the Neolithic and thus pre-date the arrival of Beaker pottery.

It remains an unfortunate fact that few Beaker domestic sites have been excavated and it is often the case on those sites that have that the affinities of the coarse ware component of the ceramic assemblage are indistinct. It is often classified as Beaker because of the presence at the site of better characterised and hence archaeologically visible Beaker fineware. Burgess (1976: 320) argued that in some cases the associated domestic wares were recognisably Beaker but that often they were not. In these latter cases the vessels are of either uncertain form or of a type which is not Beaker, they are more likely to be representative of indigen ous traditions. Whittle (1981: 314) developed this theme and pointed to an apparent temporal ordering in the composition of the ceramic assemblages recovered from Beaker settlemnts. There are very few "pure" Beaker settlement sites known from before 2150 calBC, early Beaker fineware forms are generally found in association with indigen ous late Neolithic types, Grooved or Peterborough ware. The majority of settlement sites with domestic pottery that is recognisably Beaker in form are associated with late styles of Beaker fineware and probably date to after 2150 calBC. Whittle concluded (1981: 320) that prior to 2150 calBC Beaker fineware was possibly ritual or mortuary in nature and is found on sites of otherwise indigen ous tradition. After 2150 calBC, however, domestic pottery increasingly took on the form and style of the previously ritual Beaker fineware while new types were introduced to replace Beakers as ritual ware: Food Vessels and Collared Urns. Thus Beaker settlements are not viewed as being the dwelling places of a distinct "Beaker Folk", instead they form a coherent sequence which demonstrates, in a settlement context, the gradual adoption of Beaker pottery by an otherwise autocthonous population.

When attacking the concept of a migrating Beaker Folk, therefore, Whittle, Burgess and Shennan have made two basic points:

1) That the Beaker culture is not a culture as originally defined by Childe. It could not, therefore, be indicative of a distinct people, or folk.

2) That many of the non-material cultural novelties of the British early Bronze Age cultures did in fact have insular antecedents. They need not have been introduced by an immigration from the continent.

To replace a migrationist interpretation of the Beaker culture it was argued instead that Beakers and their associated artefacts constituted a diffusionary artefact package. A diffusionary vector would have been provided by elite-group interaction, Beaker assemblages would have been adopted by indigeneous communities and accomodated within pre-existing social formations, acting either as a marker or an instrument of social change.

<u>Conclusion.</u>

For the greater part of this century the pan-European Beaker culture was considered to be the archaeological signifier of a migrating people. However, in Britain, this hypothesis has come under sustained attack in recent years. A new orthodoxy has emerged which depicts a diffusion of the Beaker culture taking place as either a cause or an effect of late Neolithic social restructurings. Although Clarke (1976: 460) took pains to emphasise, in a Beaker context, that theory formulation should be accompanied by stringent testing, to date a stringent testing of the diffusion hypothesis has not materialised. The first part of this thesis sets out to rectify this omission.

In Chapter Two it is described how the change in fortunes of the Beaker culture is best regarded as being one symptom of a more general theoretical shift that has taken place amongst prehistorians. It is also argued that the denial of any equivalence between a Beaker culture and a "Beaker Folk" is not altogether warranted.

The various diffusionist models which have been proposed to account for the Beaker penetration of British late Neolithic society are described in Chapter Three, and criticised as being inadequate for the task.

The claim that Neolithic and Bronze age burial customs show an essential continuity is rejected in Chapter Four after an analysis of the late Neolithic and early Bronze Age tombs of eastern Yorkshire.

Finally, in Chapter Five, the possibilities of a Beaker folk for explaining the archaeological changes seen to occur in Britain at the time of transition from the Neolithic to the Bronze Age are reconsidered.

## Chapter Two.

# CULTURE AND ETHNICITY.

### Introduction.

For a large part of the 20th century the dominant mode of archaeological interpretation has been culture-historical. Prehistorians, as their name suggests, have laboured to construct quasi-history from out of the material remains of a pre-literate antiquity. To aid them in this task the static concept of a unitary, archaeological, culture was adopted as a means of spatial categorisation, of entity formation. For the explanation of temporal change in the constitution of these entities, these archaeological cultures, recourse was made to the dynamic processes of migration and diffusion. Prehistory was:

> "...... aimed at distilling from archaeological remains a preliterate substitute for the conventional politico-military history with cultures, instead of statesmen, as actors, and migrations in place of battles."
>
> (Childe 1958: 70).

The "Beaker Folk" held a pre-eminent place in many of these prehistories, but as the theoretical underpinnings of the culture-history approach were critically scrutinised, and found to be wanting, so too was the reality of a "Beaker Folk" questioned, and doubted. These doubts, outlined in the previous chapter, are thus best regarded as a specific symptom of a more general malaise - the diminishing credibility of the archaeological culture as a classificatory heuristic and the consequent abandonment of the culture-history mode of archaeological interpretation. The background to these changing patterns of explanation, and issues arising, are explored further during the course of this chapter.

## The Archaeological Culture.

The culture-historical mode of archaeological interpretation has been well described, and discussed, by several authors. The following synthesis is taken, in part, from Trigger (1989) and Daniel & Renfrew (1988).

The concept of an archaeological culture owed its initial inspiration to nationalist movements which had in the wake of the Napoleonic occupation of Europe. As it became politically desirable for them to lay claim to a tract of land, romantically inclined intellectuals seized upon the evidence of archaeology to legitimise their claims by posturing as the descendants of prehistoric inhabitants, and as their rightful heirs. This practice was particularly pronounced in central Europe where the authority of Tacitus' Germania was on hand to assist with the mapping out of Iron Age tribes. The German archaeologist Kossinna systematised the concept of a discrete archaeological culture, delineated in time and space. He argued that geographically coherent assemblages of archaeological artefacts, termed cultures, were in fact the remnant traces of ancient tribes and were therefore available for the construction of a surrogate history. Kossinna believed that if cultural and ethnic groups were equivalent entities then it would be possible to trace the movements of historically attested groups back through time into prehistory. He termed his approach to the archaeological record Siedlungsarchäeologie (settlement archaeology).

## Childe, and the New Archaeology.

During the early 20th century implicit use was made of the culture concept by several British archaeologists when organising their data, but it is Childe who is generally credited with both the popularisation of the method and its detailed exposition. As his thinking matured Childe gradually weakened his definition of an archaeological culture and became less sure of its interpretation. It is possible to discriminate in his work between an early, confident, use of the concept during the 1920s and 1930s, and a later, more cautious, appraisal during the 1950s.

Childe's earliest definition of culture is well known and often quoted:

> "We find certain types of remains - pots, implements, ornaments, burial rites, house forms - constantly recurring together. Such a complex of regularly associated traits we shall term a "cultural group" or just a "culture"."
>
> (Childe 1929: vi).

He went on to explain how to differentiate between episodes of migration or diffusion that might present in the archaeological record. A transfer of a culture, in its entirety, from one location to another would be a firm indication of a migration but the transfer of only one or two cultural traits would be more difficult to interpret. Whilst not excluding migration it might also result from trade or imitation (ibid: vi-vii). Cultures were considered to be self evident in the archaeological record, to be observed facts (Childe 1935: 3), and thought to be the material remnants of a people. Childe was careful to explain that he used the term "people" to describe a social grouping united by common language and customs, that there was no necessary correspondence between an archaeological culture and a racial group, which was a biological, not a social, entity (Childe 1933). Although human societies could be viewed as functioning organisms (Childe 1935: 3), with culture an integrated epiphenomenon, culture in itself was not homogeneous. At least two different, albeit interacting, cultural spheres could be discerned. Whilst tools and other utilitarian artefacts might be described as material culture, and possess adaptive significance, other archaeological remains, such as burials, would be indicative of spiritual culture. For the materialist spiritual culture appeared to possess no function, although Childe admitted that it might play a role in the maintenance of group solidarity (ibid: 14).

This early description of an archaeological culture, and explanation of its significance, seems to have been influenced by the developing anthropological school of structural-functionalism, which portrayed pre-industrial societies as isolated organic entities, relatively autonomous in both structure and function. This portrayal was in good accord with the spatially discrete nature of an archaeological culture (Trigger 1989: 245, Childe 1933: 3). This prototypic theory of an archaeological culture has been called by Clarke the "cultural brick theory" which:

> "....necessarily assumes that cultural assemblages are monothetic sets of types, that all the components occur at all the sites, and that they all share identical distribution boundaries."
> (Clarke 1968: 247).

It must certainly have been the theory in the minds of scholars who were:

> "....worried that Beakers in no sense satisfy the criteria that denote a culture in Childe's <u>original</u> sense."
> (Burgess, in Burgess & Shennan 1976: 309).

Similarly, the definition of migration in mind seems to have been that of Childe in his early days:

> "The break which the Bell Beakers represent in the various local sequences has been much over-emphasised, and close examination of particular contexts shows that we are not dealing with the <u>wholesale transference</u> of a material assemblage from one area to another, the view implicit in the literature which has favoured migration hypotheses."
> (Shennan, in Burgess & Shennan 1976: 324).

The underlining in both of these quotes has been added for emphasis.

Familiarity with the culture concept ultimately bred contempt. As early as 1941, in Germany, Wahle had demonstrated, using archaeological assemblages of early historical date, that there was no direct relationship between an ethnic group and a culture, or that a change in one necessarily indicated a change in the other. This theme was developed by Childe who found it increasingly difficult to maintain a precise and useable definition of culture, or even to assign meaning to the definition. He ceased to regard cultures as facts, as concrete entities with an existence independant of the observer. Instead he suggested that the delineation of a culture was a subjective exercise, which required the archaeologist to decide what was, or was not, a socially distinctive cultural type (Childe 1963: 50). He abandoned the position that a culture was, to use Clarke's terminology, a monothetic set of types, suggesting instead that it was necessary for only two or three diagnostic types to be found in association, but that they need not recur together on every site assigned to a culture (Childe 1956: 33). Childe had come, in fact, to view an archaeological culture as a polythetic set of artefact types (after Clarke 1968: 231).

The problems associated with an archaeological identification of a migration also came to be better appreciated. Environmentally adapted cultural types might change in character as a people moved from one environment to another (Childe 1956: 136) and the retention or expression of types might depend upon the relative levels of technological prowess enjoyed by the immigrant and host communities.

Most damage was inflicted upon the culture/people axiom however by Childe's retreat from any substantive definition of the term people. In his early years, a people had been defined as a social grouping united by custom and language, but this definition was dropped.

> "So for the archaeologist the unit or society must remain the group enjoying the same culture - ie, giving concrete expression to common traditions. Such a group may comprise a number of settlements or local communities. Perhaps we might call its members a people, but we have no right to assume that this people as a whole spoke a single language or acted as a political unit, still less that all its members were related physiologically or belonged to one zoological race."
>
> (Childe 1963: 49).

> "Cultures are assemblages of types that are associated because they are made by the same people."
>
> (Childe 1956: 111).

> "To a prehistorian a people are just what they did."
>
> (Ibid: 111).

These definitions reduced the culture/people equivalence to a meaningless circularity. Beakers would satisfy the criteria that denoted a culture in Childe's ultimate sense, but little understanding would be derived from the satisfaction.

From amidst the wreckage of his culture concept Childe, seemed to advocate its abandonment. He emphasised instead the unique time depth of the archaeological record and drew attention to the correspondingly large amount of information encapsulated therein which related to past patterns of behaviour. He suggested that the temporal span of this record, and its material constitution, could most usefully be used to reconconstruct the course of technological evolution, an indicator of the progressive growth of human knowledge (1956: 160-162).

Childe was advocating an evolutionist, or processual, archaeology. It is not surprising to find therefore that with the advent of the "New Archaeology", the dismantling of the archaeological concept of a culture continued further. Renfrew (1977) argued that cultures, even as subjective constructs, were in fact illusions. That, in spatial terms, the archaeological record was better considered to be a continuum, with any discontinuities arising out of topographical, but not social, barriers to human interaction (1977: 94). He followed Childe in proposing that the realistic goal of prehistory was the reconstruction of long term process, and suggested that diachronic change in settlement patterning might be indicative of developing strategies of resource allocation, of social evolution.

The possibility of an archaeological theory of social evolution was a central concern of the "New Archaeology" that grew up during the 1960s. Major changes which had occurred in the structure of human societies were known only from archaeological testimony; they had preceded the keeping of historical records and they were therefore amenable to archaeological, but not historical, investigation. By concentrating their reseach effort onto these processes of long term change the "New" or "Processual" archaeologists hoped to secure for the study of prehistory a respectable and an independent status within academe. Major projects were identified - the origins of agriculture and the rise of the state - but their identification had an unfortunate consequence for British, and other north European, prehistorians. As neither process of change had been of primary occurence in Britain there was little that a study of British prehistory could contribute to their understanding (Renfrew 1982: 2). Processual archaeologists in Britain had come perilously close to arguing themselves out of a job. They managed to rescue themselves from this ignomious fate by suggesting that the emergence of ranked societies in prehistoric Europe was a social process suitable for, and in need of, clarification.

When describing this process of emergence it was pointed out that in the early Neolithic there was little to suggest anything other than an egalitarian society, but that by the end of the Neolithic it seemed that social hierarchies had begun to develop, and had continued to do so through into the Iron Age (Shennan 1982: 10). This concept of a progressive hierarchisation of prehistoric society has not yet received the degree of critical analysis accorded to the culture/people concept and it is not yet clear just how real it is. It might be argued,for instance, that processes of technological elaboration and population increase contributed to an increasing archaeological visibility of ranked societies through time, that they had been in existence since the early Neolithic and that, in fact, there was no emergence to explain. Nevertheless, it was within this theoretical context of evolving social hierarchies that interpretations of the Beaker culture began to change. Instead of being indicative of a people, or folk, the culture was now considered to be either an instrument or a marker of social change.

Specific hypotheses which seek to explain the role of the Beaker culture in social evolution will be considered in the next chapter, it is intended here to further explore the, not yet abandoned, relationship between an archaeological culture and a social, or ethnic, group.

## Ethnicity as a strategy of economic exclusion.

Some historical and ethnographical studies have concluded that there is no relationship to be found between ethnic or other social groups and spatially concentrated or bounded arrays of material culture. To thereby conclude that there was at no time in the past any such relationship is to construct an inductive syllogism thus:

some cultures are not peoples,

∴ all cultures are not peoples.

At best this is a weak form of reasoning, even in the absence of any contradictory cases. It ceases to be meaningful altogether in the presence of contradictory cases. Yet it is known from both ethnography and history that ethnic or other social groups sometimes do possess a distinctive material culture, or at least distinctive items of material culture (Clarke 1968; Barth 1969; Hodder 1982; Lemonier 1986). It is also known from these sources that sometimes migrations do leave a material trace. Indeed, it has been suggested that failures to discern ethnic patterning in ethnographic studies of material culture might be due to poor observation (Sackett 1990: 41).

Ethnic groups are social entities which are distinguished by a number of features which include the possession of a collective name by means of which group members can categorise themselves, a common history or mythology which satisfactorily describes the genesis or coming together of the group and, finally, the sharing of a common cultural idiom (Smith 1986: 22ff; Barth 1969). This cultural idiom might be interactional in that all members of a group conform to, and judge others by, a degree of adherence to a socially agreed set of behavioural conventions which usually includes the speaking of a common language. This shared cultural idiom also has a material or symbolic aspect that requires members to adopt a recognisable outward appearance which might find expression through the media of artefacts, clothing and architecture. Not all cultural traits are equally diagnostic of ethnic membership and there may be marked variation within the overall cultural repertoire of a group while members remain mutually recognisable. This may happen for instance if a group occupies more than one ecological zone. The crucial function of the cultural traits chosen to act as ethnic signalling devices is to maintain a boundary around a group so that, internally, the culture of a group does not need to be homogeneous, it just needs to be recognisably different from that of adjacent groups.

Childe's materialist orientation prevented him from seeing that his "spiritual culture" might be anything other than an ends for economic means (Childe 1956: 44). Since Childe wrote however it has become increasingly clear that much social behaviour, even of a "spiritual" sort, is economically motivated; and a behavioural model has been constructed which depicts ethnicity as a transient construct, of importance in contexts of economic competition.

It has been proposed that ethnic groups function as an expression of communal support. By outward identification with a particular group, and hence implied acceptance of its behavioural norms, a member is entitled to receive the help of fellow members of the group in preference to outsiders. Thus ethnic membership functions as a means of achieving a certain level of security. Ethnic distinctions become more marked, or exaggerated, during times of between group stress when the question might be asked: "Whose side are you on?". Individuals intermediate or ambiguous in their membership categorisation will find themselves abandoned by both sides (Barth 1969: 36; Hodder 1982: 26). Conversely the distinctiveness of ethnic boundaries may lapse during periods of peaceful coexistence. It is a corollary of this latter fact that in areas of population stasis and in the absence of competition for resources ethnic demarcation remains undeveloped and thus ethnicity is not a universal concept. Ethnic boundaries are cultural or social, sometimes territorial, but are not always biological. Individuals or groups are often able to change their ethnic allegiance by adopting the material symbols and the behavioural norms of a target membership group. Although this might result in some residual tension or ambiguity for converts this dissipates for their descendants who can expect to become fully integrated within the host society.

Whether this "economic competition" model of ethnicity is universally applicable is not known. Recourse to ethnic demarcation is certainly not the only strategy available to social groups engaged in competition over access to limited resources. The model should not be considered to be deterministic therefore, but as situational; as such it removes the theoretical underpinnings of Siedlungarchäeologie as developed by Kossinna. It emphasises the social and opportunistic nature of ethnic sentiment whilst denying what is biological or permanent. It is unlikely that an ethnic group will possess an unbroken, and unsullied, history; still less that a race will. What the model does do, however, is to suggest that at certain times and places, in certain contexts, ethnicity will develop as an important mediator of social discourse. By extension, ethnicity should, from time to time, find expression within the archaeological record, although the character of this expression might not be straightforward.

Passive Networks and Active Boundaries.

Despite problems of subjectivity, definition and interpretation the axiomatic relationship between an archaeological culture and a people, or ethnic group, was never fully relinquished as a potential principle of data organisation, and explanation. The complexity of the relationship has become increasingly clear however (Clarke 1968: 231). Progress has been made in disentangling the skein of relations that exist between social formations and their deployed material culture by the realisation that artefacts may, in fact, act as material intersections for two interacting, and partly coalesced, modes of behavioural expression: actively and passively produced style (Sackett 1986,1990).

The term active style is used to define the deliberate and conscious manipulation of symbols to transmit information about status or identity. It is an intentional statement. Items of material culture may be manufactured, or utilised, as symbols or else used in a symbolic manner. For maximum effect the stylistic message needs to be understood by its target and may be context specific. Passive style is a learned, but unconscious, way of doing, it is a conventional pattern of behaviour acquired by observation and imitation of an individual's proximate social environment during childhood and adolescence. Passive style may be expressed through an artefactual medium as techniques of fabrication and decoration are learned by example. Although artefacts so produced are not deliberately imbued with any kind of information or signal they might be perceived to be so by an outside observer. These two modes of stylistic expression are bound up with alternative, but complementary, methods of conceptualising human societies - as either passively produced communication networks (Clarke 1968), or else as actively maintained bounded entities (Hodder 1982).

If human settlements are considered as nodes in a two dimensional communication network it might be expected that, in a topographically neutral environment, the levels of social interaction between these nodes would equilibrate at a uniform steady-state. If, furthermore, methods of artefact production were learned passively from a proximate social matrix then it would follow that artefact design would vary continuously, and thus surviving material culture would show a pattern of continuous, and not discontinuous, variation. Distinct areas of cultural similarity - cultures - would not exist. This seems to be the position of Renfrew (1977: 94), as already described. This steady-state model of human interaction is ahistorical, however. It assumes homeostasis and it takes no account of dynamic processes (demographic, social, ecological or whatever) that may be acting to keep the network in a state of disequilibrium, with disconformities giving rise to areas of greater or lesser interaction. In reality, of course, the areas of greater interaction would take the stage as discrete social, or ethnic, groups.

This characterisation of a social group as a network of dense interaction forms the basis of Clarke's analysis of the culture/people conundrum (Clarke 1968: 252, 362-3). If the techniques of artefact manufacture are born out of social tradition, and if their style is a passive production of this tradition, then the degree of artefact similarity would be expected to positively correlate with the degree of human interaction. It follows that the material culture assemblages of separate social networks should be marked by high within group similarity and low between group similarity. As these similarity groups, or cultures, are socially produced there should be a rough chorological concordance between the social group and the archaeological culture:

> "The social network precipitates and maintains the culture area and the boundaries of the two should be broadly concurrent. A seris of adjoining but largely discrete sociocultural networks can therefore be compared with a series of adjacent saucers each holding a specific artefact type pool, linked only with difficulty across the watersheds between the network areas. This is the basis by means of which the long evaporated web of social patterning may be traced in the precipitated pattern of pooled artefact-types."
>
> (Clarke 1968: 252)

An interactive social group is, almost by definition, united by behavioural expression and language, it might therefore be considered to be an ethnic group. There might not be a precise agreement between ethnicity, language and material culture but there must at least be an approximate one (Clarke 1968: 291,364).

This view of societies, and of cultures, as "saucers of interaction" has been criticised as its attendant characterisation of individuals, or communities - as passive nodes in an interaction network - denies them their very essence, it denies them their ability to actively participate in social life (Hodder 1982: 185). An organised society provides an arena for the playing out of cross-cutting strategies of inter-group competition; the groups being defined by multiple criteria, including age, gender, ethnicity, status and religion. As material artefacts will be selectively manipulated in these competitions and used symbolically to demarcate group boundaries the diffusion of their style will not be passive, it will be hedged in by a number of restrictions or taboos. This active, but restricted, use of material culture as an aid to boundary demarcation suggests that the distribution of some artefacts will indeed be limited both in time and in space, but it does not necessarily follow that the distributions will be indicative of ethnicity.

The active and passive modes of cultural production are neither contradictory nor are they mutually exclusive - they are complementary. Whilst the symbolic use of artefact design to signify ethnic identity may create a barrier to inter-societal interaction it may be used simultaneously within a society to provide a common medium for transmitting information about personal or group identity, a medium which would facilitate intra-societal interaction. Material culture will be active, therefore, in preventing the stabilisation of social interaction to a uniform steady-state as envisaged by Renfrew; it will be active in providing the social context for passively produced stylistic expression, in forming the "saucers" of Clarke within which interaction might take place.

It follows from this discussion of the various roles that material culture might play in society that ethnic groups should be clearly reflected in the archaeological record. This might either be by ethnically specific symbols or, perhaps more likely, by the material residue of ethnically correlated passive interaction.This seems not to be the case however, they often appear indistinct, or not at all. This is for four reasons:

1) Archaeological cultures are used for purposes of chronological, as well as spatial, description. Thus, it is often a problem to determine the correct nature of the relationship between two, geographically co-terminous, cultures which may present archaeologically as a palimpsest. This problem has continually bedevilled studies of the Beaker culture and will be returned to in succeeding chapters. It is to be hoped the the increasing availability of C14 dates will alleviate this problem by allowing the construction of an independant time scale against which culturally assessed spatial variation might be measured.

2) Archaeological cultures are not generally regarded as being short lived entities. In European prehistory, at any rate, they are usually thought to persist for periods of time that are several centuries or more long. It is unrealistic to assume that stable boundaries would be maintained over such a span of time, but fluctuating boundaries would blur the spatial expression of a culture and do anything but facilitate its archaeological interpretation.

3) There is a, still salient, tendency to view cultures as "cultural bricks", with a well defined boundary in time, as well as in space. There is little justification for such a view. The constituent artefact types of a culture are unlikely to be changed, or abandoned, en masse. There will be a process of gradual change, or development, of the various artefact types through time so that what might

be clear from a synchronic perspective might be much less so from a diachronic one.

4) Ethnically significant patterning in material culture might be crosscut by alternative patterns arising out of pan-societal, or pan-ethnic, stylistic unity. Environmental effects would obviously be important here, but so might social considerations. The exclusive use of certain artefacts by interacting elites would certainly act to muddy the water, and indeed it is one of the phenomena used to explain the pan-European occurence of the Beaker culture.

These obstacles to definition do not justify the abandonment of the archaeological culture, however, instead they call for a sharpening of analytical tools (Clarke 1968: 232). Nor yet do they render the concept of an archaeological culture meaningless, even in the context of a "New", or a "post-Processual", archaeology.

## Ethnic Groups and a Processual Prehistory.

In an important paper Shennan (1989) has argued that ethnicity is a product of the disintegration of pre-urban modes of social organisation, it might be considered to be an epiphenomenon of the appearance of states (ibid: 15). Although this argument is well made, and gives pause for thought, it is not open to refutation. It implies that absence of ethnic sentiment lies outside of history and is therefore unknowable. It might just as well be assumed that some form of ethnic sentiment, some form of us and them recognition, has deep evolutionary roots. To a processual archaeologist, however, the debate is sterile, or at least unnecessary.

Shennan is careful to state that his argument is directed against an emic conception of ethnicity - ethnicity as a subjective category of self-recognition:

> "Ethnicity must be distinguished from mere spatial variation and should refer to self-conscious identification with a particular social group at least partly based on a specific locality or origin. If we accept this definition, then it appears that prehistoric archaeology is in a difficult position as far as investigating it is concerned, since it does not have access to people's self-conscious identifications."
>
> (ibid: 14)

A contrary viewpoint might be adopted, however, one that considers ethnicity to be an etic category - a subjective construct of an outside observer (Sackett 1990: 35). What is familiar, conventional and unremarkable for a native is alien and esoteric to the perception of a foreigner. When viewed from the outside an ethnic group might appear in more than one guise. It might merely lack conscious ethnic symbolling, the passive correlates of ethnicity alone would suffice to provide a group with an homogeneity and a cohesion recognisable to outsiders. Alternatively, an etic ascription of ethnicity may be founded on the premise of "not us", or "other". Thus, to the Romano-British observer it mattered little that the Jutes were not ethnically homogeneous, they were recognisably not British and were awarded an identity on that basis.

Now it might be thought that such etic definitions of ethnicity undermine the relevance of the concept, and this is one of the points that Shennan makes (1989: 11). However, it is crucial here to emphasise that the nature of ethnic categorisation, whether it be emic or etic, is irrelevant to a processual prehistory; but the identification of ethnic groups is of fundamental importance. If it is accepted that the true goal of prehistory is the explanation of long term change, which it must surely be, then it is of prime importance to identify, and isolate, materially advertised "ethnic" irruptions into evolutionary sequences of change. The nature of ethnic categorisation is unimportant, even if it is only a subjective construct of the archaeologist. If the Beaker culture was indeed disseminated by a migrating people it matters little whether the societies involved constituted a self-cognisant "Beaker Folk", or else if "Beaker Folk" is merely a label attached to the phenomenon by the archaeologist for descriptive convenience. The migration would still be substantive and its effects upon regional sequences of cultural development would need to be fully adumbrated before any explanation of social evolution could be realistically attempted. To uncritically force all the evidence of archaeology into a processualist mould is not a theoretical advance from a similar forcing into a cultural-historical mould. It is merely a different way of mistreating the evidence.

When discussing the culture-historical mode of archaeological explanation Shennan has written:

> "The lesson from this is not that migration and diffusion never occur and are never reflected in the archaeological record, but that archaeological data must be subjected to a process of analysis, and that we can no longer continue with implicit interpretative principles which assume precisely what should be open to question and investigation.In treating cultures as entities this is exactly the mistake we make."
> (ibid: 13).

This is a valid point, but it has an equally valid counterpart, which might be worded thus:

> The lesson from this is not that social evolution never occurs and is never reflected in the archaeological record, but that archaeological data must be subjected to a process of analysis, and that we can no longer continue with implicit interpretative principles which assume precisely what should be open to question and investigation.In ignoring cultures as

entities this is exactly the mistake we make.

## Conclusion.

In this chapter several topics have been broached, and themes developed. It has been described how the definition of an archaeological culture changed through time, how its ethnic relations have been visualised, and how the social mechanisms of its formation might have operated. But it has also been recounted how disillusionment with the very concept of an archaeological culture led to its abandonment by many scholars, and how this abandonment fatally undermined the culture-historical mode of archaeological explanation. The consequent rise to predominance of the "New Archaeology", which advocated processual explanations of social evolution, was also noted.

It is against this background that the change in interpretation of the Beaker culture, from a migrating folk to a diffusing artefact package, must be considered. Specific arguments brought to bear against the idea of a migratory "Beaker Folk" hinged upon observations that the regional variation exhibited by the Beaker culture prevented it from satisfying Childe's original criteria for either a culture or a migration. Although more developed definitions were available they were never utilised. In view of this , then, it seems that the underlying reason for the change in interpretation was the shift in the mode of archaeological thought, from culture-historical to processual. Thus, although the case of the Beaker culture is a specific one it is a member of a more general class. The significance of this will be discussed further in the conclusion of this thesis, but for the time being it is intended to avoid generalities and keep to specifics. In the next chapter, therefore, three proposed models of Beaker diffusion will be critically examined, and their heuristic potential assessed.

## Chapter Three.

# THE DIFFUSION OF THE BEAKER CULTURE INTO BRITAIN.

### Introduction.

During the course of the previous chapters it has been described how dissatisfaction with both the static explanation of the archaeological culture and the dynamic explanation of migration resulted in their discard. Thereafter the entire genus of culture-historical explanation was abandoned by the processualist prehistorians of the "New Archaeology". Included in this abandonment was the specific case of a migratory "Beaker Folk". In a British context, however, the intrusive nature of the Beaker culture was an archaeological fact that could not easily be ignored. It precluded any characterisation of the Beaker assemblages that was purely evolutionist in content although they were, and still are, sometimes seen as being in some way linked to the evolution of ranked societies. Nevertheless, a diffusionist hypothesis was required to explain the the Beaker presence in Britain, and several were forthcoming. Unfortunately they have often suffered from incomplete formulation or an inprecise definition which has produced a rather vague explanatory framework. In this chapter, therefore, an attempt will be made to clarify the various hypotheses which have been suggested. Their theoretical bases will then be open to critical examination.

### Diffusion Model One: Beakers as Prestige Items.

One theory of Beaker diffusionary spread suggests that the various components of the cultural assemblage under question acted as prestige items within societies whose political systems can be considered to have been articulated by means of a prestige goods economy. The economy of such a society is composed of several autonomous spheres of exchange, within each of these spheres transactions can only be enacted with certain socially agreed classes of goods (Ekholm 1977; Bohannon 1955). Trading of articles between disparate spheres is either not sanctioned or considered to be so unequal economically as not to be countenanced except as a policy of last resort. The segregation of such an economy may be complex but two generic levels of exchange can be recognised. At a basic level, goods of a household or agricultural nature circulate and are exchanged in socially neutral barter transactions. Of more importance, however, is the existence of higher level, prestige, spheres of exchange. At this level, certain socially or ritually important transactions require the transfer of specifically recognised types of valuable articles, termed here prestige items. As such transactions typically include bride or slave purchase, they form the basis of strategies aimed at productive and reproductive success. The acquisition and maintenance of power therefore requires a successful balancing act to be performed between the accumulation of prestige items and their judicious employment, either directly or indirectly, as payment to retainers or kin. Thus, in a prestige goods economy, the prestige items do not only symbolise power, they actively confer it; the source of power lies in monopolising control over the supply of prestige items into the exchange sphere. Such a monopoly can stifle social change if it is used to maintain an ordered structure of status relationships (Douglas 1967:132), but it is the dynamic aspect of a prestige goods economy that has interested archaeologists, when a hierarchical ranking of lineages emerges after their relative access to a supply of prestige items, for whatever reasons, becomes unequal. It is then possible for a single lineage to benefit from their preferential access by exchanging prestige items with associated lineages for wives or slaves, thus increasing their own productive and reproductive potential at the expense of their neighbours.

Thorpe and Richards (1984) have considered the incorporation of Beaker components into the political systems of societies extant during the late Neolithic of two distinct areas of Britain: Wessex and Yorkshire, as being indicative of an extending network of continental prestige goods exchange. They suggest that already by the end of the earlier Neolithic, in Yorkshire, there was an incipient prestige goods exchange system in operation, as evidenced by the large numbers of polished stone axes imported into the area from Cornwall and the Lake District. If faced by successful competition for control over the importation of stone axes into the area already established elites could follow one of two strategies, or both. They could intensify pre-existing practices, in effect an inflationary strategy whereby increasing numbers of items, in this case axes, would be needed to satisfy the requirements of prestige transactions. Alternatively, a policy of diversification might be adopted, so that novel types of prestige items would be introduced into the exchange sphere. Evidence for the latter process is adduced from the range of specialised flintwork that became current during the later Neolithic. Given a policy of diversification operating to maintain exclusiveness there would be a predisposition to link into the continental Beaker network in order to gain access to a wider range of exotic materials.

In contrast to Yorkshire, Thorpe and Richards suggest that social relations during the late Neolithic of Wessex may have been articulated by means of a "ritual authority structure", a form of political organisation more usually referred to as a chiefdom. Positions of political power within such an "authority structure" are hierarchically tiered in a dendritic fashion and are a function of genealogical distance from an apical chief, whose right to power is ultimately sanctioned by descent from territorial gods or ancestors. A chief may demand tribute or corvee from his subjects in return for which they will expect protection from the supernatural, and perhaps also material or military assistance in times of need. The existence of late Neolithic "ritual authority structures" in Wessex is predicated upon the large amount of communal labour thought to have been necessary for the construction of large henges such as Durrington Walls or Avebury, and also on their possible ceremonial functions. Thorpe and Richards (1984: 77) point out that after 2800/2700 calBC there is an apparent spatial separation of elements of late Neolithic culture with Grooved Ware and associated artefacts found concentrated in the localities of the large henges while in more peripheral areas the predominant ceramic is that of the Peterborough tradition. They propose that this chorological divergence of material culture reflects a corresponding geographical divergence in the relations of power. Peripheral, commoner, groups were being denied access to the material paraphernalia of a ritual authority monopolised by a Grooved Ware "aristocracy"; and perhaps as a result enjoyed a moderate amount of autonomy, with a looser political organisation permitting the emergence of "big man" type strategies of status acquisition. It is in these peripheral areas that Beakers first appear, elements of a continental prestige goods system adopted by alienated, and perhaps semi-autonomous "big men". Ultimately the individualising prestige goods system would have undermined the communal basis of the chiefdom's political structure leading to its ultimate collapse and general replacement by a more anarchic prestige goods economy.

This minimal summary of the prestige goods model omits more than it includes but presents a basic outline of the processes envisaged as being contributory to its operation and spread. There remain faults in the exposition, however. The exact social mechanisms responsible for the ultimate acceptance of Beaker ceramics and their associated artefacts remain largely conjectural. In Yorkshire for example it is proposed that:

> ".... there was a natural tendency to link into the continental Beaker exchange network with its access to exotic materials."
> (Thorpe and Richards 1984:73).

Maybe, but maybe not. The prior existence of a political system articulated by means of prestige goods exchange is no guarantee of the automatic acceptance into that system of alien prestige items. Similarly it does not follow that artefacts considered by one society to be imbued with the symbolic quality of prestige would of necessity retain that nebulous quality upon their adoption in material form by a different society. The reverse would be more probable if foreign prestige items were considered to be a threat to already established relations of patronage.

A second assumption in need of some clarification concerns the putative interaction between a "ritual authority structure" and a prestige goods economy, an interaction thought to be of critical importance for explaining the introduction of Beakers into Wessex. Thus it is stated that:

> "..... ritual authority structures are essentially static and prestige goods economies are essentially active. This also implies that where the two systems come into contact it is the prestige goods economy which will dominate."
> (Thorpe and Richards 1984: 68)

This is all far from clear. It is true that a prestige goods economy is essentially active but it is also essentially unstable. The flow of prestige items through a hierarchical lineage system proceeds from the top down but is balanced by an upwardly moving counterflow of wives or slaves. As a result, in a patrilineal society, the dominant lineage undergoes a dramatic increase in population which might reach such a scale as to overburden the resource base, thus causing the collapse of the system (Ekholm 1977: 120-124). This centralising tendency of patrilineal societies is avoided in societies which practise matrilineal descent with avunculocal residence of offspring. Although brides still move up the hierarchy, children are returned downwards to prevent central congestion. This configuration is still far from stable, however, as men from the lowest ranking lineages are forced to find wives outside of the political area articulated by the prestige goods economy (Ekholm 1977: 125). If a lineage is unsuccessful in this task, it will fail to reproduce itself biologically and thus cease to exist, exposing in the process the next highest lineage to a similar fate.

It is open to the lower ranked lineages in a prestige goods system to obtain wives either by raiding or kidnap from a terrorised hinterland or by adopting a policy of military conquest to impose themselves as a military aristocracy on a subject population (Friedman & Rowlands 1977: 226-227). This cannot be the scenario envisaged by Thorpe and Richards as depicting the extension of the Beaker culture into Britain as it would, in effect, posit the spread of an actual "Beaker Folk" with a society organised around a prestige goods economy, and whose incursions could be characterised as the layering of an aristocratic elite over a subjected, indigenous population; thus explaining the mixed nature of the archaeological remains. It is an alternative, diffusionist, model that is implied:

> "It is proposed that the Beaker/Peterborough association represents the penetration of the ritual

> authority system by a prestige goods economy operated by high ranking continental groups working through lower status "big men" in Wessex and lower ranking elite lineages."
> (Thorpe and Richards 1984: 77).

For this penetration to occur the lower ranking Wessex lineages and "big men" would have had to establish links with the continental groups but the nature of these links are not specified. It is not likely that peripheral groups in Wessex would become directly incorporated into a continental prestige goods economy. They themselves would require a dependent periphery to prevent their immediate collapse and the distances involved are, in any case, too great. A more realistic scenario would envisage the establishment of a straightforward trading partnership with a continental group, the foreign artifacts so acquired being used to infiltrate and re-orientate any pre-existing, embryonic, prestige network in their favour, thus undermining and causing the collapse of the established"ritual authority structure". Although more likely this scenario remains open to the same set of objections put forward for the Yorkshire explanation, it also implies that Beakers and their artefacts should be of foreign manufacture, which is not the case.

Thus a prestige goods economy may be characterised as active insofar as it requires a constant input of excess females for its continuing existence - it must expand or collapse (Ekholm 1977: 128). However, the model contains no prescriptive mechanism for prestige goods economy dominance over an "authority structure", it would depend upon the solidarity and perhaps the military muscle of the "ritual authority structure" and would be historically contingent. Of the strategies proposed for prestige goods economy expansion, whether raiding or trading, or migration or diffusion, no single one is a necessary concomitant of prestige goods economy/"ritual authority structure" interaction. There is little in the archaeology to distinguish between them. It seems likely on theoretical grounds, however, that, assuming Beaker society was organised around a prestige goods economy; a migrationist explanation of its spread, as an aristocratic elite, might present fewer problems of interpretation than one of diffusion.

Diffusion Model Two: Beakers as Status Symbols.

A different explanation for the appearance of single burials with accompanying Beaker paraphernalia across Europe has been provided by Thomas (1987). He argues that the basic productive and reproductive unit of the earliest agriculturalists in temperate areas of Europe would have been the tribal segment, or lineage, a corporate group with rights in land inherited from a real or imagined founding ancestor. Settlement tended to be static and relatively nucleated as early arable agriculture would have been dependant upon a simple technology, and thus labour intensive; it may have been left largely in the hands of women while the men tended livestock away from home. Women were therefore important for both agricultural production and biological reproduction. They were necessary for both the short and long term survival of the lineage and their exchange between lineages was likely to be strictly controlled through the medium of brideprice. However, following Sherratt (1981) and Goody (1977), Thomas suggests that the adoption of plough agriculture would have necessitated a re-ordering of these relations of production. The ox-drawn plough enabled a larger area of land to be brought under cultivation by a smaller number of people, thus encouraging the development of a more dispersed settlement pattern and the break up of centralised lineage residence groups. At the same time the plough would usurp the central role of the female in crop cultivation, her status as a food producer would be downgraded. The break up of the lineage residence groups and of their close control over social reproduction would have resulted in a greater emphasis on individual prowess which, combined with the female loss of status, would have encouraged the emergence of a warrior ethos, advertised in death by the single burials of the Corded Ware and Beaker cultures with their accompaniments of drinking vessels, weapons and ornaments.

An important feature of this model is that Beakers and their associated artifacts are no longer regarded as prestige items, that is, material objects which in themselves possess the facility to confer status by means of their possession or distribution; they are no longer considered to have an active role to play in the generation or maintenance of social inequality. Instead they are seen to be emblematic of status, their use is restricted to an elite whose position of authority rests upon direct appropriation of the productive output of their dependent, or subject, community. The use of Beakers would be restricted by social sanction or public ridicule and they would be symbols - status symbols.

Although the general thesis of Thomas' argument is persuasive it fails to provide a coherent account of why the emergence of a male warrior elite in a variety of areas should necessarily be marked by the adoption of Beaker assemblages. It was evidently not the case in some regions. As will be described in the next chapter the practice of weapon-accompanied male inhumation had been employed in the Yorkshire Wolds for centuries before the appearance of the first Beaker. It also fails to explain just exactly why it is that Beaker pots should be chosen to act as status symbols. With the socially passive role of status symbol, however, it at least seems that the diffusionary spread of Beakers would not be as problematical as it would be if they were acting as prestige items; their adoption by a community would not directly threaten the exchange relations underpinning the established social order. Local elites may well have wished to ape their continental peers and to impress their neighbours. This diffusionist model of Beaker culture spread is, therefore, predicated upon the notion that its constituent artifacts would have been considered as fitting accoutrements for high status individuals, the artefacts themselves being considered exotic or in some way of value.

Beakers as Primitive Valuables.

It is a central assertion of both the "prestige item" and "status symbol" models of Beaker diffusion that the constituent artifacts of Beaker assemblages were considered to be in some way valuable by late Neolithic societies across Europe. The idea that Beaker assemblages may have been so considered was originally proposed by Shennan (1976,1977) following his study of central European material. In this area the bulk of the so-called "Beaker" pottery which was recovered from settlement and burial contexts consisted in fact of undecorated cups, jugs and bowls, known collectively as Begleitkeramik, a range of vessels whose origins could be traced back to preceding Corded Ware assemblages and which ultimately developed into proto-Únětice forms. It was against this backcloth of ceramic and cultural continuity that true Bell Beaker assemblages appeared, usually in funerary contexts and often seeming to act as a marker of high status male burials. Furthermore, the various elements of the Beaker assemblage did not appear to share a coherent genesis in either a cultural or geographical sense; instead the different artefact types were acquired from a variety of backgrounds. The fine Bell Beaker pottery itself had originated in more westerly Corded Ware areas while the rudiments of copper metallurgy would have been imported from the Carpathian basin. This led Shennan to suggest that the various elements of the Beaker assemblage had been adopted from their different sources by local elites who were pursuing a strategy of status demarcation and that therefore the Beaker assemblages must be seen to represent a "status kit", not a complete archaeological culture.

Whatever the ultimate merits of this hypothesis, it was derived from a study of the central European material and so, not surprisingly, presents an original and parsimonious explanation of this material. To recap, in central Europe, the various constituent artefacts of the Beaker assemblage share a synchronous appearance; that is the decorated Beaker fineware, together with associated weaponry and ornaments, seem to have passed into usage at a single point in time. Furthermore, the Beaker pottery was of a fine decorated type from the outset and would have contrasted noticeably with the plain, locally made, Begleitkeramik. It is perhaps not unreasonable therefore to argue that the artefacts were functioning as primitive valuables. There are, however, crucial differences between those conditions attending the appearance of Beaker assemblages in central Europe and those further west, differences of such a type as to seriously weaken the credibility of the status kit model. In western Europe, not only is there more evidence of Beaker settlements with associated Beaker-type domestic wares, but also the initial Beaker expansion was not accompanied by the more exotic components of the assemblage (Case 1977: 77). If the spread of the Beaker culture into Britain is to be considered to result from a process of diffusion then it was a diffusion that in its early stages was purely a ceramic phenomenon. Moreover, the earliest pottery in many areas, AOC, was not as well finished and remarkable as later Beaker products were to be. Thus, before any decision can be reached concerning the acceptance or otherwise of the "status symbols" or "prestige items" models of Beaker culture diffusion, it needs to determined whether pottery alone, and in particular AOC and Maritime pottery, could function within a society in such a way as to bestow prestige, or to be emblematic of status. If, in fact, it would have been considered to have possessed the quality of "value".

Following Marx, it is possible to assess the value of an artefact in terms of its labour value; labour value being a measure of the amount of labour, or energy, invested in its manufacture (Elster 1986: 64). That the value of a prestige item may be related to its labour value has been illustrated in the case of the Raffia cloths of the Lele (Douglas 1967:131). These cloths are handwoven by the male members of the tribe and are required by the same for a variety of status related transactions. In theory, any man should be able to weave enough cloth to satisfy his personal requirements but in practice the quantity of cloth needed is such that it is impossible for a single individual to produce sufficient, he therefore becomes dependant upon his lineage elders to meet his needs. Clarke (1976) invoked the concept of labour value when suggesting that the fineware Beaker might have functioned as a status marker, and he made several assumptions about the conditions of prehistoric ceramic manufacture, backing up his argument with ethnographic analogies. Thus, the decorated fineware Beaker was not a simple household product, it represented a significant input of time and energy that, from a utilitarian point of view, would have been better spent in direct subsistence related pursuits. Ethnographic data from the Goodenough Islands showed that the manufacturing time for a comparable pot might be 5.3 hours (Table 3.1) which Clarke characterised as representing:

> "an expensive chunk of congealed time and energy."
> (1976: 470).

He went on to suggest that fineware Beakers would not be generally available as their production would require a favourable locus with regard to good potting clay, abundant and suitable fuel, water and good agricultural land. Thus centres of production might emerge in which it would be expected that the high standard of finish of such a Beaker would be achieved by semi-specialised craftsmen and it would be regarded as a valuable object, to be utilised in exchange networks. Clarke suggested that such Beakers may have travelled considerable distances by means of such networks, which were undoubtedly in prior existence throughout Europe transporting, amongst other things, stone axes, obsidian, amber and shells. Again ethnographic analogy was invoked to show how, from the Amphlett Islands, finished pots were transported by canoe and traded in exchange for a variety of commodities, both agricultural and material.

There are a number of preliminary observations that can be made concerning this hypothesis. The time taken to produce a pot in the ethnographic example given is a maximum and does not take into account possible economies of scale. For instance, to produce two pots together, the time expended in obtaining and preparing the clay and in firing would not increase appreciably, only the time taken to build the vessels would be doubled. The time taken in manufacture would therefore be, say, eight hours, that is four hours per pot. Furthermore, activities such as obtaining clay or firewood might be performed secondary to other, subsistence related, activities such as herding or plant gathering, thereby further reducing the absolute amount of time spent on pot manufacture. Children might also be employed for unskilled tasks such as fetching water or firewood. Thus Clarke's estimate (1976: 470) of 4 to 6 hours work for a fineware Beaker is too high, 4 hours or less seems a more realistic estimate. On top of this, it must be remembered that ceramic manufacture is ideally suited to being a household craft and it can be carried out in an interrupted fashion, that is at some stages work on

Table 3.1.

Time spent in the manufacture of a single pot.
(after Clarke 1976: 469).

| Processes. | Time. |
|---|---|
| Quarrying clay; selective digging, transport, storage. | 1.3 hours. |
| Preparation of clay; wetting the clay, kneading and cleaning. | 0.5 hours. |
| Building the vessel; forming rolls, rolling strips, ring building the vessel. | 1.0 hours. |
| Initial drying, smoothing the exterior. Decorating the vessel, lifting, beating, trimming, preparing rim, decorating, scraping and burnishing the interior. | 1.5 hours plus. |
| Drying the vessel; firing the vessel; gathering fuel, preparing the fire, setting the vessels, lighting the fire, tending and removing vessels. | 1.0 hours. |

Total time = 5.3 hours per vessel.

pot construction can be left off in order to attend to other chores, to be resumed at a later time (Arnold 1985: 101). Thus it is entirely feasible that pot manufacture may have been a household activity, as such it is also likely to have been included within the realm of female productive activity (Arnold 1985: 102).

In his analysis, Clarke chose to compare the apparent cost of prehistoric Beaker production with that of modern western ceramics. A better comparison, however, would be with the manufacturing time of prehistoric artifacts which are thought to have had a high probability of having functioned as valuable objects due to their exotic nature. Nearer in time to Beakers, it has been estimated that a single, spherical, jet bead would have taken about 3 hours to manufacture, exclusive of the time taken in obtaining raw material (Shepherd 1985: 212). On occasion large numbers of jet beads have been recovered from burials, which it is assumed were strung together with spacer plates and end terminals into complex necklaces. Such necklaces would require a labour input orders of magnitude greater than proposed for a fineware Beaker.

It has been argued that the value status of primitive prestige items, or status symbols, cannot be totally or adequately described by reference to objective manufacturing criteria. Instead, value ascription will partly be by social consensus. Such social assignation of value is to some extent arbitrary, although some defining characteristics of value, or prestige, constantly recur. Valuable items tend to be exotic in appearance and pleasing to the senses, they are rare, may be durable or else be suitable for conspicious consumption (Renfrew 1985: 160). Examples of primitive valuables include precious metals, semi-precious stones, a variety of different seashells, feathers, cloth, furs, livestock and human beings. It might be countered, however, that the ascription of value by reference to a defining criterion of rarity is merely a transformation of the defining criterion of labour - that it is open to anyone to obtain a jade axe, if she or he are willing to spend the time and effort in searching out the jade and fashioning the axe. The time of course would not be available, it is a situation similar to that already described for the Raffia cloths of the Lele. In any event, ceramic articles are rarely found to function as primitive valuables. Pottery may often be exotic in appearance but it is neither durable, suitable for conspicious consumption nor is it particularly rare. An exception to the latter observation might be made in cases where there is a pronounced technology gap existing between contacting societies so that high quality pots might become desirable items in communities whose native potters are unable to reproduce an acceptable equivalent. It is highly unlikely that a technological gap of such magnitude existed between the ceramic production capabilities of the societies extant in late Neolithic Europe. Experimental work has shown that the fabrication of a Beaker is, in fact, a relatively straightforward task (Gibson 1982: 72).

Where it has been demonstrated archaeologically that a qualitatively distinct ceramic assemblage has prestige connotations (that is, it is found associated with other, more orthodox, prestige items) the distinction might be due more to the superior standard of finish than to any difference in vessel form or type (Steponaitis 1984: 291). Again, it has been shown in experimental work (Gibson 1982: 72) that the most labour intensive part of the Beaker production process would have been the refinement of the fabric and the decoration of the formed pot. Within the known corpus of Beaker pottery, both funerary and domestic, standards of finish vary greatly suggesting that levels of labour investment also varied in a parallel fashion. Why some Beakers were finished to a higher standard than others, and also to a higher standard than previous types of Neolithic pottery, remains unknown but it is conceivable that considerations of display or status signalling were at least partly responsible. Pierpoint (1980: 59), for instance, has claimed that in Yorkshire there was a tendency for males to be buried with Beakers of a higher quality than those which accompanied females or children. If vessel quality was being manipulated in such a way within a society, it does not seem likely that there could be a simultaneous usage of the distinct Bell Beaker form itself for similar reasons of display without envisaging a situation whereby a complex set of nested status gradations were being expressed through the medium of a ceramic repertoire highly heterogeneous in both form and finish. This seems most unlikely.

In any case, any concept which implies a universal equivalence between labour input and value is likely to be oversimplified and wrong. It is probable that there would have existed in prehistoric societies a "value gap" between the labour of male and female, objects of male manufacture being considered of value while those of female manufacture were not. Hodder's (1986: 105ff) discussion of the Ilchamus females' decoration of milk containing calabashes is illuminating in this respect. Seen as unimportant, or trivial, by the males, the decoration is manipulated by the females to draw attention to their reproductive contribution to the domestic economy. Alternatively, female labour might indeed be predicated upon the expectation of an ultimate economic benefit, but a benefit which need not be archaeologically tangible. Her labour might be considered to be a form of social investment. To enlarge, consider a hypothetical society in which, for whatever reasons, it is important for a man to be seen to be married to an industrious wife, as advertised by her standard of potting. The wife's expenditure of time contributes to the social standing of her husband which, ultimately, might be turned to economic advantage. Thus the woman's labour would be rewarded, but the immediate object of her labour, the pot, would retain no intrinsic value. Thus there can be no necessary simple or direct relationship between the time invested in the manufacture of an artefact and its intra-societal value as a status symbol or its inter-societal value as an exchange item, particularly if the article is of female manufacture, which seems probable at least in the case of the Beaker. The provision at burial of a female produced, high quality, Beaker may even have been an action which achieved significance by virtue of the material role the Beaker played in the everyday discourse of female society, a role which acted to exclude it from any male considerations of appropriate status display. This remains, of course, unknowable.

An important prediction of Clarke's model (1976: 467) is that fineware Beakers would be found in locations far removed from their place of manufacture. It must first be remembered that the large scale movement of Beaker fineware may have been a problem. There have been large quantities of such pottery recovered from locations throughout Britain and Europe, quantities much in excess of stone axes, for instance. Although it might be argued that pottery is more fragile than stone axes and that, therefore, a higher rate of breakage and discard is a prior expectation, it would nevertheless imply the existence of a well developed system of communication and transport to maintain supplies. The difficulty of this in inland areas away from major river routes should not be underestimated, the suggested analogy of the Amphlett Islanders is not altogether apposite as they are able to transport all their pots in canoes.

To date, there have been few ceramic provenancing studies carried out with which to test this prediction, although a petrological study of Beakers in south-western England has shown them to have been of local manufacture

(Pearson 1990). This study is particularly significant as pots made from the gabbroic clay of the Lizard peninsula are found throughout Cornwall in contexts dating from Neolithic to Roman. The Beakers are an exception however, they seem to mark a distinct break in the regional tradition of ceramic production and movement (Harris 1990: 4). Similarly, petrological studies of Beaker material from three seperate locations in Ireland: Lough Gur, Dalkey Island and the Boyne Valley; in all cases pointed to local manufacture (Cleary 1983: 113, Brindley 1984). There is therefore at the moment little evidence of large scale exchange of Beaker fineware although a more extensive research programme might alter our current perceptions, particularly if the programme was designed to include areas without adequate resources for successful potting.

The "status kit" and "prestige items" model of Beaker diffusion seem to be fatally flawed. In order to explain the particular circumstances attending the introduction of the Beaker culture into Britain it would require that the ceramic fineware alone be regarded by the late Neolithic societies as being valuable in some way. This is a role for which pottery is ill-suited. Suggestions that fineware Beakers may have functioned in such a manner by virtue of the labour invested in their manufacture and by their participation in exchange networks have been shown to be unfounded. Alternative suggestions seem worse. After 15 years of Processual sturm, and 10 years of post-Processual drang, it is depressing to learn that Beakers proved desirable to the Neolithic inhabitants of Britain

> ".....in consequence of their novelty, their association with distant places, or even an appearance which might be judged attractive."
> (Thomas 1991: 101)

## Beakers as Primitive Valuables - A Test.

If Beaker pottery was indeed functioning as a primitive valuable, it might be expected that it would share with other, more conventional valuables, an isomorphic distribution within society; a distribution restricted by convention to certain sectors, or members, of a community and which might find expression within the mortuary domain. To test this hypothesis, the allocation of probable prestige items or status symbols to the early Bronze Age burials of eastern Yorkshire was examined, and compared to that of the ceramic Beakers and, for practical reasons, Food Vessels. Items chosen as being the most likely to have functioned as valuables were those made of jet, amber and metal. No attempt was made to differentially score burials on a quantitative basis, so that for instance a single jet button was considered to be of equal significance to a jet necklace. The reasons for this are manifold, but the decision may be justified by the observation that whereas coarse distinctions within a society may be expressed, and survive, within the mortuary domain, investigations of more subtle distinctions are host to a whole range of problems, both depositional and post depositional (Bradley 1988). The study was restricted to inhumation burials as they were better described from a demographic point of view by 19th century archaeologists and it seems in any case unlikely that the cremated burial population differed significantly in its composition.

Information for the study was derived from Greenwell (1877, 1890), Mortimer (1905), Brewster (1980), Dent (1983), Powelsland (1986) and Stead (1959). The distribution of artifacts was initially, and as it turned out, fruitfully, compared against burials using the criterion of age as being the factor most likely to affect the provision of valuables. There were in total 747 inhumation burials for which reasonably accurate age data was available. The burials were divided into three groups: child, adolescent and adult. As the socially recognised onset of adulthood would have occurred sometime during the teenage years, the adolescent group was arbitrarily deemed to include anyone between the ages of thirteen to eighteen inclusive, but was in fact a non-category. It includes members of both the child and the adult categories and acts to remove the fuzziness of the boundary. It thereby constitutes a grey area between distinct categories. Thus the child group was compared directly with the adult group, with the results for adolescents being expected to fall somewhere inbetween. Burials associated with either a Beaker, Food Vessel, worked jet, worked amber, a metal artefact, or any combination thereof, were scored (Table 3.2). The occasional Collared Vessel or Accessory Cup accompanying a burial were included in the Food Vessel group, all other artefactual associations were ignored. In Table 3.3, the jet and metal associated burials are collapsed into a single class of prestige burials and the relative percentages are presented. Using a Chi-squared test, the only significant difference between adult and child burials was found to be in the provision of metal and jewellery, which was largely restricted to adults. There is little evidence to suggest that ceramics at burial, whether Food Vessel or Beaker, were as restricted in their inclusion as were the more conventional valuables. Children were as likely to be provided with pots as were adults.

These results might be challenged, and explained away, as the effects of emulatory devaluation. It is worth, therefore, considering them in more depth. The emulation model would predict that, initially, fine Beakers would have been restricted to adult burials, but as time passed and metal and jet objects became more widely available, pottery would become devalued and thus be considered as a fitting accompaniment for a child. From this it would follow that the proportion of children within the class of

Table 3.2.

Burial Associations.

| Associations | Child | Adol. | Adult |
|---|---|---|---|
| Beaker only | 16 | 5 | 33 |
| Beaker & jet | 1 | | 2 |
| Beaker & bronze | 1 | | 3 |
| Beaker, jet & bronze | | | 1 |
| Food Vessel | 41 | 9 | 79 |
| FV & jet | | | 2 |
| FV & bronze | | | 7 |
| FV, jet & bronze | 1 | | 2 |
| jet | 1 | 3 | 12 |
| bronze | | 4 | 20 |
| jet & bronze | | | 6 |
| Total no. of burials studied: | 205 | 48 | 494 |

Table 3.3.

Percentage of burials with "valuable" or ceramic associations.

| | Child | | Adult | |
|---|---|---|---|---|
| Total no. of burials | 205 | | 494 | |
| | no. burials | % | no. burials | % |
| with Beakers | 18 | 8.8 | 39 | 7.9 |
| with Food Vessels | 41 | 20.0 | 90 | 18.2 |
| total ceramic burials | 59 | 28.8 | 129 | 26.1 |
| with "valuables" | 5 | 2.4 | 64 | 13.0 |

burials receiving a Food Vessel should be larger than the proportion within the Beaker class, (assuming the chronological precedence of Beakers in these burials). This turns out not to be the case, however, as 29% of all Beakers were with children as opposed to 32% of Food Vessels - not a significant increase. It is also a corollary of the emulation model that the children allocated metal or jet should be late in the burial sequence whereas, in fact, two of them were Beaker burials, one a Food Vessel and one had no ceramic accompaniment.

This brief survey of a single aspect of the material surviving in the archaeological record from a burial tradition which lasted the best part of a millenium can be nothing other than superficial, but as with all such studies while negative evidence might be inconclusive, positive conclusions cannot be ignored. Whatever sumptuary convolutions were affecting the depository practices at death of the adult population on the Yorkshire Wolds during the 3rd and 2nd millenia BC, children, by and large, were not considered fit recipients for valuable or prestigious artefacts - they were fit only for pots.

Diffusion Model Three: The Cult Package.

While the ceramic Bell Beaker itself may lack the necessary attributes to qualify as a status symbol or as a prestige item, it might perhaps have been assigned an important role in society by virtue of its contents or usage. Attention has focussed on the role Beaker pottery may have played in male drinking rituals which could have accompanied the introduction of alcohol into Neolithic societies. It might be expected that, because of its potentially anti-social consequences, the performance and manner of alcohol consumption would be liable to strict societal control or sanction. The occasion of alcohol drinking would thus be marked out both by ritual practices and by the utilisation of distinctive items of material culture, in this case the Bell Beaker and associated artefacts. It is proposed that such a combination of behaviour and material, a "cult package", might spread through societies with very different forms of internal organisation; the rapid spread of the peyote cult through the diverse Indian tribes of north America during the late nineteenth and early twentieth centuries is invoked as an appropriate analogy (Burgess and Shennan 1976: 311). The analogy, however, is not a good one. The peyote cult was but one symptom of a general reconstruction of Indian society as it strove to adjust to the norms and realities of European domination. It was regarded by its participants as being an Indian equivalent of Christianity and offered a more progressive alternative to archaic tribal religions, while at the same time maintaining a distance from the "white man's religion". Although a pan-Indian phenomenon, its acceptance was often by the younger, or more educated, members of Indian society, often in the face of opposition from tribal conservatives or elders (Hertzberg 1971: 248). It is doubtful if the cult would have been so readily accepted by unstressed societies. It is also worth remembering that the rapid spread of the peyote cult was undoubtedly facilitated by the developing communication infrastructure within the United States, peyote buttons themselves were often obtained through the good offices of the U.S. Mail! (Hertzberg 1971: 281).

The peyote cult aside, Deitler (1990) has reviewed the ethnographic evidence of alcohol consumption and drawn attention to several distinctions that must be made when considering the diffusionary spread of alcoholic drinks. The adoption by a society of alien drinking customs, or of a novel alcoholic beverage, may have many causes - and many effects. These are determined by any already established role of alcohol within the adoptive society and also by its socio-political organisation. Thus, if alcohol is unknown then the commencement of its use is likely to be socially disruptive. If the preferred alcoholic beverage of a society is not open to indigen ous production, if it has to be imported, then it might function as a "prestige item" as already described. When foreign drinking customs are adopted for their symbolic potential however, it is usually by an hierarchical society with an already established syntax of status demarcation. The drinking customs and accoutrements then act as status symbols, again as already described. On the face of it, this latter situation seems to provide a good underlying rationale for the diffusion of Beakers as status symbols as it overcomes the problem created by their apparent lack of intrinsic value.

Several other objections remain, however. In the first place, it presupposes that societies throughout late Neolithic western Europe possessed a roughly comparable form of social organisation, and one which was predisposed to penetration by a novel drinking ritual. This seems unlikely, to say the least. It is certainly possible to point to the different forms of society implied by the fortified settlements and metal using communities of Iberia when compared to the scattered homesteads of north-west Europe. Thorpe and Richards have claimed, as already recorded, that forms of social organisation in southern Britain differed radically. Secondly, the faithful reproduction of a coherent body of custom and material represented by a drinking cult is not a simple exercise. It is dependent upon the nature of the relations that exist between donor and recipient societies, and is only likely to occur in conditions of close contact (Dietler 1990: 378), Finally, Case (1987: 119) has pointed out that, although the range of Beaker ceramics does include some types which will have been used as drinking vessels, not all were suitable for such usage, nor does it mean that they were manufactured for this purpose. It is also often the case that Beakers were deposited in graves on their sides or inverted, evidently not containing a liquid. The Beaker recovered from Ashgrove, Fife, contained a residue which, when examined, was found to contain predominantly lime pollen with smaller amounts of meadowsweet, heather and ribwort. Although such a residue might remain had the Beaker originally contained a honey-based mead, it could equally well indicate that it had originally contained honey. It is quite possible, in fact, that unfermented honey may have been more of a prized commodity than alcohol, which, if available in cereal-based form, may have been relatively abundant. Domestic bees were probably not hived in temperate Europe until late antiquity or the early middle ages (Sherratt 1987: 95), during the Neolithic and Bronze Age, honey would most probably have been collected from wild populations of bees and would have been a scarce resource; its sugary impact upon Neolithic taste buds cannot now be imagined but should not be underestimated. The horn spoon recovered from the Beaker at Broomend, Aberdeen, would seem to have been of more use in extracting viscous honey from a pot than the more liquid mead or beer from what is, after all, supposed to be a drinking vessel. The amount of honey available to late Neolithic societies would have been extremely limited, however, quantities would not have been large enough to have driven a putative elite honey-slurping cult.

Thus, although the "cult package" model of Beaker diffusion seems to be the best of a bad bunch, it does not deserve to be uncritically accepted. While it might be the case that ritual alcohol consumption played a central, or at least important, role in Beaker society it is more likely that the primary diffusion of the custom through Europe would have been by means of a migratory folk, at least in the first instance. Local processes of diffusion, or acculturation, may have followed as a secondary occurrence.

It remains now to consider Beaker settlement evidence, and to examine the theoretical accommodation made between Beaker settlements and Beaker diffusion.

## Beaker Emulation.

Settlement remains of late Neolithic and early Bronze Age Britain are notoriously fugitive. Most settlements seem to have consisted of a few insubstantial structures of indeterminate lifespan which have been obliterated by subsequent land use to produce numerous scatters or spreads of mixed occupational debris. There are few stratified deposits. Thus, apparently "domestic" Beaker pottery has been found in a number of contexts, including pits, hearths, occupation floors and pot boiling sites; but it is often mixed with indigenous ceramics: Peterborough, Grooved Ware or Food Vessel. (Bamford 1982, Gibson 1982). Such mixed scatters of occupation debris are open to interpretation in one of two ways. First, it might be argued that they are the cumulative residue of several, discrete, episodes of settlement by people with different cultural traditions, and as such represent a mixed deposit. Alternatively, they could be seen to result from a single period of occupation by a group whose ceramic repertoire was stylistically heterogeneous, with any apparent horizontal stratigraphy resulting from use foci rather than settlement drift. (Whittle 1981: 310). It is sometimes possible to demonstrate in fact that assemblages do derive from seperate occupation events (Bamford 1982:49), but in many cases the problem is beyond resolution. Nevertheless, Whittle (1981) and Bradley (1984) have argued that the second possibility is the most likely and to explain the simultaneous utilisation of two different stylistic groups of pottery within one settlement they have suggested that they may represent the visible residue of emulatory cycling, using Miller's (1985) model of ceramic emulation as a heuristic.

Developed after a period of ethnographic study in a south Asian Hindu community, Miller suggested that discrimination between vertically hierarchical components, or groups, within a society may be maintained, in part, by the use of material culture, including pottery, in a system of social symbolism. Thus, the use of a particularly fine or distinctive ceramic type might be the prerogative of a high status group, while inferior groups would use less developed, or less fine, types. There would, however, be a continual process of emulation whereby groups wishing to improve their relative status would attempt to adopt the usage of the material symbolling devices of superior groups, who would concurrently be striving to maintain the status quo by availing themselves of further unique forms. There are problems with the emulation model, however, both in its general exposition and also in the specifics of its application to late Neolithic and early Bronze Age Britain.

It is unlikely that cultural emulation is a universally acceptable process. It assumes that group boundaries are permeable so that outsiders who adopt the symbolic and behavioural norms of a group are conceded full membership status. Often, however, this is not the case and intergroup boundaries are characterised as being impermeable (Hogg & Abrams 1988: 56). This occurs when symbols are biologically determined or else heavily constrained culturally. In this situation, lower status groups may choose to emphasise positive aspects of their own identity, aspects which cannot be matched by superior groups, in an attempt to alter the criteria by which status is judged or to render status differences irrelevant. They may also of course resort to direct action, violence, in an attempt to abolish inequitable status relationships.

Miller suggests that pottery is well suited to emulation because of the ease with which new forms can be created and changed (Miller 1985: 188); but surely the very mutability which renders pottery a suitable medium for emulation would also act to exclude its use from any field of status display. As already argued, ease of manufacture and general availability are not the usual attributes of status symbols and pottery would be an unlikely candidate to act as a manipulated token in emulatory cycles. Miller's examples of emulation involving the adoption and/or abandonment of metal ornaments and utensils are more convincing than his ceramic examples. He records (1985: 187) that, in fact, most pottery forms did not show any association with differences in caste. Where they did, it was often due to factors external to the pot - the relative costs of the foodstuffs for which the pots were used to cook, for example. In at least one case direct coercion was needed to prevent low status castes using anything other than earthenware vessels (1985:188), but it is unlikely that coercion on a scale necessary to prevent ceramic innovation would be possible in the long term. Pottery is a democratic medium, at least in the absence of centralised craft groups or fineware industries. In the the case of prehistoric Britain, it is difficult to imagine how, for example, a group of high status Beaker users could prevent all and sundry making Beakers if they so desired. If ceramic emulation was an acceptable strategy of social competition then archaeologically, ceramic emulation would appear as an instantaneous phenomenon, not as a series of prolonged cycles operating over periods of time several centuries long. Nevertheless, despite these objections, the emulation model has been adopted as offering a possible explanation of the complicated patterning expressed in the ceramic assemblages of late Neolithic and early Bronze age Britain.

In arguing for a process of status linked emulation, Whittle (1981) has pointed out that there is an apparent diachronic trend to be seen expressed in the compositional variability of the ceramic assemblages recovered from

"Beaker" settlement sites. There are very few "pure Beaker" sites known to date from before 2150 calBC, that is, sites which possess a ceramic assemblage composed exclusively of Beaker forms, both domestic and fineware. Early Beaker fineware forms are generally found in association with indigeneous Neolithic types. The majority of settlement sites which are recognisably "pure Beaker" are associated with the later styles of Beaker fineware and probably date to after 2150 calBC. Whittle concluded that prior to this date, the Beaker fineware found on sites of indigen ous tradition would have possessed a specialised function, perhaps high status or ritual, and adopted for specialised use on account of its novelty and continental background (Whittle 1981: 320, 331). After 2150 calBC, however, domestic pottery increasingly took on the form of the previously high status Beaker fineware while new ceramic types were developed to replace Beakers in this role: Food Vessels and Collared Urns. Bradley (1984: 72) has proposed a similar argument and has summarised it diagramatically (Figure 3.1). As it stands, however, Bradley's diagram of the ceramic replacements involved might be oversimplified as it does not take into account the continuing developmental sequence of Peterborough Ware. It is now generally accepted that both vase-type Food Vessels and Collared Urns were, in the main, continuations of the Peterborough tradition; the Food Vessels developing out of the northern Meldon Bridge and Rudston sub-styles while Collared .Urns were descended from the more southerly Fengate types (Smith 1973: 112; Burgess 1980: 85; Longworth 1984: 19). This suggests that Bradley's diagram should be modified to show continuity between Peterborough Ware and Collared Urns/Food Vessels.

In this emulatory model, then, Beaker settlements are not viewed as being the dwelling places of a distinct "Beaker Folk", instead they form a coherent sequence which demonstrates, in a settlement context, the gradual adoption and assimilation of Beaker pottery by an otherwise autochthonous population, and the subsequent evolution of early Bronze Age ceramic forms. The conditions of ceramic production in such settlements has been well summarised in culinary style by Gibson (1982: 85):

> "...there is a great variety of pottery styles in Britain at this time. Domestic sites act as a cauldron into which the ingredients of Peterborough and Grooved Ware and all their regional variations are placed. Also included are any plain wares that existed, and wooden vessels that may have been used on domestic sites. The "cooking process" itself alters the ingredients and Beaker influence is added to the stew but only in the role of seasoning. Beakers flavour and colour the mixture but only compliment the flavour rather than drastically affecting it; they help bring out what is directly there. The result, therefore, is that the pottery assemblages on domestic sites are rich and varied, containing a mixture of well established styles, pots of a type that will later become familiar as Food Vessels, or Collared Urns, and also a wealth of"unclassifiable" pottery representing the "grey areas" between established pottery types and the potters individuality."

Even if, for the sake of argument, this scheme of emulation and development is admitted acceptable within the sphere of ceramic production and use there still remain difficulties in accommodating the British material to the given model. Admittedly, in comparison to its Peterborough and Grooved Ware predecessors, Beaker pottery is a superior product, but what of Food Vessels and Collared Urns? It is difficult, in general, to accept a Collared Urn or a Food Vessel as a finer pot than a Beaker and it is equally difficult, therefore, to understand why they should be adopted as a high status ceramic. It seems unlikely that the replacement of Beakers in grave assemblages by Food Vessels and Collared Urns would have been instigated by their overt superiority over Beakers in terms of quality.

Given the equivocal nature of the settlement evidence it is not possible to refute the emulation model by demonstrating that all Beaker domestic sites, or all

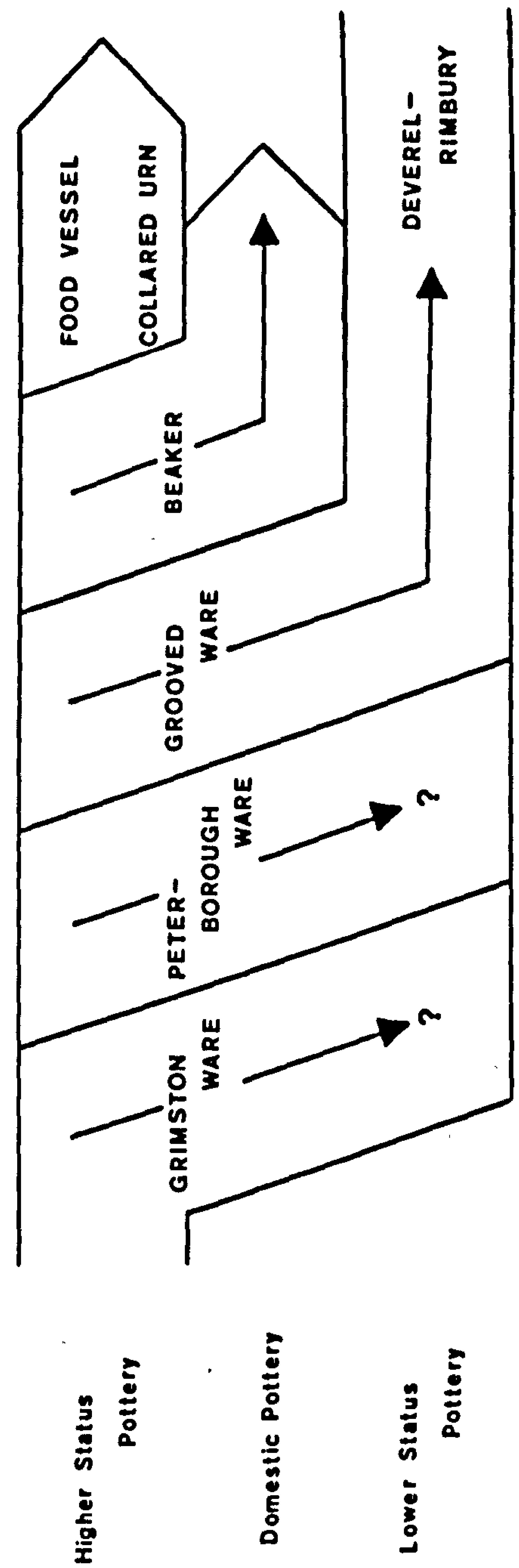



Figure 3.1.

Ceramic Emulation.
(After Bradley 1984: 72).

Peterborough sites, were in fact culturally homogeneous and that therefore mixed deposits are the detritus of multiple settlement episodes. (It is also the case that Beaker sherds are sometimes associated with earlier Neolithic pottery, at Swarkestone, for instance, and Craike Hill (Greenfield 1960: 23, Manby 1958: 233). This is never taken to indicate contemporaneity however, a timely reminder that data interpretation is indeed subjective, and one which should give pause for thought). The emulation model is open to test, however, if, in effect, the problem of site definition is turned on its head. So, if all pot types were in simultaneous usage on domestic sites, the "cauldron" of Gibson, it follows that subsequent to the introduction of Beakers, the ceramic assemblages of all settlement sites should possess both a Beaker component and a Peterborough/Food Vessel/Urn component. It is not possible that there could be a period of time when assemblages were "pure Beaker" as it would imply the chronological severance of the Peterborough tradition and require that Food Vessels and Collared Urns be derived from a "pure Beaker" substrate. Alternatively, the demonstration of "pure Beaker" sites could be accepted if there were also "pure" sites of the Peterborough tradition providing a conduit for the continuing development of early Bronze Age ceramic types. This would in effect demonstrate the existence of two contemporary and mutually exclusive ceramic traditions. Their exclusivity would also imply that there were good reasons for visibly demarcating social or ethnic group membership, perhaps reasons of economic competition (Barth 1969, Hodder 1982). This seems particularly pertinant given the apparent similarities in the locational positioning of late Neolithic and early Bronze Age settlements.

It is, of course, generally accepted that there were "pure Beaker" settlements, if only during the late phases of the culture. (Whittle 1981, Gibson 1982). Sites such as Ross Links, Northton, Hockwold and Martlesham have been well described and require no further elaboration here. It is significant that they are often sand-dune sites where rapid burial has successfully isolated a single settlement phase and preserved it relatively intact.

It is not just Beaker settlements that have been preserved under sand-dunes, however, in recent years two Food Vessel sites have been excavated on the Isle of Islay: Kilellan Farm and Ardnave. At Kilellan Farm midden, the bulk of the early Bronze age pottery recovered consisted of large shouldered jars, probably round based, the majority plain but some decorated. These shouldered jars were in association with a Food Vessel assemblage which included an Irish Bowl, vase-type Food Vessels and some very large Encrusted Urns. Both the Food Vessels and shouldered jars were composed of similar fabric, but also present were some sherds of a superior fabric and decorated with cord, comb or groove ornament. The excavator claimed that these sherds were Beaker, although conceded that they were hardly typical (Burgess 1976: 200). Beaker or not, the small quantities and atypical fabric might indicate that the pots in question did not originate in Kilellan Farm. In any case, the relative proportions of material are not in accord with the emulation model. This would predict that during the currency of Food Vessels, Beakers were a lower status ware. At Kilellan Farm, therefore, the expectation would be that the midden would have contained largely Beaker domestic forms with an occasional piece of decorated Food Vessel. This was not the case. At Ardnave, a ceramic assemblage was recovered from a collapsed stone structure containing multiple occupation levels with a covering midden, it differed from that found at Kilellan Farm in that it was "pure Food Vessel". With the possible exception of a single rim sherd, the shouldered jar assemblage of Kilellan was not represented and there was not a Beaker in sight (Ritchie, G. Welfare, H. 1983).

It seems, then, that any explanation of the Neolithic - early Bronze Age ceramic succession which is predicated upon a continuing process of emulation is theoretically dubious, and can derive little support from what unequivocal settlement evidence is available. The existence of "pure" Beaker and Food Vessel settlement sites indicates that the different types of late Neolithic and early Bronze Age ceramics do not constitute an evolving style continuum; but, to some extent at least, must represent separate traditions. It seems most likely that any settlement assemblages which include sherds from different ceramic traditions should be considered as evidence for several, discrete, episodes of occupation. The diversity seen to exist within the overall ceramic repertoire of late Neolithic/early Bronze Age Britain is surely the product of several, sometimes unrelated, social processes, of which an influx of settlers from continental Europe carrying with them Beaker pottery may well have been one.

## Conclusion.

It has been argued in this chapter that the various models which have been proposed to explain a Beaker culture diffusion into Britain are unsatisfactory. Perhaps the most convincing is that of the "cult package", although this too is beset by problems. The question of Beaker settlements was also discussed in this chapter and it was pointed out that, logically, they must have existed independently of, but been contemporary with, indigen ous settlements.

Having briefly discussed the settlement evidence it is now proposed to move on and examine the funerary practices of late Neolithic and early Bronze Age Yorkshire, to see if it is true that they display continuity rather than disjunction.

## Chapter Four.

# LATE NEOLITHIC AND BRONZE AGE MORTUARY PRACTICES.

## Introduction.

In this chapter, the mortuary practices of the late Neolithic and early Bronze Age populations of the Yorkshire Wolds are examined in order to evaluate the claim of ritual continuity. Although both traditions are analysed on a descriptive level for evidence of formal similarity or dissimilarity, the investigation proceeds beyond this and uses the evidence of the burials in a cautious attempt to recapture, in approximate terms, the structure of their living societies. Although the validity of such a methodology has been the subject of much criticism in recent years, it is hoped that by such means a more realistic assessment of societal continuity might be produced than that which might be obtained from a simple exercise of trait comparison.

Traditionally the most convincing evidence of a Beaker immigration was considered to be the change in funerary rite occuring at the Neolithic/Beaker interface. Neolithic burials had been collective in character and interred in communal long barrows or chamber tombs. There were few grave goods included in such burials and the skeletons were mixed. To some scholars this suggested an egalitarian society. In contrast the Beaker immigrants brought with them the continental practice of individual inhumation under a round mound with inclusion of grave goods to denote individual status. Beaker society was ranked. In recent years, however, this view has been challenged and the new orthodoxy denies the significance, or even the actuality, of this change in burial practice.

With the excavation of sites such as Hambledon Hill (Mercer 1980) and Offham Hill (Drewett 1977), it is now apparent that earlier Neolithic burial practices were more complex than previously thought, with rites of excarnation, inhumation and cremation taking place at a variety of sites. Furthermore, the population figures suggested by the number of individuals recovered from long barrows are very low and women and children are under represented (Bradley 1984: 22) - it is evident that only a minority of the early Neolithic population were laid to rest under a long mound, perhaps the privileged element in society (Megaw and Simpson 1981: 95). During the later Neolithic, burial practices varied regionally but some areas, notably the Yorkshire Wolds, saw the indigenous development of the practice of individual inhumation under a round mound accompanied by grave goods. Burgess (1980: 53-61, 299-300) particularly has argued that it is in these later Neolithic burial practices that the forerunners of early Bronze Age rituals are to be found, not the European mainland. Single, furnished, inhumation in a pit, shaft or cist under a round barrow were features long thought diagnostic of Beaker and early Bronze Age burial practices but are all now known to have been utilised during the Neolithic. Conversely Neolithic practices of cremation, excarnation and the reuse of a tomb for more than one burial are seen to persist into the early Bronze Age. Burgess has concluded that the appearance of the continental burial tradition affected indigeneous rituals ".... only superficially." (1980:61). It has proved difficult, however, to extend this model to other parts of Britain. In the north and west, chamber tombs and passage graves seem to have continued in use until sealed off at the end of the Neolithic. In southern England, the situation is more complex and there is little evidence of single inhumation under a round barrow, although the later long barrows are smaller and tend towards being oval in shape rather than rectangular (Bradley 1984: 32). Male burials predominate and skeletons tend to maintain their integrity. Bradley (1984: 43,78) has argued that the absence of a sustained tradition of single inhumation during the southern late Neolithic may have been due to regional ideology which called for the expenditure of labour on large ritual or communal monuments which emphasised the cohesion and importance of the corporate group at the expense of the individual.

As evidence for ritual continuity in funerary custom through the period of the Neolithic - Bronze Age transition is most clearly marked in northern England, particularly Yorkshire, it is those burials that are analysed here, and the claim of ritual continuity critically scrutinised. Before proceeding with the analysis, however, it is first necessary to review the literature of archaeological mortuary studies so as to avoid any overly optimistic or elaborate interpretations of the available data.

## Mortuary Practices: Theoretical and Practical Considerations.

There is a continuous thread of thought to be found running through the antiquarian and succeeding literature that imparts general identities of rank, or status, to certain well endowed burials or funerary monuments. Greenwell for example wrote:

> "To the heads of these smaller communities, if such existed, the greater number of the barrows must probably be attributed, if the supposition is correct which regards them as burial places, not of the mass of the people, but of those who occupied a position of authority."
>
> (1877: 111)

Mortimer concurred:

> "These mounds must be regarded as the places of

sepulchre of chiefs of tribes, clans, and families, or of the people in authority claiming and being allowed a position of respect."

(1905:lxxi)

Despite the persistence of such opinions it was not until the advent of the "New", or "Processual", archaeology that systematic attempts were made to evaluate the validity of their inferences. Initial attempts to reconstitute the structure of a living society from its funerary remnants were judged favourably, but the field of study has more recently taken on the aspect of a theoretical and methodological minefield.

The concept of social structure, in the sense used by functionalist anthropologists, is the theoretical starting point for most archaeological investigations of mortuary custom. Social structure is considered to be an extra-organic network of relationships that exists between individuals in a society, and which acts to constrain their behaviour. Within pre-industrial societies, this network of relationships is considered to be relatively stable and its nodes of interaction are visualised as constituting a series of pre-defined "roles" which must be filled by human "actors". An individual may occupy a number of different roles, each with a different relative status and allowing differential freedom of action, or exercise of power. It is a feature of a ranked society that not all roles are open to occupation by a suitable individual.

Binford(1972) and Saxe (1970) suggested that social structure might survive within the funerary record and be available for archaeological recovery. The relative status of an individual would be expressed by the number and magnitude of duty obligations owed to him in death, but arising out of the multiplicity of roles held during life. Binford suggested (1972: 226) that the primary roles afforded differential mortuary treatment would be age, sex, relative rank and group membership status. He recognised, however, that death in unusual circumstances might entail the deceased being treated as a member of a post-mortem membership unit (war victims etc) which would overide normal considerations of role and status. Personal attachment might also affect behaviour on an emotional plane and, given latitude, might afford significant variability in funerary behaviour.

In order to evaluate the potential of this method for archaeological research two independent programmes of ethnographic evaluation were carried out. One, relatively coarse grained, used information derived from the Human Areas Relations File (Binford 1972), while a more detailed study of the funerary practices of three well documented groups was conducted using componential analysis (Saxe 1970). Binford argued that the status differentials maintained by, or maintaining, social structure would require symbolic recognition, whether behavioural or material, and that this symbolic recognition might extend to the mortuary domain. Thus, in simple, non-hierarchical societies there would be a restricted repertoire of status differentials aligned around differences of sex or age, and which would lead to relatively simple burial practices. By contrast, in more complex societies, the greater number of roles, and thus status relationships, would generate a more differentiated funerary ritual. Binford tested his hypotheses against a sample of forty non-state societies organised into simple, hierarchical, categories of social complexity as determined from their subsistence base (hunter-gatherers/shifting agriculturalists, settled agriculturalists, pastoralists). He found it generally true that there was a relationship between social and ritual complexity, and that, furthermore, amongst settled agriculturalists both vertical and horizontal divisions in society might be reproduced, augmenting and obscuring differentiation due to sex and age.

Saxe presented his findings as a series of hypotheses, although not all were tested due to the small size of the data base. He did have enough data, however, to conclude that the degree of mortuary differentiation was correlated with social complexity, and that although individual roles may not always be represented in the mortuary domain, they were a contributory factor to the complexity of ritual. Roles of higher social significance, moreover, would merit more recognition within ritual, thus providing empirical validation of the intuitive statements of earlier antiquarians and archaeologists.

Although ethnographic studies are favourable to the idea that social structure might be reflected in burial ritual there are a number of problems to be resolved, or conditions to be met, before such a methodology can be utilised for archaeological investigation. Any patterning found to exist in the archaeological record is a remnant of that displayed at the time of funeral, having survived the vagaries of depositional and post-depositional processes (O'Shea 1984: 23ff).

The symbolic representation of a status relationship may take many forms but will not necessarily involve any material elaboration of the corpse or its tomb. Behavioural celebration of status is a common enough ethnographic occurence and yet to the archaeologist the duration and complexity of ritual leading up to final interment remains obscure. Furthermore, the inclusion of material objects within a tomb is not always intentional, it may be coincidental. Thus, for instance, in some cases pots may be included in graves merely as food receptacles, without having any symbolic significance in themselves. It is also possible that objects might find their way into a grave accidentally at the time of funeral, material debris from the area surrounding the tomb, for instance.

Once buried, a number of processes, both natural and human in origin, may disturb the mortuary deposit. There may be a spatially selective loss of part of the archaeological record due to processes of erosion, or burial under alluvium or hillwash. The differential preservation of material is also a problem. Organic material will, in most cases, decay away - although not always. If a grave has been anaerobically sealed, either intentionally or providentially, and if the seal has remained intact, then the finds of preserved features such as coffins may be taken to denote atypicality, instead of normality. Similarly, the existence of stone cists in some graves must be balanced against the possibility that apparently unencisted burials may have originally been provided with a wooden equivalent. Graves may also be damaged by later human activity, whether deliberate or accidental. Thus the re-use of a tomb for a secondary burial may either disturb the primary or destroy all trace of its existence, it may also be that large, rich graves may have been selectively plundered at some time for their contents, effectively removing them from consideration.

Problems of archaeological interpretation multiply when a chronological series of burials is considered. Two types of change have been identified that will manifest themselves archaeologically, either acting alone or in concert. The first is a change in symbolling behaviour, when socially agreed mechanisms of designating role or relative status are altered. The second is when the social structure itself is in a process of change (O'Shea 1984: 256).

In the first case, the social role signified by a particular feature of funerary ritual may remain the same, but the method of its signification might change. Thus, for instance, if it was considered apposite to include a weapon in a grave to signify , say, "comrade in arms", the types of weapon used through time might change dramatically although their action as symbols would remain constant. A more alarming scenario of change would envisage a shift of the formal location of role recognition, either spatially within the mortuary domain or ceremonially by alteration of rite. Thus, to extend the hypothetical example of the warrior burial, if, for instance, a volley of arrows over the grave during interment were to replace weapon inclusion as the appropriate signifier. Further problems arise in the case of valuable artifacts intended to signify high status. The perceived value of an artifact is often seen to be a function of distance from its source, in effect, a function of supply (Bradley 1988, Sahlins 1974: 277ff). Thus alterations in the absolute levels of artefact availability through time would lead to changes in the value state ot artifacts included in the grave and hence their utilisation as status symbols.

The second type of change likely to present is when the social structure itself is unstable, the social roles signified may not be constant and thus the symbolic significance of funerary inclusions and architecture would alter accordingly, despite their type and outward appearance remaining constant. (or worse, changing in a fashion outlined in the previous paragraph). This process of change is insiduous as a position of apparent stability over a long time period may represent social reality or alternatively be a mirage arising out of the numerous fluctuations in social structure and acting to obscure significant social change.

In an ethnoarchaeological study of change in the burial practices of two Plains Indians groups during a period of 60 to 70 years in the 19th century AD, O'Shea (1984: 256ff) demonstrated that although there was a certain amount of stability in the major social subdivisions afforded recognition, there was a change in the relative complexity of social structure and, for one group, a change in the meaning of certain critical symbols. O'Shea concluded, however, that the changing patterns of social relations were represented in the mortuary domain and suggested that, given sufficient chronological precision and methodological rigour, such shifts in social complexity would be open to archaeological monitoring. Other than O'Shea's study, there is little information as to how rapidly or erratically burial practices would have changed through time in pre-industrial societies. It is a pity that studies of mortuary stability have concentrated upon Victorian England (Pearson 1982, Cannon 1989), Iron Age Greece (Morris 1987, Cannon 1989) and 19th century AD native Americans (O'Shea 1984, Cannon 1989). All these societies were undergoing radical processes of change and it would be surprising if such changes were not reflected in their mortuary practices.

Ideology and Monumentality.

It is now clear, however, that classical anthropological theories of social role and social structure were formulated after the study of ritual, rather than everyday, behaviour. The use of role theory in archaeological explanation has therefore been criticised as being descriptive, deterministic and lacking in explanatory potential (Miller & Tilley 1984, Hodder 1982, Pearson 1982). The ritual version of social structure is viewed as being an ideological construct designed to protect an established social hierarchy.

The social fact of unequal access to a communities productive base has resulted in the development of justificatory belief systems, or ideologies. Ideologies act to present the interests of a dominant group as being coincident with those of society as a whole and may take one of two forms. The elite status of a dominant group can be represented as being the natural state of affairs, and to question it is tantamount to questioning the basic order of nature. This is seen in the concept of the god-king or, more recently, king by the grace of god. Alternatively, reality can be denied or mystified by a coherent system of beliefs which presents an alternative, untrue, explanation of the causes of inequality. Marxists might point to the ideology of equal opportunity in a free enterprise economy as denying the capitalist exploitation of labour. Pearson's (1982:101) discussion of Merina burial practices in present day Malagasy falls into this class, archaic categories of status derived from lineage membership are maintained in death although the true relations of power are now aligned along political and economic axes. Ideologies are not merely fabrications of misinformation or propaganda, they are accepted unquestioningly as the truth by their beneficiaries at least and possibly the whole of society. They act to maintain inequality and to oppose change.

It might be questionable as to what extent the full range of ideological strategies developed in industrial societies might be deployed in a prehistoric community. Larrain for instance has proposed:

> "In capitalist societies class differences are negated, and a world of freedom and equality reconstructed in consciousness; in pre-capitalist societies, class differences are rather justified in hierarchical conceptions of the world."
> (1979: 48, quoted in Pearson 1982: 100).

If this is correct then it should follow that the ideological strategy chosen by prehistoric societies would be that of naturalisation, they would seek to naturalise social inequality. It follows from this that the structure of society presented in ritual should be a realisation of that reproduced in everyday practice. Bloch (1977) has suggested that, from available ethnographic data, it appears that the amount of social structure present in ritual communication does indeed correlate with the amount of institutionalised hierarchy, an apparently independent confirmation of Binford's findings. There is a subtle difference to be discerned between the positions of Binford and Bloch, however, a difference given expression in the term "institutionalised hierarchy". A tension, or dialectic, may exist between the ritually expressed "official" structure of a society - that is, the institutionalised hierarchy - which is presented as being eternal and unchanging, and the shifting power relationships of everyday practice. When the dominant strata of an established hierarchy feel themselves to be under threat, ritual may be utilised to stress the legitimate nature of the privilege embodied in the hierarchy in an attempt to normalise the situation. Similarly, in the absence of an established hierarchy, ritual may be used by groups competing for power to provide a gloss of legality and tradition upon any newly won dominance. Post-Processual archaeologists have made much of this (see for example Hodder 1982: 200, Pearson 1982). They suggest that periods of extravagant display in ritual, including funerary, behaviour will be indicative of social instability or episodes of transition. On the other hand, during periods of stability continual affirmation of the natural order is superfluous and would not need overmuch ritual support.

Childe (1945), in fact, had already suggested that an analagous process might be seen at work if the archaeological record was looked at in the long term. Some of Childe's suggestions are ambiguous, however, and can in fact be used to show that, in some cases at least, the effort expended in mortuary ritual is related to the degree to which power is centralised in the hands of an elite.

In an early attempt to produce a "lawlike generalisation", Childe had suggested that, both in absolute and relative terms, the amount of wealth or energy expended on mortuary ritual diminished as a function of increasing levels of civilisation or societal stability. He elaborated by proposing that apparent local fluctuations in this general trend might occur as a result of external disruptions to a society resulting in social instability and radical reorganisation. Exceptionally rich tombs he envisaged as belonging to a single transitional stage of societal development, that of early state formation. There are certain problems of definition with Childe's approach, however, and it is not universally applicable. For instance, if he intended to imply that exceptionally rich royal burials were found at a time of social consolidation which was ultimately to give rise to the states and civilisations of classical antiquity, then they would indeed belong to an early, transitional, period. If, however, they are situated within their own particular social or cultural cycles, then it is wrong to suggest that they were either transitional in nature or a feature of social instability. This can be demonstrated with reference to the royal tombs of Old Kingdom Egypt and Mycenaean Greece; both groups discussed by Childe as examples.

For the first four hundred years or so after the establishment of a united Egyptian state around 3100 BC, both Pharoahs and nobles were buried in mastabas, so undifferentiated in terms of relative status that it remains a topic of debate as to just where exactly the first pharoahs were buried. With the accession of Djoser, just after 2700 BC, at the beginning of the third dynasty, however, and with the subsequent erection of the step pyramid, there is no longer any doubt - it was the beginning of a process of mortuary aggrandisement which culminated in the construction of the great pyramids of the fourth dynasty. This was the apogee of royal, centralised, power and the, still mastaba, burials of the nobles clustered around the large monuments of their god-kings. However, the fifth and sixth dynasties saw a gradual diminution in size of pyramids being matched by an increasing elaboration of the mastaba tombs of the nobles. Furthermore, by the sixth dynasty nobles could be buried in their home districts, well away from the pharoah as the centralised administration collapsed onto regionalism and finally to the anarchy of the First Intermediate Period beginning around 2200 BC. This is clear evidence that in the particular case of Old Kingdom Egypt impressive royal burial was concomitant with a powerful, centralised, regime; it did not indicate a society in transition nor was it a feature of social conflict (although it might have been a cause).

The initial centuries of the Mycenaean era, starting around 1600 BC, were marked by a rash of rich burials in tholoi, shaft graves and chamber tombs; but as in the case of Egypt, it is difficult to distinguish between royal and aristocratic burial. With the construction of such edifices as the "treasuries" of Atreus and Minyas during the 14th century BC it becomes easier to identify the probability of a royal tomb, the majority of the population by then receiving burial in a chamber tomb. It is true that these tholoi effectively ended the practice of constructing monumental tombs, but this was followed by the diversion of energy into the building of evermore sophisticated fortifications around the citadels of the 13th century BC which, together with a subsequent series of site destructions and the fragmentation of palatial culture during the 12th century BC, would hardly suggest that the last two hundred years of the Mycenaean era was a period of stability. Thus again the evidence suggests, if not so clearly as for Egypt, that imposing royal tombs would be built at a time of apparent stability, not the reverse.

On the face of it, then, these two examples would seem to discount any strategic use of ritual in the maintenance of social inequality or the legitimation of an institutionalised hierarchy. It appears that protohistoric societies were not sufficiently well versed in the subtleties of social theory to appreciate that it was better for the exercise of absolute power to be concealed behind an ideological veil than for it to be advertised blatantly. The occasion of burial was used to state fact, not to court public opinion. There is no reason to think that prehistoric societies would have been any different.

However, both examples discussed monumental architecture, and it might be argued that this is a form of display not readily suited to manipulation during times of social instability.The physical size of a tomb seems to be a more certain indicator of social control than does the relative wealth of individual burial assemblages. Buried artefacts are mobile and may have been acquired by way of trade or plunder, and not necessarily received as tribute from a subject population. The planning and erection of a monument, on the other hand, requires the participation of a sufficiently large labour force and the organisation necessary for its mobilisation. Centralisation of power is necessary. Large burial monuments - whether they be pyramids, tholoi or barrows - would be the prerogative of a firmly established elite, of an institutionalised hierarchy, with power sufficient to command the manpower necessary for their construction. Occasional large tombs within a series varying continuously in size might indicate transient accumulations of power in the hands of discrete individuals. A consistent, and noticeable, discontinuity in size within a series would suggest the presence of a fixed division within society. A rather general proposition might be advanced: that in societies which saw fit to honour their dead by the erection of funerary monuments the degree of political centralisation is inversely proportional to the number of monuments built, but directly proportional to their size. This is not to say, however, that an absence of monumental burial implies an absence of social ranking, positive conclusions cannot be drawn from negative evidence.

Mortuary Practices: Summary.

There are major theoretical and practical obstacles acting to impede the interpretation of funerary remains, particularly of the type excavated in the Yorkshire Wolds. They are chronologically imprecise, incompletely preserved and, by and large, indifferently excavated. It is clearly nonsensical to embark upon an elaborate multivariate or componential analysis of the available data set in the expectation of recovering a relict social structure. On the other hand, scholars such as Pader (1982: 201) are simply being unrealistic when calling for more information about the larger social context being derived from full and detailed cemetery excavations together with analysis of conjunctive settlement sites, patterns of land use and economic structures in a situation of carefully controlled chronological precision. It is tempting to add: "with eye witness accounts and a cinematographic record as well". Such a conclusion is an abdication of archaeological responsibility - the archaeology of a period exists as given, not as wished for. In the particular case of British Neolithic and early Bronze Age burials Bradley has summarised the situation well:

> ".... the opportunity for more detailed study has been missed and is unlikely to occur again. For this reason we must be content with a rather wide approach to the problem."
>
> (1984: 75)

The wide approach of Bradley seems preferable to the abdication of Pader. It is the task of the prehistorian to coax whatever information is available out of a body of material by careful study and evaluation. This can be achieved, despite numerous but not hopelessly insurmountable taphonomic difficulties by a clear assessment of the attainability of objectives, objectives which will usually fall far short of a complete reconstruction of prehistoric society.

What has all this got to do with prehistoric Yorkshire? A first, pessimistic, conclusion is that overly sophisticated interpretations of the surviving burials of Neolithic and Bronze Age Britain are likely to fail. Social attitudes to burial are complex and are perhaps rendered inaccessible by the vagaries of deposition and survival. On a more optimistic note, however, it seems that a straightforward interpretation of the burial monuments themselves may be possible. They should be viewed as statements of personal, or dynastic, power and not as architectural strategems of ideological concealment. During the following two parts of this chapter the second of these conclusions will be exploited. First it will be described how the provision of monumental - that is, barrow - burial seems to differ through time. Secondly, a very limited social interpretation of this description will be attempted.

## Death and Burial in Neolithic and Early Bronze Age Yorkshire.

The classic early Neolithic funerary ritual in the Yorkshire Wolds was that of burial under an earthen long barrow. At least 18 such barrows are known to have existed and they have been discussed in detail by Manby (1970) and Ashbee (1984). Although variations do occur, the ritual comparisons and structural features associated with these northern long barrows appear to have been remarkably consistent. The standard pre-mound configuration was of a mortuary house, or structure, situated within a long, east/west aligned, mortuary enclosure with a ritual area, usually marked by a concave wooden facade, at its eastern end. The funerary ceremonies included excarnation of some, but not all, the bodies interred and the destruction of their remains by the cremation of the mortuary structure was a frequent, but not universal, practice. It was not usual to include grave goods with the burials, although sherds of Grimston Ware are sometimes found associated. Most barrows contained less than a dozen individuals, the exception being Market Weighton with 26. The erection of a covering mound acted to terminate the funerary aspect of the site while simultaneously, perhaps, marking the onset of a new period of monumental significance.

Related to these long barrows by both ritual practice and material associations are a series of round barrows. These mounds are found to cover linear cremation features, perhaps the remains of mortuary structures, and they are sometimes associated with Grimston Ware. The round cairn at Whitegrounds contained a linear burial chamber within which were 8 inhumations in various states of articulation, a C14 date of 3970-3530 calBC derived from one of the bones confirmed its early Neolithic status (Brewster 1984).

By the end of the early Neolithic the construction of long barrows had ceased but round barrows continued to be built through into the late Neolithic. Nationally, Neolithic round barrow burials have been arranged into a six stage sequence on the basis of their artefactual associations (Kinnes 1979), although in Yorkshire it is useful to accommodate later Neolithic examples within two, approximately diachronic, groups.

The first group achieves coherence by virtue of the recurrent presence of Towthorpe Ware and large leaf-shaped arrowheads as material associations, the almost complete absence of cremation, and the apparently transitional nature of the burial rite from multiple to single inhumation. The mound at Callis Wold 275 (Coombs 1976, Mortimer 1905: 161) covered a linear paved area aligned

NW/SE and marked at each end by a post pit, possibly remaining from a mortuary structure. On the pavement were the bones of 10 adults and 1 child associated with 3 leaf arrowheads, there were also some burnt bones. The mortuary area was partially enclosed by a palisade trench which had originally supported a facade, there were sherds of Towthorpe ware in the fill. A similar structure was tentatively identified under the destroyed barrow at Boynton (Manby 1980a), while at Aldro 88 there were the possible remains of a mortuary structure aligned E/W and containing four inhumations, a Towthorpe bowl, and a leaf arrowhead. Other barrows are distinguished by the presence of collective inhumations upon clay or paved areas, these include Towthorpe 18, Aldro 94, Sherburn 7, Sherburn 8 and Wold Newton 284. There is also an increasing frequency of graves or cists, often holding the remains of more than one individual, under the mounds at Huggate 230, Painsthorpe 99, Towthorpe 18, Aldro 94 and Wold Newton 284. Hedon Howe, with its 5 rectangular stone lined cists is probably best accommodated within this group. Cowlam 57 contained two multiple deposits of skeletons together with some individual inhumations, one with an antler macehead. The arrowheads recovered from this series of burials are notable on account of their large size, they are not representative of stray arrowheads from the Wolds area generally and Green (1980: 85) considers them to have been prestige objects, probably manufactured specifically for funerary use. Mortimer (1905: 59,123) further observed that the arrowheads from Aldro 88 and Painsthorpe 99 were not of local flint, and that some were perhaps broken intentionally at the time of burial. The overall period of use for this barrow group remains to be determined, as does the presence of any internal phasing. The only C14 dates are from Callis Wold 275 and Boynton. They confirm the suggestion that they are early in any structural sequence - the dates cannot be distinguished from the long barrow sites. Kinnes (1979) would see some of these mounds as being multi-period in use, if not construction, and there seems little reason to contradict him. The largely destroyed Grindale barrow or enclosure developed through two phases separated by several centuries (Manby 1980a).

Inhumation under a round mound survived to become the most widespread funerary rite during the late Neolithic, although the number of burials recovered is low. At Whitegrounds, a circular shaft grave was sunk into the top of the pre-existing Neolithic cairn and the body of an adult male was inserted, together with a jet slider and a Seamer type flint axe (Brewster 1984). The original cairn was enlarged to a diameter of 20m with a turf mound and encircled with a sandstone kerb. A C14 date falling within the range 3510 - 2920 calBC suggests that this burial took place early in the late Neolithic sequence. Similar secondary inhumations with accompanying monumental alteration have been recorded at the Seamer Moor, Garton Slack 37 and Kemp Howe long barrows (Manby 1988). New barrows were apparently erected at Painsthorpe 118 over an adult inhumation associated with a jet slider; and at Aldro 175 over two central inhumations associated with flint flake knives, one of which was rectangular and exceedingly fine. At Garton Slack 112, three children were individually inhumed in hollows within a ring ditch, each associated with a bone skewer pin, before a mound was raised over a central unaccompanied double inhumation of adult and child.

A more distinctive group of late Neolithic barrows has been termed the "Great Barrows" (Manby 1988) of Duggleby Howe, Garton Slack 79, Prior Moor, Rudston 67, Willie Howe and Wold Newton 284. All except Garton Slack 79 are located within, or adjacent, to the Great Wold valley and are notable for their large size. However, while it is evident that these barrows could well have functioned as monuments throughout the late Neolithic, the manner or timing of their construction remains uncertain. Wold Newton 284 has previously been discussed as falling within the criterial ambit of the Towthorpe group of barrows, while little is known of the interiors of Prior Moor and Willie Howe, they achieve inclusion in this group by virtue of their size and position. Garton Slack 79 had been partly destroyed with the removal of about 5 or 6 skeletons by the time Mortimer (1905: 241) dug into it and found a further 8 inhumations, none of undoubted Neolithic date. There were a number of secondary insertions into the mound of Rudston 67 but the primary burial consisted of the body of a one year old child accompanied by the partial skeleton of a young woman in a woodlined cist, but without any material associations (Greenwell: 1877).

The southern and eastern sections of Duggleby Howe were excavated by Mortimer (1905), who discovered 13 inhumations (termed A to M) and 53 cremation deposits, the construction and utilisation of the Howe apparently spanned the later Neolithic. The mound itself consisted of an inner and an outer portion. The inner mound, 23m in diameter and 3.4m high was tripartite with concentric layers of chalk grit and clay overlaying an earth core. The outer mound was of heavy chalk rubble and measured about 38m in diameter. Three or four stages of burial deposition have been proposed (Kinnes 1979, Manby 1988), all contained within the inner mound. The earliest mortuary activity on the site consisted of the excavation of a shaft grave, 2.7m deep from the original ground surface, and the deposition of a single male inhumation (K), accompanied by a Towthorpe Bowl and a flint core with some flakes, all within a wooden cist or chamber. Two further inhumations were placed in the fill of the shaft, an adult male (I) and a child (H), both unaccompanied except for the presence of a disembodied skull (J) with the adult. The second stage of burial deposition involved the interrment of three adult males at the level of the old ground surface, two at the top of the shaft grave and one just east in a shallow grave. Each of these inhumations was furnished with grave goods. Burial (G) possessed a large flint adze, kite shaped flint arrowhead and an antler macehead; Burial (D) a finely polished rectangular flake knife comparable to the one at Aldro C75; inhumation (C) in the shallow grave had both transverse and oblique arrowheads, boars tusks blades, utilised beavers teeth and a large bone skewer pin. It is likely that the inner mound was erected after this series of burials as the next stage of burial deposition involved the inhuming of 6 infants, 1 adolescent and 1 adult (A,B,E,F,L,M,N,O) within the earthen core. The inner mound also contained a cremation cemetery with at least 53 deposits, three with skewer pin associations. It is likely that this cemetery extends further to the northern (unexcavated) part of the mound and possibly to the west as well. The outer mound was erected after the deposition of the cremation deposits, but it is not clear exactly when. The large number of cremation deposits indicate a significant time interval between the two mound building episodes. It is similarly not clear if the final series of inhumations constitute a stage of burial activity distinct from the cremations or if together they form a coherent series.

Finally, it remains to consider the Beaker and early Bronze Age practice of burial under a round mound. Over 500 such round barrows are known to have existed on the Wolds with many more having been destroyed. The main descriptive corpora remain the works of Mortimer (1905) and Greenwell (1877), augmented by a series of more recent excavations, particularly the large scale projects at Garton Slack (Brewster 1980), Wetwang Slack (Dent 1979,1983) and Heslerton (Powelsland 1986). Several synthetic studies of various aspects of burial ritual have also been published including Brewster(1973), Peterson (1969,1972) and Tuckwell (1975).

The treatment of corpse and method of interrment was variable. The modal form was of crouched inhumation, either lying on the old ground surface or in a grave. Graves might be shallow pit graves or deeper shaft graves, the grave beneath Rudston 62 reached down 10.5 ft beneath the old ground surface. Cremations are also attested, however, and burials might be multiple. Peterson (1972) noted that over 100 of the Wolds graves excavated by Mortimer and Greenwell contained two or more inhumation burials, in some cases apparently interred together but sometimes sequentially. Burials might also be inserted into a barrow mound. The mounds themselves could be of one or more constructional phases , three discrete structural episodes were identified at Tallington in Lincolnshire (Simpson 1976). The outer rim of a mound was sometimes marked by one or more post rings, a circular kerb of stones or a ditch. Such features were usually buried by subsequent mound collapse or barrow enlargement. Pit graves were often lined as wooden cists or else inhumation might take place within a monoxylous coffin or on a wooden platform (Peterson 1969). Stone cists are known from two barrows: Rudston 62 and Driffield 138. About 30% of burials were provided with an accompanying pot, usually a Beaker or a Food Vessel but sometimes a Collared Urn; less than 15% were marked out by the inclusion of jewellery manufactured from jet or of bronze weapons or tools. Often burials were unaccompanied, or attracted only a simple flint knife or some flint flakes. The frequency of provision of organic grave goods of course remains unknowable.

The archaeologically recoverable evidence of the Neolithic funerary rituals practised in the Yorkshire Wolds suggests a progression from multiple, unaccompanied, burial to single inhumation with grave goods. The transition occurred during the currency of Towthorpe Ware when single inhumations accompanied by Towthorpe Bowls and/or large leaf-shaped flint arrowheads might be found under round barrows in juxtaposition with collective, albeit fully articulated, inhumations. This change seems to have been consolidated during the later Neolithic with an increasingly fine range of goods being included in burials. However, it is evident from the small number of burials recovered that only a small part of the population received formal burial under a barrow at any stage of the Neolithic. The mode of disposal used for the majority of the population remains unclear. There is evidence, for the earlier Neolithic at any rate, that cremation might have been a more widespread practice than the limited number of crematorium barrows would suggest. The remains of funerary pyres are sometimes found under barrows, for instance Seamer Moor, while at Garton Slack 37 and Raisthorpe long barrows, deep crematorium pits were discovered. Kinnes (1979: 59) has suggested that such sites may have been relatively common, but not surviving unless fortuitously covered by a mound.

During the final Neolithic, there may have occurred a drastic change in burial practices - as witnessed by the large cremation cemetery at Duggleby Howe. It is not known how best to interpret the Duggleby Howe cremation cemetery or even what signifance it warrants. It seems most likely from its stratigraphy, and from other comparable examples, that the appearance of this cremation cemetery is a constituent event of a larger chronological horizon. The appearance of cremation cemeteries during the final Neolithic seems to have been a national phenomenon, and has been well described by Kinnes (1979). Associations are rare; other than the polished bone skewer pins seen at Duggleby Howe there are only the two polished ovoid maceheads recovered from Stonehenge and Dorchester II, which seem to indicate that these cemeteries are facets of the Grooved Ware culture, or complex. In Yorkshire, this appears to represent a complete inversion of the late Neolithic burial ritual, from the practice of individual inhumation with prestigious grave goods for a select portion of the population to what seems to be cremation, largely unaccompanied, for the entire community. It would of necessity disrupt any tradition of single inhumation.

On the other hand, it might be argued that the discovery of the few known cemeteries is fortuitous, that many more similar cemeteries have gone unrecognised because of the lack of grave goods and that, in fact, they would represent the missing majority of the late Neolithic population. If this is correct, and unaccompanied cremation burial was a rite of low status disposal, comtemporary with, and complementary to, a smaller number of higher status inhumations then the physical separation of these two alternatives, the preponderance of cremations and the absence of any associations with the cremations would again mark them off from early Bronze Age examples, where cremations were often furnished with grave goods and intimately mixed with inhumations, Rudston 52 for example (Greenwell 1977: 234).

In reality, there is little real continuity in burial practices. No matter how the Duggleby Howe cremation cemetery, and related examples, are interpreted; they indicate that the predominant, if not universal, mortuary ritual at the end of the Neolithic was unfurnished cremation. This was in marked contrast to the furnished inhumations of the succeeding early Bronze Age. It is true that, as argued by Burgess, many features of early Bronze Age ritual were already present during the later Neolithic. These include round barrows covering pits or cists and individual inhumations with provided grave goods - which included pots, tools and weapons. This formal similarity need not necessarily indicate that early Bronze Age practices were derived from a late Neolithic substrate, however. The same range of ritual features were to be found in the Standtvoetbeker and Bell Beaker culture graves of

Holland, the likely point of origin for any putative Beaker Folk.

## Population and Burial in Garton Slack during the Early Bronze Age.

Although there are some generic similarities to be seen between the round barrows of the Neolithic and the early Bronze Age, there is also a large numerical disparity. The known Neolithic barrows of the Towthorpe and later Neolithic groups number about 20, from a period of approximately 700 years. In contrast, there were over 500 early Bronze Age barrows built over a period of 1000 years. This might suggest that there was a massive population increase over the periods in question but it seems more likely that society in early Bronze Age Yorkshire was less politically centralised than it had been during the later Neolithic. This supposition is given some support by the fact that the late Neolithic barrows are, on average, larger than their early Bronze Age counterparts (Figure 4.1). This is in accordance with the proposition developed previously: that the degree of political centralisation in a society is inversely proportional to the number of burial monuments but directly proportional to their size. If the Neolithic barrows were the resting place of a privileged elite, however, it raises questions about the nature of the burials contained within the early Bronze Age barrows. Were they an elite, as surmised by Mortimer and Greenwell; or is, in fact, the entire population to be found buried under these mounds, with status marked out more subtly by means of grave type and artifact inclusion? To answer these questions it is necessary to arrive at an estimate of early Bronze Age population density.

Estimation of prehistoric population densities is a tricky business and, with one or two exceptions, is usually wisely avoided. Atkinson (1972) attempted to reconstruct

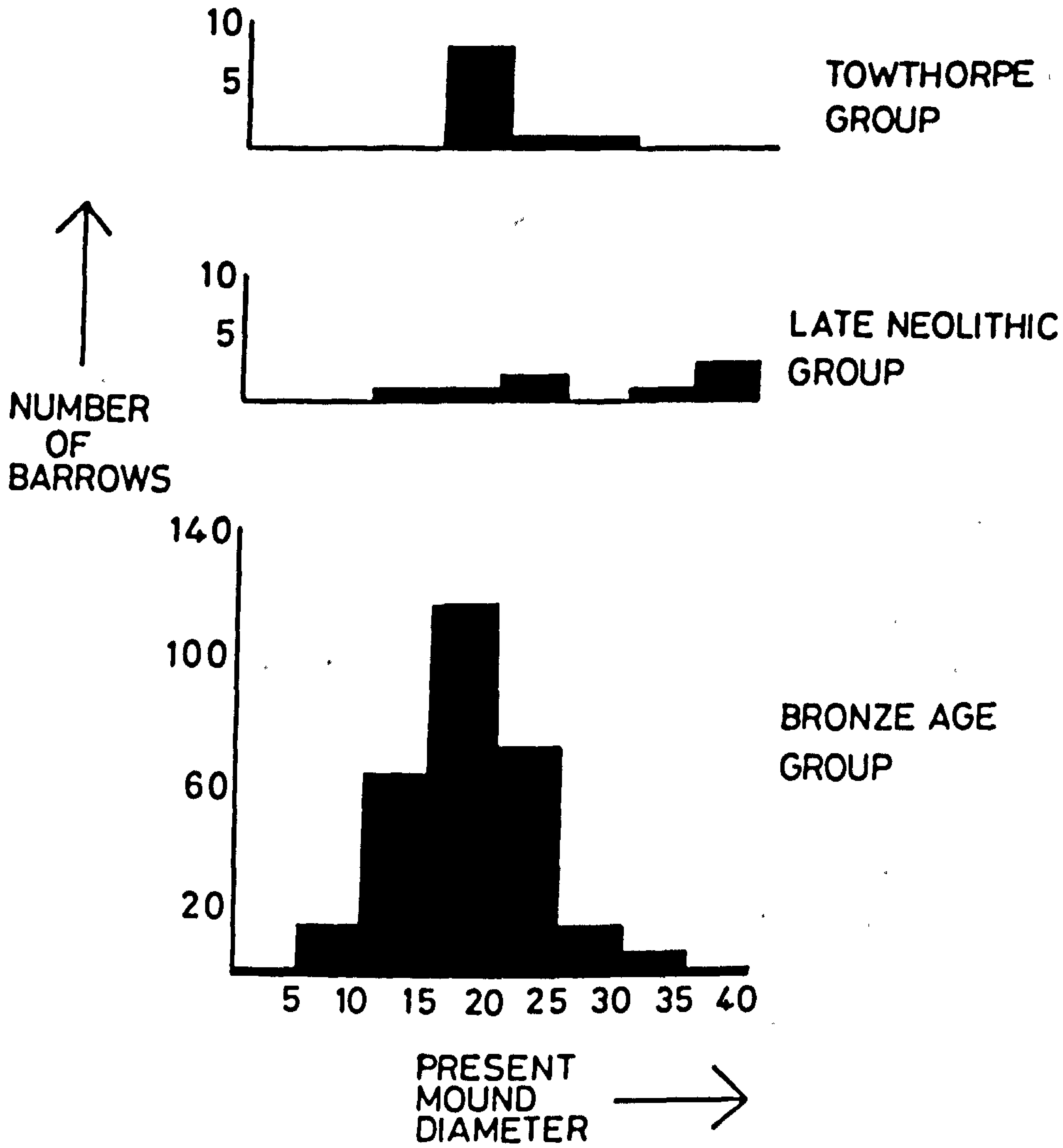



Figure 4.1. Round Barrow Mound Diameters.
(In metres).

the total early Bronze Age population of England and Wales south of a line drawn from the Mersey to the Tees. Using data from field survey and air photographs in conjunction with that derived from ordnance survey maps, he arrived at a rough approximation of the number of barrows known and assumed to represent original numbers. He then noted that 40 Wiltshire barrows excavated in the 15 years prior to his writing had contained an average of 3 burials each, a figure in close agreement with that derived from the Yorkshire excavations of Mortimer and Greenwell. Armed with this data, and assuming a static population, a generational span of 33 years and a period of barrow building that lasted for 900 years, he estimated that throughout the early Bronze Age the area under question would have been occupied by a population of 2000. Although recognising that this was a low estimate, he felt it was possible that these burials did not constitute an aristocracy, but represented the total population - just about. In contrast to Atkinsons approach, Green (1974) restricted his study to the Ouse Valley and attempted to show that, in fact, only a small proportion of the total population received barrow burial. Making allowance for probable barrow destruction, he retained Atkinsons figure of 3 burials per barrow while suggesting a generation span of 30 years and a barrow building period of 1150 years, before concluding that the barrows represented a population in the Ouse Valley of 79 persons at any one time. However, Green then went on to suggest that the actual population density of the valley would have been in the order of 10 persons per sq. km., giving a total population of about 3500, and thus indicating that only one out of 44 individuals received barrow burial, probably as a mark of high status.

The conclusions of Atkinson and Green are contradictory, although that of Green is more persuasive as the resriction of his study to a single area allowed a more intensive analysis of the available burial data. It is proposed here to test Green's conclusion by a similarly intensive analysis of the early Bronze Age burials of Garton Slack, in the Yorkshire Wolds. Archaeologically, this is a particularly well explored area.

During the excavation campaigns carried out in Garton and Wetwang Slacks by Brewster (1981), and more recently Dent (1979, 1983), large areas of a valley bottom were stripped prior to gravel quarrying and a number of early Bronze age barrows were exposed. The burials recovered from these barrows can be combined with those excavated by Mortimer during the last century to approach a minimal estimate of the number of people likely to have been eligible for barrow burial in this area. Even in this relatively well investigated area however the number of barrows excavated remains an unknowable fraction of that originally extant. Succeeding episodes of arable agriculture have contributed to the destruction or loss of barrows, either directly by ploughing, or indirectly by causing their burial under colluvium as the higher slopes of the surrounding wolds lost their protective tree cover when they were brought into cultivation. This process of Barrow destruction may well have begun in Garton Slack as early as the Romano-British period (Manby 1980b: 64), although the relatively good survival of barrows in this area, when compared to the Great Wolds Valley, for instance, may be attributed to the poor, sandy nature of the soil (Manby 1980b: 65).

It is a difficult task to estimate what percentage of the original barrow concentration remains and what percentage has been excavated. In the areas around Wetwang and to the south, Mortimer (1905: 193) recorded the presence of a number of fields which incorporated the descriptive element "hill" into their name. Thus, already by the end of the 19th century AD, he concluded that numerous barrows had probably disappeared. Aerial photographs reveal the presence of 15 unexcavated ring ditches in the area but this is likely to represent a minimum as many round barrows have been shown to have been constructed from turf with no surrounding quarry ditch (Dent 1983). It was, furthermore, difficult to obtain photographs in some areas due to the depth of hillwash (Brewster 1981: 8). Thus the surviving barrows represent only a portion of what may have existed originally, and if the extent to which barrows were discovered during the gravel stripping of Garton and Wetwang Slacks is indicative of possible concentrations in other areas, this surviving portion might not even be a major one. Still, it is possible to derive a minimum figure for the living population who were ultimately buried in these barrows and to discuss its significance - whether it is too large to represent an aristocracy, a discrete layer in society eligible for elite status burial or whether it is, in fact, commensurate with such an idea.

There have been 51 early Bronze Age barrows or graves excavated in the area under consideration, 18 by Brewster and Dent, 33 by Mortimer. The total number of burials recovered, both inhumations and cremations, is given in Table 4.1, the unspecified class referring to burials of unknown age. By comparison with more recent excavations in the wider Wolds area (Table 4.2), it can be seen that adult burials normally constitute about 70% of the total buried population, a figure much in agreement with that derived from the Garton Slack total if the unspecified class is left out. Thus it is reasonable to suggest that the number of adult burials recovered would amount to some 137. The figure 137 is a gross underestimate of the burial population however, for the following reasons:

1) The preservation of skeletal material is variable. Although a layer of clay in the mound often protects

Table 4.1.

Age Distribution of Burials Excavated by Mortimer.

| | Total Number | Percentage |
|---|---|---|
| Adult | 118 | 60.5 |
| Adolescent | 15 | 7.7 |
| Child | 34 | 17.4 |
| Unspecified | 28 | 14.4 |
| Total | 195 | |

Table 4.2.

Age Distribution of Recently Excavated Burials.

| | Total Number | | |
|---|---|---|---|
| | Adult | Adol. | Child |
| Wetwang Slack (Dent 1979,1983) | 10 | 0 | 6 |
| Staxton (Stead 1959) | 9 | 0 | 3 |
| Heslerton (Powelsland 1986) | 14 | 2 | 8 |
| Cowlam Wold (Watts & Rahtz 1984) | 24 | 3 | 6 |
| Total | 57 | 5 | 23 |
| Percentage | 67 | 6 | 27 |

burials, it is not unusual to find an unaccompanied pot under a barrow which, it is assumed, was originally placed with a now decayed burial (Mortimer 1905: xxxix). Realistically it is not possible to attempt a correction of the raw burial data for differential decay. Most burials were not accompanied by pottery and if decayed would have left little trace under a barrow for 19th century diggers to notice, however astute they may have been.

2) It seems to have been the case that graves under barrows were often recut or reused for secondary burial with the initial inhumation being scattered. Time and again graves are recorded that, in addition to a complete burial, contain broken and incomplete skeletons and fragmented pots, the evidence of earlier interments (Mortimer 1905: xxiv). Some attempt has been made to correct for secondary re-use by, wherever possible, accepting the total number of individuals represented in a barrow, if only by odd bones, as representing the true number of burials.

3) In most cases in this area, the barrows had been largely flattened by agricultural activities, their mounds having been dispersed before excavation. However, from a study of all barrows dug by Mortimer and Greenwell, it can be seen, not surprisingly, that the number of burials found in barrow mounds is correlated with surviving mound height, the higher the surviving mound, the greater the number of burials it will contain (Table 4.3). Most of the barrows in the Garton Slack area have mounds surviving to a height of less than 0.3m, to compensate for mound destruction, therefore, a notional figure of 1 adult per barrow was added to the burial figures.

4) The efficiency of the excavation methods of early

Table 4.3.

Number of Bodies Surviving in Mounds of Round Barrows when Excacavated.

(All Mortimer and Greenwell Barrows with surviving primary burials included. If primary burials had decayed by time of excavation then secondary, mound, burials would probably have done so also).

| Surviving Mound Height (When Excavated) | No. of Barrows | Mean no. of Bodies/Mound |
|---|---|---|
| 0 - 0.3m | 65 | 0.1 |
| 0.31 - 0.6m | 103 | 0.5 |
| 0.61 - 0.9m | 50 | 0.9 |
| 0.91 - 1.2m | 32 | 2.0 |
| 1.21 - 1.5m | 24 | 1.2 |
| >1.5m | 28 | 2.2 |

Table 4.4.

Extra Burials Recovered upon Re-excavation of Mortimer and Greenwell Barrows.

| | Initial Burials | Extra Burials |
|---|---|---|
| Mortimer Barrows: | | |
| Barrow Nook (Watts & Rahtz 1984) | 3 | 7 |
| Callis Wold 275 (Coombs 1976) | 15 | 2 |
| Garton Slack 37 (Brewster 1981) | 16 | 1 (?2) |
| Greenwell Barrows: | | |
| Cowlam 55 (Watts & Rahtz 1984) | 3 | 0 |
| Cowlam 56 (Watts & Rahtz 1984) | 5 | 6 |
| Rudston 42 (Pacitto 1972) | 16 | 3 (?4) |
| Octon Wold (Brewster 1966) | 0 | 8 |
| Etton 79 (Brewster 1970) | 2 | 0 |
| Etton 241 (Brewster 1970) | 4 | 0 |
| Etton 242 (Brewster 1970) | 7 | 0 |
| Etton 238 (Brewster 1970) | 2 | 1 |
| Total | 73 | 27(?29) |

Percentage of Burials Missed in Original Excavation:

Mortimer Barrows Only - 28%
All Barrows - 38%

diggers has often been called into question, re -excavated barrows have, on average, shown that 28% of burials were missed (Table 4.4). It seems that this might be excacerbated by a chronic underestimation of the number of individuals contained within cremation deposits.

Thus, it is now possible to work out a corrected, although still a very much minimal, figure for the buried adult population in the Garton Slack area. If the initial figure of 137 adult burials is increased to 174 in order to correct for incomplete excavation of the Mortimer barrows, and a further 34 added to take into account barrows with a surviving mound height of less than 0.3m, a total adult population of 208 is arrived at, or on average 4.1 per barrow. Now, it appears from aerial photographs that there are at least a further 16, unexcavated, barrows in the area so a further 66 adults can be added bringing the grand total for the area to 274. If a stable population with a 33 year generational span is assumed to have been using the barrow group for burials over a period of 1000 years the population at any one time would have been:

$$274 * 33 / 1000 = 9 \text{ adults.}$$

Thus, at any one time, a community of nine adults, perhaps three or four households, would have been disposing of their dead under burial mounds.

However, the assumption of a steady state population may be questioned. Hassan (1981: 125ff) has estimated from ethnographic sources that the maximum growth rate of a prehistoric population might have been in the order of 0.5% a year, with a doubling time of 133 years. Thus, over a period of 1000 years, there is the potential for a community to have doubled in size 7 times over. Such a rate of increase is not possible within the numerical confines of the Garton Slack data, however. The maximum possible rate would envisage an initial adult population of 2 doubling every 250 years to reach a final population of 32 individuals. A uniform rate of increase is unrealistic but the calculation serves to provide a maximum and a minimum outside of which it would be unlikely for the size of the population to vary, but within which it might fluctuate. In prehistoric Yorkshire, such population fluctuations would not necessarily be the major events that historical demography might suggest; in the absence of urban centres and of a developed communication system, epidemic disease would not have caused the major drop in population seen in Medieval times. A succession of poor harvests would, however, have increased the incidence of mortality amongst the more vulnerable members of society, the young and the old, as malnutrition increased their susceptibility to disease. This process of periodic increase in the mortality rate would have been chronically recurrent and would have acted as a brake upon population growth, perhaps even have reversed it upon occasion. More severe demographic oscillations may have been of human making however; either violent depredations of a similar, if more limited, type to that recorded in the Domesday book or more peaceful episodes of immigration or emigration. In view of the probability that the prehistoric population of the Wolds would not have been stable, then it might be considered permissible to suggest that the barrow burials may have been derived from a population in the valley that varied through time, perhaps from somewhere between 4 to 16 adults at any one time.

If it was difficult to establish a possible figure for the minimal number of adults buried in the round barrows of Garton Slack the difficulties are magnified when it comes to considering the size of the area served by the barrow group and the density of the population it might have supported. An approximation of area can be arrived at by

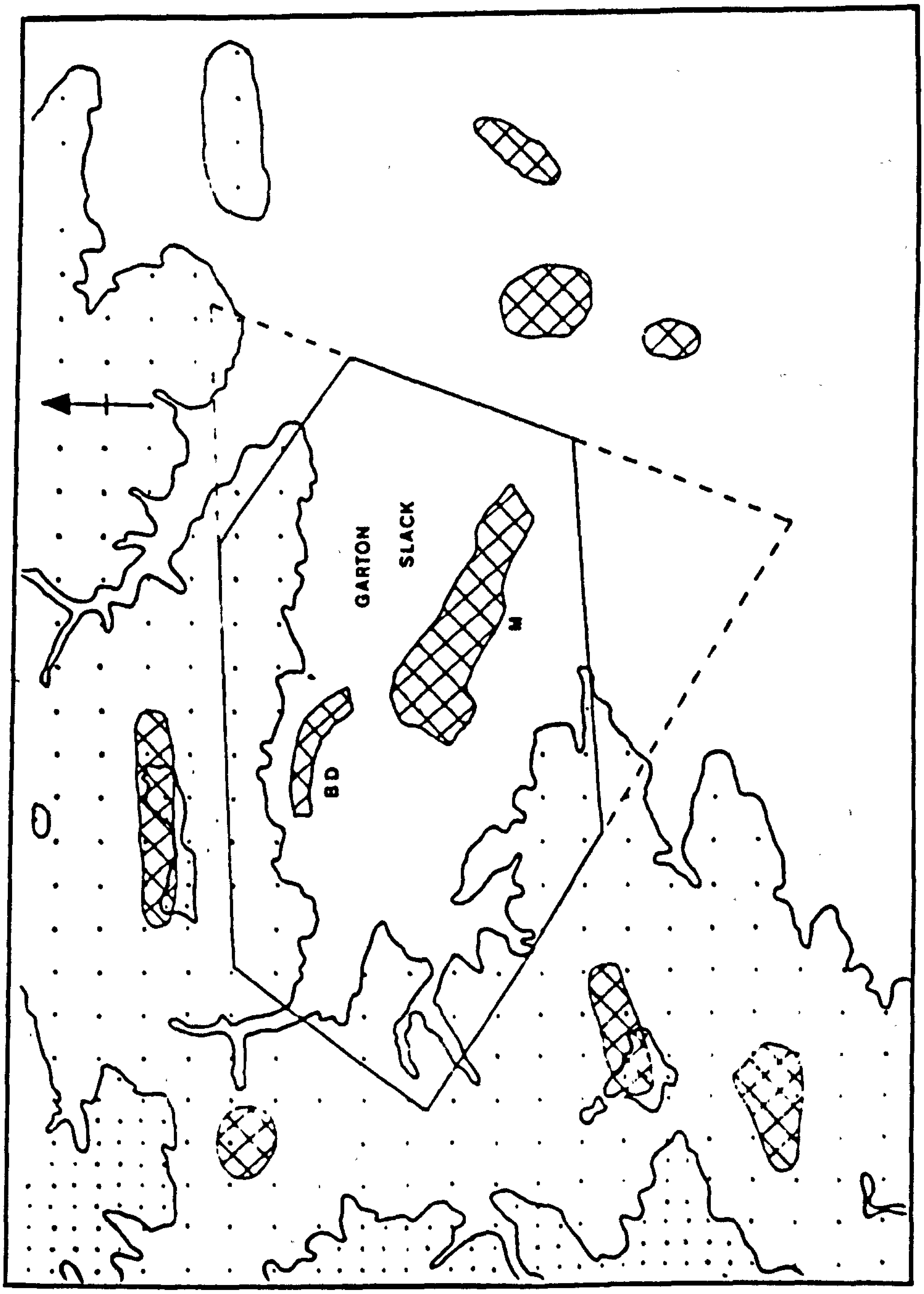



Figure 4.2. Garton Slack Area.

Cross-hatched areas - barrow concentrations.

BD - excavated by Brewster and Dent.
M - excavated by Mortimer.

constructing a Thiessen polygon around the group, its borders demarcated by equidistance from other concentrations of barrows (Figure 4.2). This catchment area, calculated to cover 59.4 sq. km., seems reasonable as it covers the valley and from a subsistence point of view would seem to present an integrated unit. (This is not to suggest in any way that it may have functioned as a political entity). Estimating the carrying capacity of the area remains problematical, however. Although data from Yorkshire were recorded in the Domesday Book the Wolds and suffered particularly badly from the ravages of Scots, Danes and Normans; large areas had been laid waste (Maxwell 1962: 212). Nevertheless, according to Domesday the population density was less than 2.5 adult men per sq. mile (Maxwell 1962: 196). If this figure of 2.5 is doubled to compensate for wastage, and doubled again to take into account women then a figure of 10 adults per sq. mile is arrived at, or 3.7 persons per sq. km.. This might not be an unreasonable figure as the Hearth Tax returns of 1672 recorded a population density of 6 persons per sq. km. (Neave & Neave 1990: 380).

This figure of 3.7 is in accordance with estimates of Neolithic or Bronze Age populations derived from the potential carrying capacity of the land which, given the agricultural techniques and technology available, have been reasonably consistent in suggesting a population density of between 5 to 10 people per sq. km., which might translate to 2.5 to 5 adults per sq. km. (Renfrew 1973; Green 1974: 132; Hawke-Smith 1980: 66). Optimising models of carrying capacity have been criticised, however, in that ethnographic studies often show a population much lower than a supposed maximum. In fact, the maximum limit of population density is usually constrained by the level of availability of the least abundant critical resource at the worst time of the year (Jarman, Bailey & Jarman 1982: 7; Hassan 1981: 166). In the Garton Slack area it is likely that a shortage of readily available surface water would have constituted a major deterrent to prehistoric settlement. At the beginning of the 14th century AD, dew ponds were being built at Wetwang while during the early 18th century AD, the village was dependant for its water supply upon wells and a pond, which was often dry in the summer months (Pierpoint 1980: 14; Harris 1961: 34). If it is assumed, therefore, that wells and dewponds were not utilised by the Neolithic/early Bronze Age inhabitants of the slack, it is likely that the actual population would have been considerably lower than its potential maximum, and lower than levels reached in Anglo-Saxon and Medieval periods when wells were used. Burgess (1980: 172) has suggested that the level of population around 2000 calBC might have been between a quarter to a half of Domesday figures and this seems a reasonable premise. Thus in Garton Slack, the putative figure of 4 adults per sq. km. might be adjusted downwards to 2, or even 1, adults per sq. km. giving a potential population for the catchment area of between 59 to 118. It might also be objected that the limits of the catchment area itself are unrealistic, that they may be justifiably be altered to conform more closely with the actual topography (Figure 4.2). This would have the effect of reducing the total area from 59.4 sq. km. to 46 sq. km. and produce a population figure of between 46 to 92, as opposed to the buried population figure previously calculated to fall between 4 to 16.

It is now possible therefore to attempt a new calculation for the likely percentage of the total early Bronze Age population represented by barrow burials. At time of maximum population would be between:

$$16 / 46 * 100 = 35\%$$
$$16 / 92 * 100 = 17.4\%$$

If between 17-35% of the population were receiving barrow burial then it is a figure much in excess of Green's estimated 1 in 44, or 2.3%. It is still a minor component of the estimated population, however, but it must be remembered that the number of burials estimated is very much a minimum. No account was taken of skeletal decay, and it remains unknown what percentage of barrows have been excavated.

If only part of the population was receiving barrow burial, the remainder remains archaeologically invisible. It might be expected, for instance, that simple flat graves may have been utilised, but there is little evidence for this. During the large scale Garton Slack excavations of Brewster, when large areas of ground were stripped, some possible flat graves were found but their excavator felt that they had originally been covered by mounds of which, in two cases, there was stain evidence remaining (Brewster 1981: 18). In any case, the flat graves often contained rich burial offerings, Garton Slack 6, for instance, where a female inhumation was accompanied by a large number of jet and bronze beads.

A study of numbers alone then is equivocal - if over 20% of the population were receiving barrow burial then it seems to be too large a percentage to represent an aristocracy. Unfortunately, due to the vagaries of survival, it is not possible to estimate what is the exact percentage of the population interred under barrows; or, indeed, if they all were. More information may be obtained from a study of the nature of the barrows, and of the burials, themselves.

Many barrow mounds cover, and are assumed to be contemporary with, a single grave. These burials are sometimes obviously aristocratic in nature with the splendour of the grave furniture being matched by the size of the covering mound. The well known stone encisted Beaker burial of Driffield 138 (Mortimer 1905: 274) was under a mound presently 37m in diameter; less celebrated but equally impressive was the Wessex style burial of Towthorpe 139 (Mortimer 1905: 5) where an extended inhumation with a bronze (Armorico-British A) dagger, stone perforated macehead and a plano-convex knife of black flint was laid to rest under a barrow now 40m in diameter. These are two of the largest surviving early Bronze Age mounds and are comparable in size to late Neolithic examples. However, many smaller mounds may have been erected over what were in effect small cemeteries. Petersen (1972: 39) has emphasised that it is inaccurate to conceive of burial sequences as simply representing one primary, implying most important, burial with satellite or subsequent secondary burials. It is true that most mounds centre over a particular burial but it is not invariable, at Heslerton 1L the mound was built to cover 5 burials arranged in an arc around a centre point (Powelsland 1986: 126). At Wetwang Slack B (Dent 1979), it is envisaged that the final mound was erected over five graves, at Cowlam Wold 1 one grave and at least one, perhaps three, cremation pits were dug before mound construction. Mortimer (1905) took pains to emphasise that at Garrowby Wold 101 and Painsthorpe 98, in both cases three graves , each containing a single inhumation, had been in existence before the raising of the mound. It is, in any case, often not possible to say whether it was the relative position or the importance of a grave that predetermined its choice as centre marker. It is probable that some graves remained uncovered for a prolonged period of time as there is ample evidence for the re-use of existing graves with intact burials in the fill (Peterson 1972: 28). At Heslerton, it was suggested that flat cemeteries may have remained uncovered for hundreds of years. Whether flat cemeteries have survived uncovered is uncertain. As noted previously, there was little evidence of this in Garton Slack. The 11 inhumations uncovered at Staxton (Stead: 1959) are generally regarded as belonging to a flat cemetery although the area had been ploughed and the archaeological evidence was equivocal, identification as such was by comparison with southern examples. It should be noted however that four of the burials were recovered from a complex of two intersecting grave pits, a feature not unusual under a round barrow.

It seems inaccurate, then, to conceive of the Yorkshire barrows as constituting a single class of monuments - as being the resting places of an early Bronze Age aristocracy. Some barrows do indeed seem to cover the bodies of high status individuals, but many do not. They seen instead to have been small cemeteries, perhaps family plots. If this is accepted, and when it is remembered that it is the smaller barrows which will have been less likely to have survived the rigours of post-constructional agricultural land use, and that the calculated percentage of the population receiving barrow burial was very much a minimum, then there seem reasonable grounds to argue that, in fact, the major part of the early Bronze Age population of the Yorkshire Wolds, or at least Garton Slack, was honoured with barrow burial; either in small, unassuming, family barrows or else, upon occasion, under a more imposing and monumental form. This, in turn, suggests that early Bronze Age society was less rigidly hierarchical than that of the preceding late Neolithic.

Conclusion.

In this chapter it has been demonstrated that a ritual discontinuity can be seen to exist between the single inhumation burials of the late Neolithic and their early Bronze Age counterparts. They are separated by the Grooved Ware related cemeteries of unfurnished cremations, a national phenomenon exemplified in the area under study by Duggleby Howe. It has further been argued that the respective political organisations of the societies under study may have differed appreciably. The small number of large late Neolithic barrows point to a society with a marked vertical status differentiation which found expression within the mortuary domain. In contrast, the succeeding early Bronze Age society appears to have been less politically centralised, with less hierarchical differentiation. There was still an element of vertical ranking, and it remains to be apprehended in the mortuary domain, but, to all appearances social relations were distinguished by a greater degree of equality, or competition. The interpretation of the final Neolithic cremation horizon is at present uncertain, and its significance not known. There is little evidence of continuity between Neolithic and Bronze age funerary ritual and it is mistaken for Burgess to claim that the appearance of the continental, Beaker, burial tradition affected indigeneous rituals "... only superficially".

## Chapter Five.

# THE BEAKER FOLK.

### Introduction.

The theoretical basis of the Beaker diffusion hypothesis - that Beaker ceramics were desirable on account of their intrinsic value - has been refuted. Furthermore, empirically, the archaeological data do not support the case for cultural continuity through the Neolithic-Bronze Age transition. The suggested schemes of ceramic emulation, to explain the existence of Beaker settlements, and of continuous stylistic evolution of late Neolithic/Beaker pottery, to explain the ceramic diversity of the early Bronze Age, are incompatible. In eastern Yorkshire there appears to be a disjunction in burial ritual. In this chapter, therefore, the value of a migration model for explaining Beaker culture spread will be reassessed, and the possibilities of the economic model of ethnicity, described in Chapter Two, for explaining the cultural consequences ethnic intermixing will be considered.

### Migrations.

The desirability of identifying archaeological indicators of prehistoric migrations was emphasised in Chapter Two, and the relative paucity of such identifications noted. Over the last two decades the consequences of random, short-distance, population movements following on from settlement fission have been considered, and the "wave of advance" model has been constructed to explain the initial spread of agricultural communities through Europe. However, the phenomenon of long-distance migration - a phenomenon of intentional, goal-directed behaviour - has been largely overlooked. Nevertheless, long distance migrations have been well described in both contemporary and historic societies, and their character, or structure, is well understood. There seems no reason to doubt that similar migrations would have occurred in prehistory (Anthony 1990: 898).

A generalised model of long-distance migration has been developed within the demography literature (Lee 1966). Structurally, it consists of three components: an area of origin, an area of destination and a variable set of intervening obstacles. The area of origin is the initial place of residence of a potential migrant or migratory group. A number of factors are operative at this location in both encouraging and discouraging migration, those which favour migration are termed "push" factors. Similarly a potential area of destination can be described by reference to a corresponding set of factors, those favouring immigration and settlement being termed "pull" factors. Separating the two areas it is envisaged that there is a set of obstacles that will act to discourage migration to a greater or lesser extent.

In industrial, and industrialising, societies with a well developed communications network information about the desirability and accessability of potential migratory destinations is readily available. "Pull" factors are considered to play the major role in any decision making process that may take place prior to migration. It is unlikely that this would have been the case in prehistoric societies however. Knowledge of the opportunities available for settlement at distant locations would have been limited and the nature or severity of any intervening obstacles ill-defined; "push" factors present in the home environment would have been of most significance for prehistoric groups. The nature of ethnographically described "push" factors varies and they are not altogether rational - it is the potential migrants perception of the balance existing between the hazards and advantages of relocation which is realised during the decision making process, not necessarilly an objective reality. Factors which influence the decision may be acute or chronic, social or personal, economic or ideological. The classic causes of migration are war and famine and need no further elaboration here. Less spectacular events may also be important in triggering migrations, however, and perhaps more frequent in occurrence. Quarrels within or between kin groups, perhaps expressed as witchcraft accusations or outright violence, can result in the ejection or departure of segments of population; as can struggles over the succession to political power (Kopytoff 1987: 18ff). More chronic causes of emigration include socially agreed modes of inheritance that stress primogeniture and which encourage a constant outward movement of "younger sons" to acquire land and status of their own, which might find expression as kin-linked aristocracies spreading out and imposing themselves upon, or being accepted by, subject populations. Conversely, people might wish to escape overly repressive political regimes. (Mabogunje1970:5ff; Wolf 1982: 98). Of course, migrations need not be monocausal. Anthony (1990: 898) has recently drawn attention to the Helvetic migration of 58BC described by Julius Caesar, and which was apparently motivated by both ideological and economic "push" factors. Their territory was not large enough to adequately support their population and it was too remote for them to effectively engage in combat with their neighbours, combat which was considered necessary to enhance their martial reputation.

When, for whatever reasons, the "push" factors at an area of settlement begin to predominate there begins an attempt to explore surrounding, and more distant, regions for possible new areas of settlement. The nature, or severity, of intervening obstacles are evaluated. As is the case with "push" factors, the nature of intervening obstacles is not absolute, but is a subjective assessment. The sea may present an impassable barrier to one society while being considered an open highway by another. Obstacles also need not be physical. A strong, centralised, polity is able to offer more resistance to an unwanted stream of migrants passing through its territory than are less organised, acephalous, social groupings. Much of this exploration, or information gathering, might be secondary to other activies. Thus normal itinerant activities such as raiding or trading will intensify prior to the onset of a migration. Migrants do not usually move into unpopulated areas; favourable destinations identified ethnographically in Africa are those of low to moderate population density which offer the physical, and perhaps more importantly, the political space for an immigrant group to establish itself and expand (Kopytoff 1987: 32).

Thus, the choice of destination area is constrained by three factors:

- Availability of information about accessibility and suitability of potential destinations.
- Accessibility of potential destinations.
- Suitability of accessible destinations.

These factors act to prevent any "wave of advance" type migration, with population slowly spreading through all land available behind an expanding frontier. Instead, destinations are discrete areas and are often physically separated by a set of natural or human obstacles. Selective and directional migrations between such discrete areas are not likely to be expressed as a single event but instead will constitute a dynamic process through space and time as migrants continually reassess their opportunities. This process of long-distance, goal oriented migration between discrete locations has been termed "leapfrogging". The directional or channeled movement of migrants between such locations is termed a migratory stream.

There are several important consequences of migratory streams (Lee 1966). The magnitude of migrant flow in such a stream will depend upon the relative desirabilities of the home and destination areas and also upon the ease of passage. Streams might be small or alternatively run to completion with apparent abandonment of the area of origin. Another feature of a migration stream that is not running to completion is that there is a tendency for a counterstream of returning migrants to develop. This might be because a more direct aquaintance with an area of destination causes a reevaluation of the relative desirability of the home location, or perhaps because of amelioration of some of the "push" factors initially operating in the area of origin. In any event, not all migrants intend permanent resettlement - some merely want to "make good" before returning home. A counterstream will carry back with it new ideas and perhaps novel innovations acquired from societies and enviroments outside the immediate area of contact of the home community. Migratory streams and counterstreams thus have the potential to act as vectors for the diffusion of information.

Upon arrival at a destination the immediate strategy of an immigrant group is to consolidate its position and to guarantee its security, either by increasing in numbers or by achieving political dominance over their indigen ous neighbours. Relations with the home community may be exploited in an attempt to persuade more people, usually kin, to migrate by stressing the (real or imagined) advantages of the new residential location. This strategy would help to prolong the flow of a migration stream. Alternatively, or additionally, the indigenes can be incorporated into immigrant society by constructing fictitious genealogies and creating blood links through intermarriage. Political dominance might be achieved by the straightforward application of military force but more often by negotiation or manipulation. It might even be that the political system introduced by the immigrants is perceived to be superior by the native inhabitants of an area who therefore acquiesce in its extension (Kopytoff 1987: 40ff). On the other hand, of course, immigrant enclaves might be tolerated or absorbed by a host society.

The demographic consequences of even a moderate flow of migrants might be severe. Repeated studies have demonstrated that young adults show the greatest propensity to migrate (Lewis 1982: 83), with the result that over a prolonged period of time the effects of a physical transfer of population are compounded by the differential fertility of the home and emigrant groups. The decrease in numbers of the home population as a result of emigration will be associated with a further chronic decline as the birth falls below the death rate and thus population losses through natural causes are not replaced, the population will decline even further. In contrast the birth rate of an immigrant community will far outstrip its death rate so that there will be a sharp population increase manifest over the initial generations. The expansion of an immigrant community might be further excacerbated by an absolute increase in the marital fertility of the first one or two generations before the increasing population triggers off social mechanisms of birth control (Easterlin 1976).

If the Beaker phenomenon were to be recast in such a modified migratory mould how would it appear?

It has been suggested that the beginning of a migration will be marked by a flurry of "scouting", an intensification of contact activities during which information anbout possible routes and destinations might be collected. This is precisely the pattern of activity noticed during the earliest Beaker phase in Britain by both Case (1977: 74) and Lewthwaite (1987: 48). While Case was content in suggesting that the early scatter of AOC finds, and their coastal locations, were probably the residue of trade, Lewthwaite was more specific in suggesting that it represented a "familiarisation phase", during which time the potential of Britain for settlement was evaluated and the techniques and technologies of maritime travel perfected.

A prolonged period of Beaker migration, taking place by processes of streaming and leapfrogging as outlined earlier, would be expected to give rise to the discontinuous and nodal pattern of Beaker settlement familiar from many a distribution map. The initial expansion during the currency of AOC and early decorated forms would have been a dynamic period of population movement and countermovement but with an overall expansionary trend. Innovations would be taken up in frontier areas and rapidly disseminated throughout the expanding network of migratory groups. This would account for the apparent diffusion westwards of the eastern elements of the Beaker assemblage at a time postdating the initial ceramic spread. It would also suggest that the possible origins of the maritime Beakers should be reconsidered. Although it is evident that AOC Beakers developed within the Corded Ware matrix of north western Europe, it is by no means clear that this area was the focus of a complete unilinear sequence of typological development. There are in fact few maritime Beakers known from this area and they have not been found in association with AOC types (van der Waals 1984 :5). The technique of comb impressing which allowed the evolution of complex design structures may have been adopted anywhere in the area of initial AOC spread, perhaps southern France, and might have allowed the ceramic expression of a pattern repertoire in prior use on less permanent media.

The greater fecundity of immigrants suggests that over a century or two their numbers, and thus settlement density, should increase at a greater rate than that of the indigeneous inhabitants. Again this expectation is met in Britain where Whittle (1981: 314) has argued that apparently "pure" Beaker settlements, that is settlements with both Beaker fineware and identifiable Beaker coarseware, seem to be a relatively late phenomenon, becoming common only after 2150 cal BC.

At the supra-regional level, then, several features of the Beaker culture may be explained by a model of long-distance migration. It would be encouraging if more support for this model was forthcoming at the regional, or intra-regional, level. Two aspects in particular suggest themselves: the tendency of migrants to establish themselves in political interstices and the possible impact of immigration on the demographic profile of a region. The two most intensively researched areas of late Neolithic/early Bronze Age Britain - Wessex and Orkney - do seem to provide some evidence of these processes.

In the area of Stonehenge, a project of surface survey has provided a wealth of environmental and settlement data which complements the known archaeology of the monumental remains (Richards 1984). It seems that during the later Neolithic, a zone of intense, Grooved Ware related, domestic and ritual activity was bounded by the Avon Valley to the east and Stonehenge Bottom to the west, with the henge of Durrington Walls acentrically located at its eastern margin (Figure 5.1). Stonehenge itself was at this time lying abandoned, and probably overgrown; but there was some evidence of domestic activity to the west, perhaps associated with the exploitation of flint around Wilsford Down. The appearance of Beaker assemblages in the area, however, was associated with major alterations in the social organisation of the landscape. After about 2250 calBC Durrington Walls was abandoned and the entire "Durrington zone" of ritual/domestic activity seems subsequently to have been ignored by Beaker users. Stonhenge was refurbished and work commenced upon a series of architectural elaborations. Although the area around Stonehenge itself seems to have been empty of settlement, perhaps being devoted to ritual usage, there are surface indications of Beaker activity in the western half of the study area, from Robin Hood's Ball south to Wilsford Down. This westerly zone was associated with arable farming which may have intensified during the early Bronze Age. If it is permissable to regard the late Neolithic "Durrington zone" as constituting some sort of a political centre, it is noticeable that Beaker settlement occurred outside of this area, and seems eventually to have led to its eclipse. Evidence of a similar process, albeit on a larger scale, is to be found at the northern extremity of Britain - the Orkney Islands and adjacent parts of the mainland.

Again, during the late Neolithic, the Orkney Islands were a major focus of Grooved Ware settlement and ritual (Childe 1947: 84-90, Clarke et al 1986: 92), another political centre perhaps. However, the islands are virtually devoid of Beaker finds - only three Beakers are known and there is virtually no Beaker-related metalwork (Clarke et al 1985:92). The situation in Orkney is in marked contrast to the adjoining areas of the mainland - the northern part of the highland region - where there is a dearth of Grooved Ware but a significant Beaker presence (Mercer 1982: 259). It has been suggested that:

> "Beakers caused a disjuncture in the networks on which the Orkney leaders relied. In these circumstances the power structure merely atrophied with the result that for most of the 2nd millenium there is nothing except the rich grave group from Knowes of Trotty to suggest that Orkney formed part of any wider network."
> (Clarke et al 1985: 92).

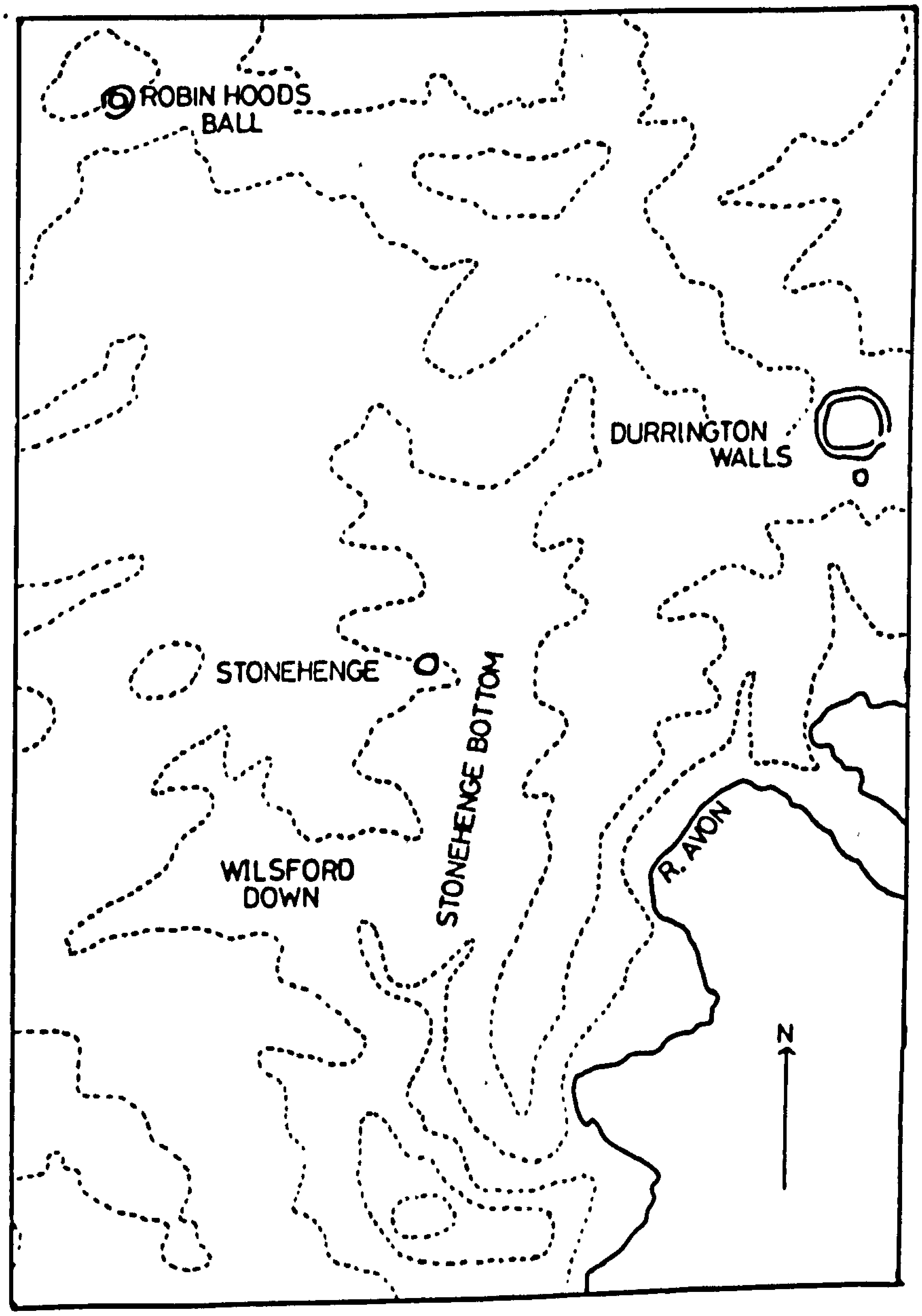



Figure 5.1.

Stonehenge Environs.
(After Richards 1984).

Bradley (1984: 59) has noted that most areas of Grooved Ware activity, which he termed "core areas", are linked by the sea, and suggested that the sea may have provided an avenue of contact. If this was indeed the case then the choice of the word atrophy in the above quotation may be apt, if an influx of maritime Beaker Folk was responsible for the disruption of whatever constituted the Grooved Ware network.

At the regional level, therefore, there is some suggestion of immigration into what seem to have been "politically peripheral" areas. In Wessex, furthermore, there is also some evidence, tenuous perhaps, of a Beaker-associated population increase. A significant input of high fertility migrants into a region would be expected to cause an appreciable rise in population, but the archaeological detection of such a rise remains problematical. Current methods of demographic reconstruction are not sufficiently precise for such a purpose. Intensive or extensive surface survey may suggest patterns of settlement or land-use, but can do little more. They provide no information about settlement size or duration. It is not possible therefore to arrive at comparative population estimates based upon fluctuations of settlement numbers, or density. The reconstruction of population size from burials is also a hazardous procedure, as discovered in the previous chapter. There are, however, several mutually corroborating lines of evidence currently available which point to a major change in patterns of land-use which are associated with the arrival of the Beaker culture, a change which might be suggestive of population increase.

Palynological and malacological studies of late Neolithic environments have been consistent in indicating the presence of secondary woodland, or scrub (Evans 1990; Thomas 1982; Smith 1984). Pigs, better adapted to woodland than cattle, become the predominant domestic animal on

Grooved Ware sites (Grigson 1982). Similarly, woodland food plants are strongly represented in Grooved Ware contexts (Jones 1980), as are the skeletal remains of wild game (Richards & Thomas 1984: 207). Indeed, it has been suggested that the characteristic transverse arrowhead of the late Neolithic is ideally suited to hunting in wooded environments (Evans 1975: 122). This is not to suggest that the Grooved Ware users of late Neolithic Britain constituted some sort of relict population of Mesolithic hunter-gatherers - the agricultural component of their subsistence base has been well documented (Jones 1980). The diversity of food resources exploited does, however, point to an extensive, rather than intensive, system of exploitation.

This coherent picture of late Neolithic environment and subsistence does not survive the introduction of the Beaker culture, however. The percentage of wild animals in faunal assemblages falls, dramatically at Mount Pleasant where there is a stratified sequence (Richards & Thomas 1984: 207); the pig also appears to lose its place as the predominant domesticate (Grigson 1982: 307). The transverse arrowhead is not, of course, a component of Beaker flint assemblages. These different patterns of faunal exploitation and management are associated with extensive woodland clearance and an increase in importance of arable cultivation establishing a mode of subsistence that was to persist throughout the Bronze Age (Evans 1990; Thomas 1982). The replacement of a heterogeneous and extensive system of land-use by a more homogeneous and intensive system would be a natural concomitant of rising levels of population, secondary to immigration.

As a final point, it is worth considering the maritime technology available to a nautical "Beaker Folk". For reasons of seaworthiness and limited technology it seems likely that any late Neolithic/early Bronze Age sailors who were bold enough to venture out onto the stormy waters of the Atlantic would have done so in skin boats. (Johnstone 1980: 27,112). Large boats of this type are thought to be represented by Scandinavian rock carvings of the early Bronze Age. They are depicted with quite large crews, that of the Bjornstadt example in Norway apparently consisting of 48 members. Such boats would have been capable of transporting migrants and their livestock over quite long distances, although no doubt the seasonal constraints on travel discussed by Case (1969) for early Neolithic migrants still applied. If the "Beaker Folk" were manufacturing such large boats it would perhaps explain why leatherworking was regarded as an occupation of sufficient prestige so as to warrant distinctive burial, such as that at Amesbury 51 (Ashbee: 1978).

## Ethnic Intermixing and Ceramic Style.

Although the generalised model of long-distance migration successfully explains several aspects of the Beaker culture, its theory remains underdeveloped in a number of critical areas. In particular, it fails to provide a comprehensive account of the number and variety of possible accommodations that might occur between immigrant and indigeneous communities. Fortunately however, the nature of these accommodations is open to investigation by use of the "economic competition" model of ethnicity described in Chapter Two.

Where two ethnic groups become interspersed in a region as a result of a migration and are in direct competition over resources there are a number of stable outcomes possible (Barth 1969: 19ff), which are enumerated below:

1) The interspersed groups might polarise into territorial entities but remain in open competition

for resources. Such an outcome would be expected to result in the continuing high profile maintenance of ethnic boundaries, expressed spatially, and should be simple to detect archaeologically.

2) An accommodation might develop between the groups which would involve each in the exploitation of separate ecological niches and the development of a symbiotic relationship, such as those that exist between pastoralists and sedentary cultivators. Ethnic identities might persist but not in so marked a fashion, archaeological identification might be more problematic.

3) A stratified polyethnic, system might separate out with the individual ethnic groups accepting, willingly or unwillingly, unequal access to the resource base. The cultural differences of ethnicity would resolve themselves into a complex of status diacritica.

4) One group might displace another physically, leading to emigration of the competing group. Again this should be simple to detect archaeologically and, indeed, is the pattern envisaged in much of the early, "migrationist", literature.

5) Most interestingly perhaps, and certainly the most complex from an archaeological point of view, would be the symbolic displacement of one group by the other. The people would remain in the region but be absorbed into the opposing ethnic group by mechanisms of boundary crossing as outlined earlier. The problem here is that, as competition over resources is resolved, the need to clearly demarcate ethnic identity diminishes and therefore absorbed groups would be able to keep many of their ancestral customs

or cultural traits, providing the ethnically most significant traits of the absorbing group were adopted. It has been shown in many apparently unified African societies, for instance, that the histories of individual kin groups are divergent, showing them to have been incorporated into the society at different times. These groups often retain some of their ancestral practices, including burial customs, which contribute to a cultural diversity that is difficult to explain in other than historical terms (Kopytoff 1987: 5). Group history is fabricated to normalise its internal relationships. Material culture might be likewise variegated, with similar diverse origins. Orme (1981: 203), for instance, described the material culture of the Azande as constituting a patchwork of different types acquired from conquered and assimilated, or partly assimilated, peoples.

It appears, therefore, that there are a number of cultural outcomes that may occur in response to ethnic intermixing, the third and the fifth of the alternatives outlined above seem particularly apposite for the explanation of the cultural variability exhibited by Beaker assemblages. This variability would have arisen out of the incorporation of local populations by incoming Beaker groups, initially perhaps by political coercion or accommodation with later consolidation by intermarriage. The differential contributions made by local traditions to the geographically expanding Beaker culture would account for its increasing regional diversity through time. The absolute numbers of Beaker Folk needed to effect a cultural transformation would not have needed to be great. Adams (1968: 210) has graphically described how a steady drip of Moslem pastoralists into Christian Nubia radically changed the culture of the region despite a large measure of population continuity. Such processes of ethnic integration would of course render questions of race unrealistic as

Childe foresaw. The Beaker Folk ultimately would have been a biological amalgam whose origins would wait to be discovered in many corners of western and central Europe.

When it comes to considering the archaeological correlates of the above alternatives the obvious conclusion can be drawn that more attention should be paid to the full cultural assemblages of the period under question and particularly the settlement evidence. But such a conclusion is unhelpful, the present explanatory impasse is in many ways a direct result of the very lack of such evidence. It is to be hoped that this unfortunate circumstance will be progressively rectified but in the meantime the role of ceramic style in both within and between group symbolling and the mechanisms of its stylistic transfer between populations might be fruitful fields for consideration. The social significance of ceramic style and its role in ethnic demarcation have been widely discussed (reviewed in Rice 1987). It seems possible to partition ceramic into the active and passive categories (Sackett 1986,1990) discussed in Chapter Two, while bearing in mind that these categories are not fully distinct. The decoration of a pot is generally considered to be a manifestation of active style, while its technological and functional characteristics are more usually thought of as being passively produced.

Decoration may be used actively to transmit information, it may act as a medium of communication, but its interpretation is far from straightforward. It may indeed function as a device of group demarcation, but the groups need not necessarily be ethnic (Rice 1987: 267). Decoration may also sometimes have a magico-religious aspect and be designed to communicate with ancestors, or the gods (Sterner 1989: 458). The precise choice of message to be conveyed by ceramic decoration, or indeed by any items of material culture, is arrived at by social consensus and the underlying logic of such choices remains unknown (Lemonnier 1986: 179), if not unknowable. Decoration may also function passively, however. To an outside observer the meaning of a design might be unknown but its manner of execution may be distinctive, and recognisably ethnic.

From an archaeological perspective there are further problems with any attempt at translating, or interpreting, actively produced ceramic decoration. On account of its symbolic load, decoration is unstable through time, and reflects shifting social relations. Furthermore, decoration is context dependant and its degree of elaboration may be a function of the visibility of the pot and the intensity of social interaction (Braun 1991). Decoration is also sensitive to any changes in the magico-religious beliefs of a society that may take place. The decoration of Beaker pots is assumed to have changed quite radically through time, and is indeed one of the mainstays of typologically based chronologies. The decoration of an AOC Beaker is far removed from that of a Clarke S4. The defining feature of a Beaker pot is its shape, or form, not its decoration.

Mention of vessel form moves the discussion on to a consideration of passive style. In a ceramic context passive style is thought to be more stable than active, and therefore of more use to the archaeologist as an indicator of group identity. Passive style is encapsulated by vessel form, it is a reflection of the method of its manufacture and the manner of its usage. It is manifest particularly in the more utilitarian types of pottery: cooking and storage vessels. There are three clusters of factors which together act to render the form of these vessels resistant to any processes of rapid change (Rice 1897: 460). These clusters are technological, dietary and physiological.

Potters resist changing their technology or methods of manufacture as any such changes represent a risk (Rice

1987: 462). Tried and tested manufacturing techniques are trusted, and the properties of established clays and tempering agents understood. Alterations in methods or materials may have unforeseen consequences, and experimentation be considered an unnecessary luxury. Diet also acts to stabilise vessel forms through time (Rice 1987: 462). Methods of food preparation or serving, together with flavour preferences, may be socially ingrained and again will act to discourage experimentation with new forms or fabrics.

Physiological resistance to change is engendered by motor habit patterns. These are unconscious behavioural regularities which are caused by differential muscle development, which is itself a consequence of the prolonged and habitual repetition of a set sequence of physical actions. Any change in this sequence which requires a different arrangement of muscular coordination is difficult, or uncomfortable (Arnold 1985: 205, 233-6; Rice 1987: 462). The stabilising influence that motor habit patterns exert on vessel form can be viewed from two perspectives: from that of the user and that of the maker. The manufacture of a pot requires a co-ordinated set of movements learned and practised over a long period of time. Any novel set which interrupted established motor habit patterns, thereby proving difficult or awkward to perform, would be resisted. From the point of view of the user, a familiar form is preferred for ease of handling. This is particularly the case with large jars which are unwieldy and difficult to manoeuvre or carry; one pattern of handling in a society is usual and the form of the jar reflects this.

Thus it seems that the form of utilitarian ceramic types, their passive style, is conservative and may therefore be a more reliable indicator of ethnicity than the more highly decorated finewares. This of course is an archaeological commonplace. It has long been known that coarsewares, or domestic wares, are more reliable in this respect - even if they are not so frequently studied.

In the light of these discussions of ethnic intermixing and ceramic style more information may be derived from the settlement evidence, originally discussed in Chapter Three. There, the mixed nature of many settlement deposits was described, how Beakers are often found together with ceramics of indigeneous type. Two possible explanations were proposed:

- that the deposits might be the cumulative residue of several, discrete, episodes of settlement by people with different cultural traditions and as such represent a mixed deposit.

- that the deposits might result from a single period of occupation by a group whose ceramic repertoire was stylistically heterogeneous, with any horizontal stratigraphy resulting from use foci rather than settlement drift.

The first of these settlement alternatives was the one preferred in Chapter Three, and is simply explained in ethnic terms as it would envisage the co-existence of indigeneous and Beaker communities, each producing their own distinctive vessel forms. Eventually, ethnic integration and intermarriage would produce a fusion of ceramic types, with vessel forms of mixed ancestry emerging in the early Bronze Age. If the eventual forms of Food Vessels and Urns owed more to late Neolithic pottery than to Beakers, it might suggest a large degree of population continuity.

However, it was also noted in Chapter Three that the second of these two alternatives is the one preferred by proponents of Beaker diffusion, and also that the model of ceramic emulation has been utilised for its explanation. Against this, it was pointed out that emulatory cycling failed to reconcile the existence of "pure" Beaker settlements with apparent continuity of indigen ous ceramic traditions. The model of ceramic emulation is also, in this British case, in direct contradiction of an expectation generated by the above discussion of passive style - that change through time in the forms of ceramic vessels will be slow and gradual. If Beaker pottery formed a discrete stage in a unilinear sequence of ceramic development, as is envisaged in the emulation model, then the expectation of gradual stylistic change is not met. Instead, vessel forms are seen to undergo a stylistic somersault, with Peterborough forms giving way to Grooved Ware, itself supplanted by Beakers before an ultimate return to the late Neolithic related forms of Food Vessels and Urns. This is contrary to all that is known of the gradual morphological evolution of vessel form.

The second settlement alternative may be explained differently, however, and in an ethnic fashion. The communities producing such mixed assemblages might be of indigen·ous ancestry but have adopted Beaker "ethnicity" some time after coming into contact with Beaker immigrants. Thus, a large part of their own cultural repertoire may have been retained, including domestic pottery, but the material diacritica of their adopted ethnic group taken up and displayed, including fineware Beakers perhaps. Beaker/indigene communities would then co-exist with "pure" Beaker communities, both recognisably Beaker in ethnic terms, and perhaps with a coherent mythology of origins, but retaining some differences of material culture, and of social customs. If the necessity for ethnic signification diminished, or the method of its symbolling change, then through time the production of discrete pottery styles would cease, and ultimately vessels of mixed ancestry would be produced. That the forms of subsequent early Bronze Age ceramics betrayed their late Neolithic ancestries, albeit with Beaker influences, is in accord with expectations generated by the above discussion of passively produced style. This process may perhaps also explain the patterning of Beaker assemblages recovered in central European contexts. Here distinctive Beaker vessels are usually found in association with less fine Begleitkeramik, a ceramic form of Corded Ware ancestry which ultimately developed into proto-Únĕtice ware.

## Conclusion.

The arguments and observations put forward during the course of this, and preceding, chapters do not "prove" that the spread of Beaker assemblages through Europe, and into Britain, was a direct concomitant of a migratory folk. They do go some way towards demonstrating that such an eventuality is one possible reading of the evidence, a more likely one, perhaps, than that which proposes diffusionary spread on the lines of the cult package or status kit models. A sceptic might remain unconvinced. It is intended here, therefore, to briefly summarise the points made during the first five chapters of this thesis, and then to arrive at some definitive statement of conclusion.

In several regional studies it has been demonstrated that there were substantial changes in the archaeological record of the late Neolithic-early Bronze Age transition in Britain. The appearance throughout Britain of a new culture - the Beaker culture - was associated with changes in burial practices in Yorkshire; subsistence, population and political organisation in Wessex; political organisation in northern Britain. These instances are case studies only and do not pretend to provide a comprehensive picture of archaeological change at this time, but represent a "sample", sufficient to indicate that widespread change did occur.

Whereas all these changes, and Beaker variability in general, can be explained by reference to a single model of long-distance migration this is not the case if a diffusionist explanation is attempted. Numerous individual accounts are necessary to describe changes in different parts of the country as being historically unique, but nevertheless convergent - a convergence which led to the ultimate adoption of Beaker assemblages. Not only is this inelegant, it seems unlikely. Diffusionist hypotheses are in any case further flawed, probably fatally, by the underdeveloped nature of their theoretical bases. Particularly serious is their failure to provide any satisfactory account of why ceramic Beakers should be perceived by late Neolithic societies to possess that ethereal attribute of value.

If a migrationist explanation of Beaker culture spread is more parsimonious than one of diffusion, it is also more versatile. It successfully accommodates the complex pattern of ceramic development across the late Neolithic - early Bronze Age interface, which the various diffusionist models signally fail to do. Therefore, in consequence of its simplicity, and of its inclusive nature, a migrationist explanation of the Beaker phenomenon is preferred. A primary vector of migration would have been responsible for the initial spread of Beaker assemblages through Europe, with secondary processes of ethnic accommodation, and perhaps emulation, being responsible for its spatial variability.

Scholars antipathetic to the idea of a migrating "Beaker Folk" have sought to force their point home by adopting Childes simple, but outdated, definitions of culture and migration, definitions which Childe himself had abandoned before the end of his career. However, none of the evidence adduced in this thesis to support the idea of a Beaker migration is particularly new. The basic model of long-distance migration was articulated by Lee in 1966, while the economic model of ethnicity was discussed by Barth in 1969. These both antedate the dissatisfaction with Childe's early definitions of culture and migration that found expression in the mid-1970s; but they were never sought out by any attempt to reconsider the possibilities of a Beaker migration in the light of more recent research. It is also the case that many of the explanatory constructs which underpin Beaker diffusion hypotheses have been uncritically, and perhaps mistakenly, accepted. Clarke's (1976) proposal of labour value for instance to explain the demand for Beaker fineware, and Bradley's (1984) scheme of emulation for explaining late Neolithic - early Bronze Age ceramic development. That such analytical lacunae can exist, apparently unnoticed, within the fabric of prehistory is worrying, and possible reasons for their existence will be discussed further in the conclusion of this thesis.

## Chapter Six.

# THE STUDY OF THE CRANIA OF PREHISTORIC BRITAIN: HISTORICAL ANALYSIS.

This chapter introduces a programme of original work during which all the major collections of prehistoric crania known to be housed in English museums were visited. The crania were examined metrically and the derived data analysed statistically. In itself, the chapter reviews previous approaches to the study of British prehistoric crania and also presents a statement of aims.

## Ethnology and Ethnography.

The first systematic contribution to the study of British prehistoric crania appears in the first edition of D. Wilson's book: The Archaeology and Prehistoric Annals of Scotland, published in 1851. He provided metrical data for 15 Scottish skulls and described their archaeological contexts. After study he grouped the skulls into three broad classes: kumbecephalic, or boat-shaped; brachycephalic, or broad-headed; and a class of intermediate type. From their associated artefacts he recognised the intermediate class to be Anglo-Saxon, but was not able to ascertain, with any confidence, the correct chronological order of the remaining two classes. He did realise, however, that they were probably prehistoric and that, further, they were recovered from distinctive, and separate, sepulchral contexts. On the basis of their apparently "primitive" morphology, Wilson suggested that the kumbecephalic skulls were of greater antiquity than the brachycephalic types (1851: 169), no doubt influenced in this conclusion by craniological data being collected at that time from contemporary "primitive" societies in Australia and North America which had shown them to be of a dolichocephalic cranial type.

Wilson was an evolutionist. He saw himself as heir to a "British School" of ethnology. This was a declaration of commitment to the theory of monogenism, championed in Britain by J. C. Prichard, and which held that all humans were members of a single species. The distinguishing features of the various "racial" groups, including head shape, were thought to be acquired, their acquisition being determined by their relative level of civilisation. Thus it was thought that the physiognomy of a people would alter in association with their intellectual faculties and their social customs (ibid: 164). This was a biological statement of the "psychic unity" of mankind. Nevertheless, despite his evolutionist tendencies, Wilson considered that the difference in cranial form that existed between his kumbecephalic and brachycephalic classes was of such a magnitude that it was justifiable to propose that they had originally belonged to two separate races.

This conclusion was partly in accord with the work of the Scandinavians, Nilsson and Retzius, who had suggested that the prehistoric crania of Scandinavia were the surviving markers of three successive races, which they had been able to place in chronological order on the basis of their archaeological associations. The earliest race were characterised by a brachycephalic skull form and had been hunter-gatherers; the second were dolichocephalic, or long-headed, farmers; while the final skull was of intermediate type and belonged to a Bronze Age race, tentatively identified as "Celts" (ibid: 163). This concern with identifying a "Celtic" race was to be taken up in Britain and was a consequence of the discovery of the Indo-European group of languages, thought to have descended from a single ancestral form, proto-Indo-European. The putative lexicon of the proto-Indo-European speakers suggested a homeland in northern Europe or central Asia (Renfrew 1987: 14); it was assumed, therefore, that the Indo-European languages had been carried west by an invading race , or races, foremost amongst which would have been the "Celts". The westerly distribution of the non-Indo-European languages known to have survived, at least into classical times, strengthened this conviction. Wilson himself argued that both his kumbecephalic and his brachycephalic classes of crania must have pre-dated the "Celts" as the true "Celtic" skull, known from the early historical period, was intermediate in form.

The tentative diachronic succession proposed by Wilson for his Scottish crania was confirmed by Bateman in England (1852). Bateman noted that the chambered tombs he excavated only ever contained flint artefacts, never bronze, and must therefore predate the smaller round barrows, which sometimes did contain burials accompanied by bronze. He further observed that the chamber tomb interments possessed boat-shaped skulls, which he preferred to call dolichocephalic, whereas those of the round barrows were of a short round form, quite different in morphology from those of the Romano-British period. Bateman thought that the earliest round barrows would have been built at the end of the Neolithic, and that therefore the introduction of bronze working post-dated the arrival of a new people.

In the second edition of his book, Wilson confirmed Bateman's suggestions but maintained that the "Celts" must have arrived at a time subsequent to that of the brachycephalic race (Wilson 1863: 320). He was aware that in taking this stance he was in contradiction of the proposed Scandinavian sequence but he argued that the racial history of Britain was more complex than that of Scandinavia, the position of the latter being more peripheral, and that there should be no prior expectation of equivalence (ibid: 318). In the time that had lapsed between the two editions of his book, Wilson had taken a teaching post in Toronto, Canada, where he had been exposed to the practices of the native Americans. He became familiar with the use of a cradle board and provided a detailed account of its use and anatomical consequences:

> "But in the ordinary use of the cradle-board by other Indian tribes, all that is aimed at is facility of nursing and transport, and perfect safety for the child. It is accordingly provided with a cradle formed of a flat board projecting beyond its head and feet, and with an arch or head-piece so arranged as to protect the face and head in case of a fall. On this cradle the infant is invariably laid on its back, with the head resting on a pillow or mat of moss or frayed cedar-bark, and is secured by bandages which hold the limbs in an extended posture, and necessarily retain the head in a nearly fixed position. The child is not removed from the cradle-board when suckling, so that the head is subjected to no lateral pressure on the mothers breast. At other times it is slung over her back, suspended from the branch of a tree, or placed leaning against any convenient rest, with the head constantly affected in the same direction. The consequence necessarily is, that the soft and pliant bones of the infants skull are subjected to a slight but continuous pressure on the occiput, during the whole protracted period of nursing incident to nomad life, and when the occipital and parietal bones are peculiarly susceptible to change. The only modifying element is the pillow. When, as is the practice with many Indian tribes, the infant is thrown back, and the consequent flattening affects the parietal bones, extending nearly to the coronal suture; but where a broad and high pillow is used , the weight of the head rests chiefly on the occipital bone, producing the vertical occiput."
>
> (Wilson 1863: 273-274.)

Wilson suggested that the signs of compression to be seen in the parieto-occipital region of many of the brachycephalic crania he had studied might have resulted from the use of such a cradle-board during infancy (ibid: 273). He even went so far as to suggest that the change in head form seen in early historical times might have been, in part, due to the abandonment of such cradling practices, although maintained that the difference in shape between the prehistoric dolichocephalic and brachycephalic crania was altogether too great to be explained by such a conjecture (ibid: 275).

In the second edition of the Prehistoric Annals of Scotland reference was made to the Crania Brittanica of J.B. Davis and J. Thurnam, which was published in five parts between 1856 and 1865. Upon completion it comprised two volumes. The first volume contained chapters relating to the ancient history , archaeology, ethnology and craniology of Britain. The second volume presented a series of 56 lithographic prints of individual crania, with associated descriptive text and discussion of its archaeological and anatomical significance; also collected together were metrical data obtained from 307 skulls, largely British Neolithic and Bronze Age but also some Romano-Britons, Anglo-Saxons and Neolithic Scandinavians. Despite the dual authorship of this work there appears to have been some disagreement over interpretation (Thurnam 1863: 125). Thurnam published a supplementary series of 3 papers (1863, 1864, 1867) wherein he provided some extra data and discussion, but also presented conclusions radically different to those expressed by Davis in the Crania Brittanica.

Throughout his discussion in Crania Brittanica Davis took pains to deny that there was any evidence for a prehistoric succession of races,or at least cranial types, arguing instead that dolichocephalic and brachycephalic skulls were present in Britain throughout both the Neolithic and the Bronze Age. He supported his position by refusing to accept that the small, round, barrows did, in fact, post-date the larger and more elaborate Neolithic chamber tombs:

> "But to regard the colossal mound of Newgrange, and the elaborate galleries and chambers of Wellow, Uley

> and other barrows of this kind as the most primeval is difficult, if not impossible, unless the support of other very convincing evidence could be adduced."
> (Davis, in Davis and Thurnam 1865: 229).

In his discussion of the skull from Wetton Hill barrow he says:

> ".... in this stone barrow on Wetton Hill, presenting only rude flint implements, British pottery, primitive flexed position of the skeleton, and the rude short cist; therefore with every mark of the primeval period, and no element of remote antiquity wanting."
> (Davis, in Davis and Thurnam 1865, Volume II: Wetton Hill.)

The British pot in question was a Food Vessel, but a relative chronology of prehistoric pottery would not be constructed for another fifty years. In maintaining this position, Davis was able to claim that the brachycephalic skull form was of indigen ous origin, thereby refuting the Scandinavian claim that the Bronze Age was instituted by an immigrant race carrying with it the rudiments of metallurgy. He suggested that bronze weapons had been obtained from Phoenician traders.

Davis' refusal to accept the archaeological evidence for cranial differentiation may perhaps have been motivated by his views on racial origins. He was a member of the Anthropological Society of London, a society founded in 1863 by the polygenist J. Hunt as an alternative to the more orthodox, monogenist, Ethnological Society (Stepan 1982: 45). Polygenism was a theory of racial uniqueness. It proposed that individual races constituted separate species, that racial characteristics were immutable and that inter-racial marriage would be infertile (ibid: 42). It seems possible therefore that Davis would have been predisposed to deny the existence of two, separate, prehistoric races. To accept them would have necessitated the concomitant acceptance of either racial evolution or racial intermixing, both anathema to the polygenist.

Davis thought that dolichocephalic skulls might be pathological, the result of premature synostosis of cranial sutures (Davis, in Davis and Thurnam 1865: 230), but he was at a loss to explain the recurrent association of dolichocephalic skulls with chambered tombs. His discussion of cradle-boarding, and its role in the genesis of occipital flattening, was more secure, although he admitted that brachycephalic skulls of a similar configuration were known to him from societies that did not practice cradle-boarding (ibid: 233). He was also unhappy with the idea that a dolichocephalic race should suddenly cease to exist and be replaced by a brachycephalic one; he made the valid point that the tendency would be for them to blend into one another (ibid: 230). In a separate monograph (1862), Davis suggested that cradle-boards would have been made from a thin, light, wood, perhaps willow. He thought it possible that such boards may have been included with infants at burial, but that they would be unlikely to survive, although a few traces might remain for the discerning observer. He argued that cradleboarding would not be the ultimate cause of brachycephaly however, preferring to consider it as an excacerbating factor.

Thurnam seems to have possessed a rather more sophisticated understanding of archaeology than did Davis, or else a rather less doctrinaire view of racial origins. He agreed with Bateman and Wilson that round barrows and long barrows formed chronologically distinct groups, and that as the former occasionally contained bronze whilst the latter never did then long barrows were the more ancient type (1863: 120). He proposed the axiom: long barrows, long skulls; round barrows, round skulls (1863: 158); and pointed out that although brachycephalic skulls had indeed been recovered from long barrow mounds they were always secondary interments, they had never been found at the base of a barrow (1867: 57). He agreed with Davis that, in many cases, the degree of brachycephaly appeared to have been exaggerated by artificial means (ibid: 156), but disagreed that dolichocephaly might be caused by premature fusion of the saggital suture, pointing out that equally often the coronal or lambdoid sutures were also found to be fused (1867: 70). For his racial identifications Thurnam turned to classical sources. The brachycephalic/round barrow race he assumed to be the Belgae as they appeared to constitute the final tradition of prehistoric burial to have existed before the Roman conquest. The dolichocephalic crania he thought might belong to the ancestors of the people described by Caesar as being those of the interior, who he equated with the Silures, described by Tacitus in the Agricola as being of Iberian ancestry, and therefore, by comparison with the Basques, a pre-Indo-European race (ibid: 77-79).

While Wilson, Bateman and Thurnam had between them established and confirmed the Neolithic date of the dolichocephalic crania and the Bronze Age date of brachycephalic ones, it disturbed Thurnam that this sequence was not consistent with that of the European mainland where brachycephalic skulls had been recovered from Neolithic burials in both Denmark and France. The Scandinavian, Retzius, and the Frenchman, Broca, had both claimed that the brachycephalic crania recovered from these contexts belonged to a pre-Indo-European race (Thurnam 1863: 123). To solve this problem Thurnam took it upon himself to study and measure a series of 61 crania, obtained from prehistoric, mainly Neolithic, tombs in France. He reported a mixture of skull types (1864: 508), with both dolichocephalic and brachycephalic crania being found frequently in the same tomb. He concluded that, in France, two races had come into contact at a very early date and had subsequently blended. He accepted that a similar process of racial blending might also explain the mixture of cranial types to be found in the megalithic tombs of Scandinavia (1864: 508). Thurnam felt forced to conclude that there was no such thing as an identifiable "Celtic" skull, and that instead the individual language groups of the "Celtic" family might, in themselves, constitute distinct races, each with a distinctive cranial morphology (ibid: 515).

With hindsight, it is possible to see that the embryonic nature of prehistoric chronology had led Thurnam and his contemporaries astray. It was assumed that the use of bronze must have been introduced throughout Europe at an approximately synchronous chronological horizon and that, therefore, all Neolithic burials must be of a similar date. This mistake was compounded by the absence of any method of accurately measuring the duration of the Neolithic, estimates tended to err on the side of brevity. It is now known that the Bronze Age commenced at an earlier date in Britain than in either Scandinavia or north/central France. From his descriptions of their burial contexts, it is evident that the majority of French crania Thurnam studied were in fact of late Neolithic date, obtained from tombs of the S.O.M. culture:

> "They consist usually of a quadrangular chamber, into which opens a narrow gallery, or allee couverte. In no instance, so far as I know, are there sets of chambers opening on each side of a central gallery, as in several of the English tumuli"
> (Thurnam 1863: 133)

The S.O.M. was a relatively long lived culture, currently thought to have run from 3350 calBC to 1750 calBC (Howell 1983: 62), thus much of the French Neolithic material studied by Thurnam may in fact have been contemporary with that of his British round barrows.

Thurnam finally compared the prehistoric crania of Britain to those known from contemporary, 19th century, societies. He thought that the Bronze Age crania were, on average, larger than Alpine or eastern European brachycephalic types, and argued that the Neolithic crania were also longer and narrower than those of any European dolichocephalic people (1867: 64).

In 1877, Rolleston contributed to the volume British Barrows a report on the crania excavated by Greenwell. He described in detail a sample of 13 individual crania, providing metrical data, and also presented an overall discussion of the complete collection. He suggested that, in Bronze Age contexts, two distinct cranial morphologies were present - dolichocephalic and brachycephalic - and that they were not the extremes of a continuous population. However, it was not realised at the time that some of the Yorkshire round barrows were in fact of Neolithic date, and of the five skulls chosen by Rolleston as being typical of the dolichocephalic type two were actually from Neolithic barrows. He also noted that both types of skull were obviously distinct from those of the Anglo-Saxons (1877: 645). He followed Thurnam equating the dolichocephalic long barrow race with the Silures of Tacitus, but preferred to see the round barrow race as being of the same stock as the Cimbri, on account of the similarity in cranial dimensions between British and Scandinavian material (ibid: 680,630). He also saw evidence for artificial deformation in some crania, although did not think it would have been intentional (ibid: 593). Again, he thought that the Neolithic crania bore some resemblance to those of modern Australians , but more so to those of the Inuit (ibid: 717).

J. Mortimer had excavated large numbers of crania from the round barrows of the Yorkshire Wolds during the closing years of the 19th century. They were studied by W. Wright, who published a descriptive catalogue of 62 specimens, in which he included metrical data (1904, 1905). From this data, he deduced that the "round barrow, round head" part of Thurnam's axiom was not even approximately correct (1904: 120) since his sample of skulls contained brachycephalic, dolichocephalic and intermediate types. He concluded that the race that had migrated into Britain at the beginning of the Bronze Age was of a mixed type, pointing out that it was an unlikely circumstance for a "pure" brachycephalic race to have arrived:

> "To grant this conclusion one must believe that a pure round headed race could have made its tardy progress across Europe unmixed - an assumption which to my mind is unwarranted and incredible."
> (1905: 442).

Wright's conclusion was a sensible one but unfortunately it was based upon a faulty data set. Again, like Rolleston before him, he was unaware that many of the crania he examined were of Neolithic date, and these accounted for much of the dolichocephalic end of his distributional range of Cranial Index.

The final large corpus of cranial data to be published was by Schuster (1905/6), who examined and measured the collection of 222 crania which was then housed at the Department of Comparative Anatomy at Oxford. This collection contained some material which had been excavated by Thurnam but was largely composed of the crania recovered from the excavations described by Greenwell in his British Barrows. Again, there was the occasional Neolithic cranium, and an Iron Age one, mixed in with the round barrow sample, while included in the long barrow lists were several Anglo-Saxon crania belonging to secondary interrments in a barrow at Crawley, Oxfordshire (Crawford 1925: 159). As Schuster refrained from making any synthetic analysis of his data, however, these oversights did not cause any confusion.

By the end of the 19th century, most anthropologists were in agreement that, in Britain, during prehistoric times, a brachycephalic race had succeeded a dolichocephalic one, but there was no consensus regarding their respective identities. Abercromby put a stop, in part, to this speculation in 1902 when he identified the continental antecedents of the ancient British "Drinking Cup", to be known henceforth, in accordance with German and Scandinavian terminology, as a "Beaker". He also observed the recurrent association of brachycephalic crania with Beaker accompanied burials and proposed that the brachycephalic race had passed over into Britain at the beginning of the Bronze Age bringing with them their Beaker pottery. The "Beaker Folk" had been born. T.H.Bryce (1902) provided further support for this synthesis by pointing out that the central European origin of Beaker pottery proposed by Abercromby accorded well with the known geographical distribution of brachycephalic crania.

In 1917, Turner published and summarised all cranial data obtained up to that time from Scottish burials. He reconfirmed the dolichocephalic - brachycephalic succession initially proposed by Wilson, but observed that the presence of dolichocephalic crania in some early Bronze Age short cists would suggest that the morphological separation of Neolithic and Bronze Age crania might not be so clear cut as had so often been assumed (1917: 209). Nevertheless, he followed what had, by then, become the conventional wisdom of assigning to the Neolithic dolichocephalic race an Iberian origin, although he overlooked Abercromby's contribution when assigning to the brachycephalic race a French or Danish origin, although he did credit them with the introduction of bronze metallurgy. He agreed with Thurnam that there was no archetypically Celtic cranial type (ibid: 235-254). Turner's paper was perhaps the final example of the 19th century genre of cranial studies in which the data and description of physical anthropology had been combined with observations derived from ethnographical and archaeological sources to arrive at an evolutionist, or later, historical, synthesis. Such studies were accepted as legitimate archaeological activity and were influential in shaping contemporary interpretations of prehistory. This situation was changing, however, with physical anthropology becoming increasingly marginalised from the archaeological mainstream.

## Biometrics and Population Genetics.

The dogma of polygenism had survived the publication of Darwin's Origin of Species in 1859 by substituting the concept of race for that of species. The origins of racial variety were assumed to be of great antiquity and the defining biological traits of race very slow to change. Therefore, it was maintained that racial inequality was immutable and that races of "inferior ability" could not benefit from the "advantages" of European education or culture. Within Europe itself, the rise of nationalist sentiment during the latter part of the 19th century resulted in the expenditure of much effort by the "scholars" of various countries in describing ideal types of national head forms and expounding upon their, supposedly, superior characteristics. In Britain, however, the limitations of such a typological approach were realised by Galton and Pearson, who pioneered the use of quantitative techniques in the study of cranial variation. They emphasised the importance of studying the crania from large, representative, samples of a population and establishing the degree of variability present in a population. Variations of cranial form seen to exist between different population groups were still considered to be immutably racial in aetiology however, with the extra-somatic environment having no influence whatsoever upon the developmental process. Boas' observations of limited heritability (1910-1913) were specifically rebutted (Pearson & Tippett 1924: 119). Although the methodologies of statistical analysis benefitted greatly from this approach, the anatomical or archaeological significance of the results were rarely discussed. It was regarded as being sufficient to establish the degree of morphological (equated with racial) similarity extant between groups using a variety of statistical distance measures. Publications became increasingly statistical in content and ceased to appear in the mainstream anthropological or archaeological literature, being placed instead with newly established specialist journals, notably Biometrika. During the 1930s, the quantitative approach of the biometricians was integrated with the Mendelian theory of particulate inheritance to establish the present day discipline of population genetics. The theoretical principles of population genetics continue to inform most comparative studies of cranial morphology. Thus, it is assumed that variations in cranial form which exist both within, and between, populations are genetically determined, and as such can only change by the processes of evolution or microevolution.

Working within this theoretical milieu, Morant (1926), as part of a larger study, gathered together and synthesised all of the previously published data relating to prehistoric crania which was available to him. He calculated the means and variances of the numerous measurements and indices in order to compare the two groups objectively. Although taking care to exclude crania of uncertain context from his analysis, he remained unaware of the Neolithic crania in the round barrow series of Wright and Schuster, and also included the data obtained from the Neolithic crania of Duggleby Howe in his Bronze Age Group. As a result, the distribution he produced of the Cranial Indices of Bronze Age male crania showed a greater variation than comparable Neolithic and 17th century samples, the distribution also departed from normality, being skewed towards higher values of Cranial Index. Morant concluded that his Bronze Age crania must therefore be constituted of two racially pure groups (dolichocephalic and brachycephalic) and some hybrids. The results were, therefore, manipulated to produce a "pure" Bronze Age group. Essentially, he extrapolated a theoretical normal distribution from the data to the right, brachycephalic, side of the modal value (ibid: 63). Although, in so doing, Morant fortuitously excluded the Neolithic skulls in his sample, he also excluded many long headed Bronze Age types. From a sample of 151 crania, 60 were ultimately excluded. If it is assumed that 21 were of Neolithic provenance (Table 6.1) then the remainder must have been Bronze Age; their exclusion renders inaccurate Morant's mean Bronze Age Cranial Index of 82 - it is too high. Two years after his study of English crania, Morant collaborated with Reid in a similar study of Scottish short cist crania (1928), and showed them to more closely resemble the English Bronze Age material than recent Scottish material. The Scottish skulls were also compared with a number of recent European samples, although the value of this exercise was lessened by the omission of any dating information for the European material.

Morant's study was criticised by Fereday (1956) in a short paper which provided a statistical summary of metrical data obtained from 95 English Neolithic crania. She pointed out that Morant had included 47 skulls from Staffordshire in his Neolithic series without clearly indicating their provenance. With only two chambered tombs excavated in Staffordshire by Bateman, it is not altogether clear from what source Morant derived this body of data. Nevertheless, his mean Cranial Indices, at 72 for males and 74 for females, exceeded Fereday's figures by only one unit in each case. The identity of the Staffordshire crania remains a mystery.

Despite the unsatisfactory nature of Morant's study, based as it was on previously published data of uneven reliability, it remained definitive for over thirty years. The only (comparatively) recent studies of the crania of the prehistoric Britons have been those of Brothwell

Table 6.1.

Probable Neolithic skulls included in Bronze Age series of Morant.

(Prefix and number refer to original craniometric report; W = Wright (1904/5), S = Schuster (1905/6)).

| | |
|---|---|
| W2 | - Garton Slack 37, burial 8. |
| W3 | - Garton Slack 37, burial 11. |
| W4 | - Garton Slack 37, burial 9. |
| W5 | - Garton Slack 37, burial 10. |
| W7 | - Garton Slack 37, burial 12. |
| W17 | - Wold Newton 284, burial 2. |
| W18 | - Wold Newton 284, burial 7. |
| W44 | - Callis Wold 275, burial 3. |
| W56 | - Hedon Howe 281, burial 5. |
| W57 | - Painsthorpe Wold 118 |

| | |
|---|---|
| S99 | - Sherburn Wold 7. |
| S149 | - Cowlam 57. |
| S150 | - Cowlam 57. |
| S151 | - Cowlam 57. |

Garson (1904) - Duggleby Howe; C,D,G,I,J,K,L.

(1960,1974) who, by and large, confirmed previous findings. As part of a general study of the palaeodemography of early Bronze Age Yorkshire it was again shown that, although largely brachycephalic, the Bronze Age crania were heterogeneous with respect to their Cranial Indices, affinities with the Neolithic populations of France and Denmark were also restated. This study was impaired, however, by the, still unrealised, bugbear of the Neolithic round barrows. In a later, more wide ranging, study, Brothwell utilised previously published metrical data in conjunction with that from more recent, unpublished, sources in a canonical variate analysis of 11 cranial measurements. Again, the morphological separation of Neolithic and Bronze crania was achieved, but it was also suggested that, in Yorkshire, the crania belonging to male Beaker burials might be morphologically distinct from those of Food Vessel or other early Bronze Age burials.

## Archaeological Doubts.

If prehistorians found the specialist literature of the biometricians difficult to digest it was of little consequence; in response to the overt racism of Kossinna and his successors, with their theories about the inherent superiority of an Indo-European race, moves were afoot to uncouple the concept of race from those of ethnicity and culture. Childe (1933) accepted the theoretical possibility of a race as a biologically discrete entity, but doubted that it had any practical meaning in Europe or the Near East, given their shared heritage of chronic migration and population dispersal. He also argued that, while the Cranial Index might be a relatively stable hereditary character, it would be a poor indicator of racial identity, pointing out that in contemporary Europe the apparently distinct "Nordic" and "Mediterranean" racial groups were both dolichocephalic. Childe argued that an archaeological culture could not be indicative of race but should instead be considered to be representative of a people, or ethnic group. He defined an ethnic group as being a population with shared language, customs and peculiarities of material culture. Thus it was a legitimate exercise to characterise the archaeological culture that represented an Indo-European speaking people, but not a genetically segregated Indo-European race. Measures of racial affinity derived from samples of crania were therefore rendered meaningless to the prehistorian. Childe was, in fact, stating a view shared by many of his contemporaries in other disciplines. The Nazi thesis of Aryan supremacy had, during the 1930s, prompted the Royal Anthropological Institute and the Institute of Sociology to issue a joint statement in which a committee of distinguished biologists and anthropologists developed much the same theme. There was no general consensus as to the biological definition of a race, but all were agreed that no pure races existed, and that race did not in any case equate with culture (Stepan 1982: 168).

Despite Childe's rejection of any equivalence between an archaeological culture and a racial group, in the case of the "Beaker Folk", he felt it necessary to make an exception:

> "In this instance therefore it looks as if culture and race coincided and one might legitimately speak of a Beaker race."
>
> (Childe 1939: 218).

With this apparent conjunction of an intrusive archaeological culture with a novel racial type, there seemed little need to consider any alternative explanation for either occurrence other than that of straightforward immigration. It was this amalgam of archaeology and physical anthropology that contributed to the "Beaker Folk's" survival, intact, of Clark's (1966) scathing attack on the "invasion hypothesis" and it is still seen by proponents of a migrationist model of Beaker culture spread as constituting irrefutable support for their position. Once doubts were expressed about the cultural component of this amalgam, however, it was realised that the evidence of physical anthropology was not quite so clear cut as had always been assumed. The underlying cause, or causes, of variation in cranial morphology remained unknown and factors other than direct inheritance might be influential (Harrison 1980: 160-163). There was also a chronological gap of several hundred years between the early Neolithic chamber tombs and long barrows, from which dolichocephalic crania were recovered, and the early Bronze Age contexts of the brachycephalic types, a period of time sufficient, perhaps, for a process of indigeneous change to have taken place (Burgess 1976: 321). Whittle suggested that the practice of artificial deformation may have been overlooked (1981: 302) and indeed it had for over seventy years, although in the 19th century it had generated much discussion, as previously described. In consequence of these uncertainties, the proponents of Beaker culture diffusion felt safe in ignoring the challenge presented to their theories by the evidence of the crania.

Nevertheless, pointing to potential weaknesses in a theory, to its possible flaws, is not a procedure to be considered analogous to its decisive refutation. Nor yet is ignoring a body of evidence any substitute for offering a coherent thesis of explanation. It remains the case that, time and again, both subjectively and objectively, marked differences in form have been observed to exist between examples of Neolithic crania and their early Bronze Age comparanda, an unsavoury "fact" perhaps, and one that has been left to languish in the unfashionable backwaters of archaeology. Still, unfashionable or not, explanation remains wanting. It is the purpose of this study to make the first, perhaps tentative, steps in such a direction. It will attempt to answer the following three questions:

1) Are the anatomical differences reported to exist between crania of the Neolithic and early Bronze Age real?

2) Assuming the answer to question (1) to be affirmative, then what are the possible aetiologies of such differences?

3) In the light of the answers to questions (1) and (2), is it possible to apprehend the intrusive presence of a "Beaker Folk" amidst the human crania of prehistoric Britain?

# Chapter Seven.

## THE HUMAN CRANIUM I: ONTOGENESIS.

### The Human Cranium.

The cranial skeleton surrounds and protects the brain whilst also providing the structural template for the face. In the young adult it is composed of 22 individual bones which are formed, after fusion,from 45 embryonic precursors. As a simplification for the basis of further discussion the cranium can be considered to consist of three functional/structural units: the calvarium, the naso-maxillary complex and the mandible (Figures 7.1, 7.2). The calvarium is the braincase, the collection of bones that encloses and protects the brain. It consists of an upper portion, or cranial vault, and a lower portion, the cranial base. The cranial base is divided into two parts, anterior and posterior, by the sphenoccipital synchondrosis and is angled around this cartilage in the sagittal plane. The naso-maxillary complex encloses the nasal air passages and suports the palatal dentition while the mandible, or lower jaw, contains the basal dentition.

Structurally differentiated skull forms do not form discrete populations, morphologically they are a continuum. However, for descriptive purposes, it is convenient to dichotomise skulls into two extreme forms: dolichocephalic and brachycephalic. These forms have been defined metrically using the ratio between head length and head breadth to provide the Cephalic Index for head form, or Cranial Index for skull form. These indices are estimated as follows:-

$$\frac{\text{maximum skull/head breadth} * 100}{\text{maximum skull/head length}}$$

Dolichocephalic skulls are defined as having a cranial index of less than 75 while the brachycephalic index is in excess of 80.

A dolichocephalic skull is built around a relatively narrow, but elongated, cranial base with an open, flat, cranial flexure in association with an antero-inferior positioning of the naso-maxillary complex and a corresponding downward and backward rotational alignment of the mandible. The resultant facial profile tends towards being convex, or retrognathic. The cranial base of the brachycephalic skull is shorter but wider than that of the dolichocephalic skull, with a more acute and upright flexure, in conjunction with a more protrusive lower jaw. There is a tendency towards a concave, prognathic, facial profile. The reduced lateral dimensions of the dolichocephalic head are associated with close set eyes and a thin, but long, nasal cavity. The eyes of a brachycephalic individual are further apart and the nasal cavity is wider, but shorter. The convex and concave profile tendencies of the different skull types carry inbuilt dental malocclusion patterns but in both cases compensatory mechanisms exist to produce a straighter, orthognathic profile. Thus in the dolichocephalic skull there may be a broader mandibular ramus to push the lower jaw forward while in the brachycephalic a more open gonial angle might act to lower the mandible (Enlow 1990).

The sex of an individual has some effect upon cranial morphology. In relative terms, the male lungs are larger than the female as they need to serve the respiratory demands of an increased muscle mass. This results in a larger airway with a larger nose and naso-pharynx. Thus the nasal region of a male tends to be more protruberant ,

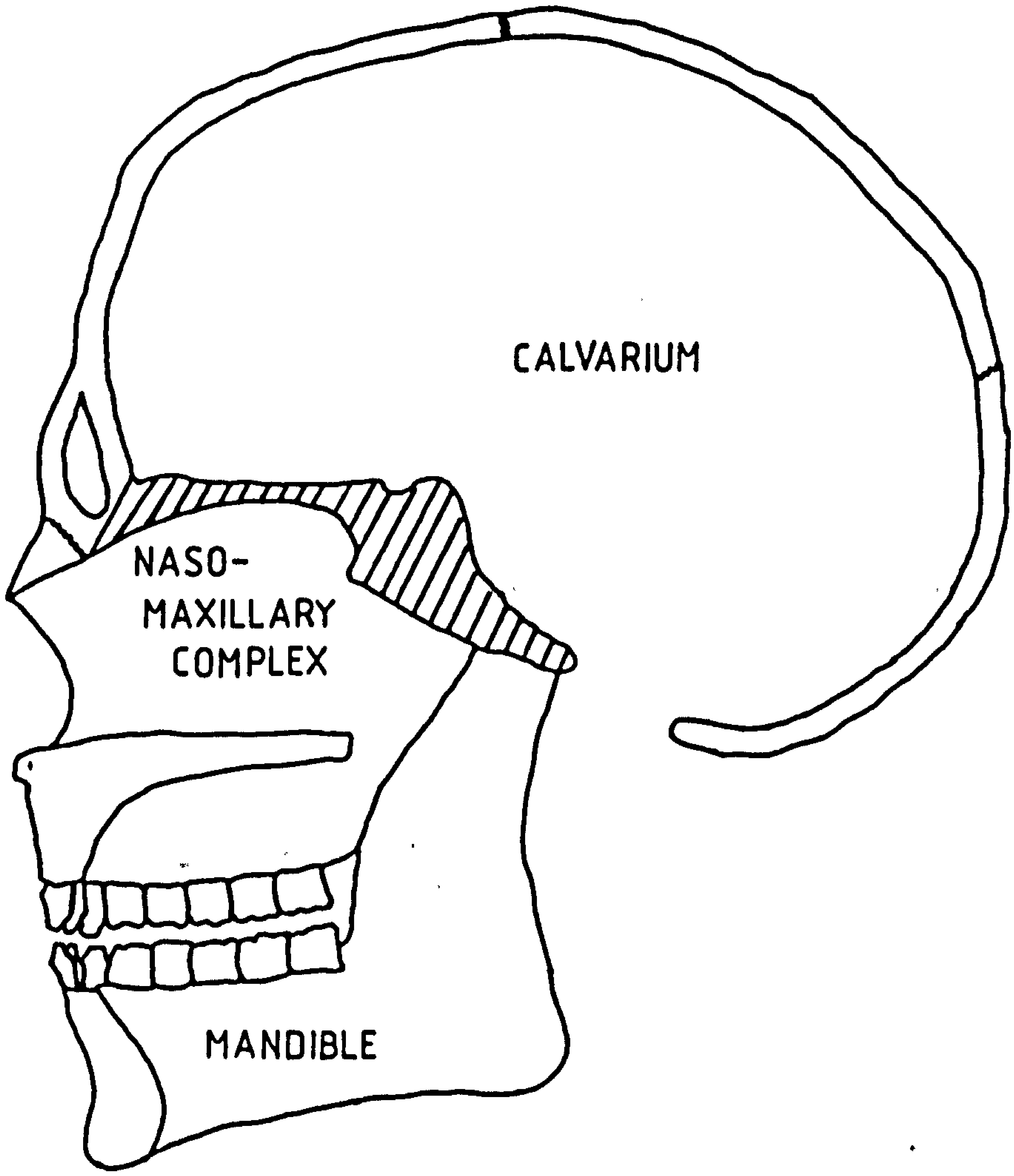



Figure 7.1.

The Human Cranium in Sagittal Section, Showing its Three Major Structural/Functional Components.

(The shaded area represents the cranial base).

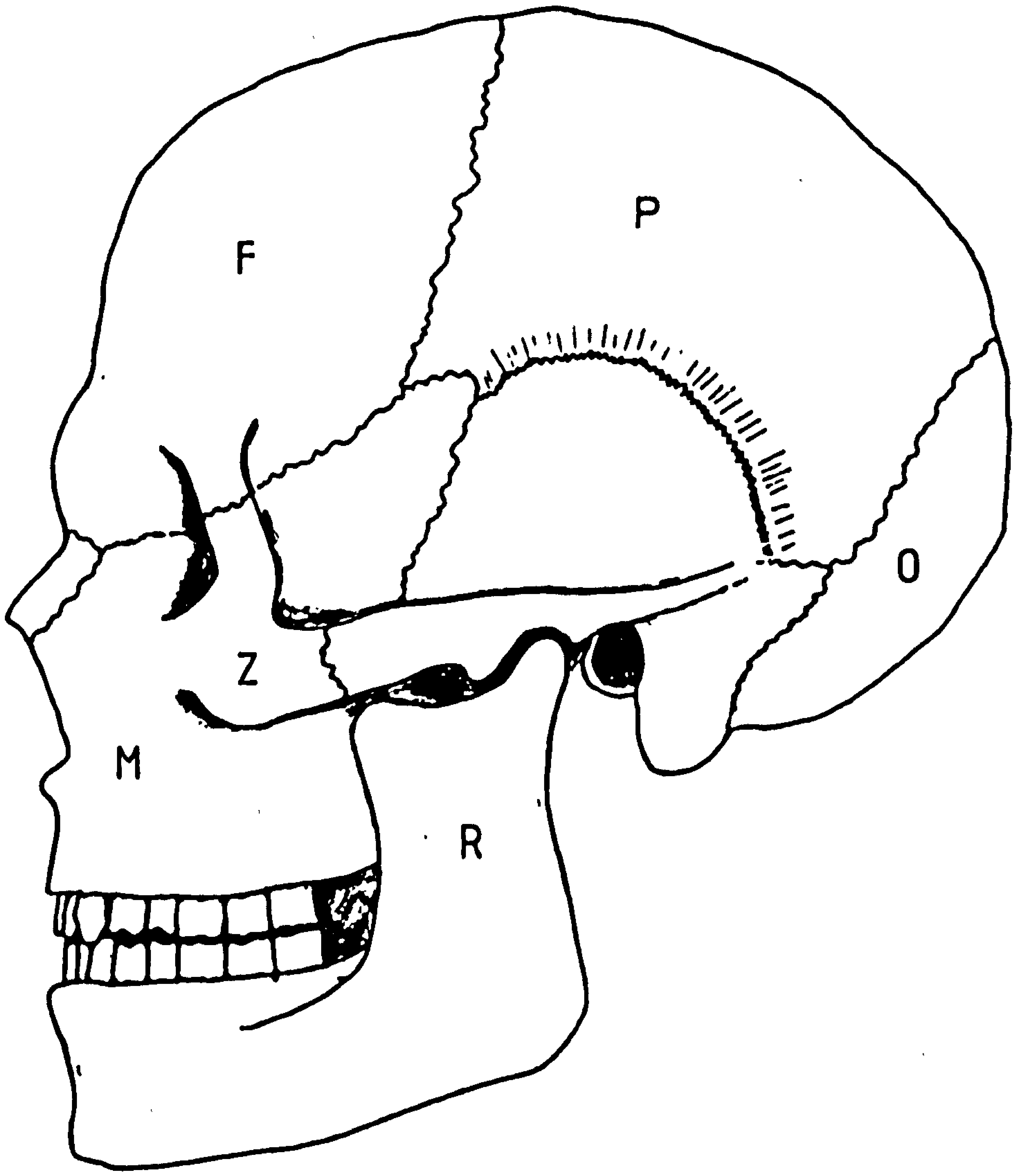



Figure 7.2.

The Human Cranium, Showing the Positions of Bones Mentioned in the Text.

F - frontal bone; M - maxilla; O - occipital bone;
P - parietal bone; R - mandibulary ramus;
Z - zygomatic bone.

males having a tendency towards a retrognathic type face while females tend towards a flatter, more orthognathic, face. In females, facial development begins to slow after about 13 years of age but in males the puberty related increases in body size necessitate that the maturation process of the face continues through adolescence. Male skulls on average tend to be more robust than female skulls due to the demands of the more substantial cranio-facial musculature.

The structural/functional units do not develop in isolation. There is an underlying balance provided by the cranial base which accommodates regional adjustments in anatomy so as to maintain the overall functional integrity of the skull. The face cannot vary in shape or size independently of the cranial base or it would be necessarily deformed. Alterations in the configuration of the brain and cranial base therefore cause secondary changes in facial morphology, and vice versa.

Natural Selection and Adaptation.

The physiological configuration of an individual organism, the sum of its structural and functional characteristics, is known as its phenotype. The phenotype is the physical expression of the underlying genetic code, the genotype, after modification by environmental factors during growth and development. Modern evolutionary theory emphasises the role played by natural selection in acting upon the heritable variation contained within the total available genotypes, or gene pool, of a population to produce more environmentally suited individuals. Genetic variation is maintained by random mutations which constantly occur as chromosomes are damaged during meiotic division. These mutations produce novel gene variants, or alleles, most of which are lethal in effect and thus will not be retained within the species, others appear to be selectively neutral. However, upon occasion, a mutation will occur which confers upon its owner a relatively increased chance of survival, which may be translated into reproductive success, thereby ensuring that the mutant allele will spread through the circumjacent population. This process of mutation and selection is recurrent, and may effect many physiological traits, with differential mortality acting as a "filter", weeding out less fit individuals to produce a population with a range of phenotypic, ultimately genotypic, variation better adapted for survival within its particular, exigent, environment. The genotype of an individual organism becomes adapted to the environment by virtue of the superior survival characteristics of its "carrier", its reproduced phenotype.

It has long been known that human crania are morphologically variable. Numerous statistical studies of craniometric data have shown that it is possible to produce phenetic classifications that possess either geographical or chronological validity, studies of British Neolithic and Bronze Age crania have already been discussed in the previous chapter. On a global scale, statistical analyses are exemplified by that of Howells (1973) who successfully discriminated between samples of crania drawn from 17 populations using a suite of 57 measurements. The interpretation of these classifications in many, if not the majority, of craniometric studies is based on the premise that that adult cranial form is realised after rigid conformation, during growth, to an inherited genetic blueprint - the genotype. The genotype itself is assumed to have evolutionary roots which reach down deep into the Pleistocene. Skull form is therefore considered to be an adaptive feature, the result of natural selection.

As the timing of natural selection is dependent upon the rate of genetic mutation it is a long term process in humans, proceeding over spans of "evolutionary time" that may be considered in terms of tens of thousands of years. Humans anatomically modern in form are now thought to have a history of about 100,000 years (Lewin 1989). Natural selection is unlikely to signicantly alter anatomical form in what might be termed "historical time", that is to say periods of several millenia or less. It is this short term immunity to the effects of natural selection which has engendered the concept of anatomical, and thus cranial, immutability and encouraged the belief that skull form may act as a stable indicator of biological distance. Thus morphologically distinct, or at least statistically separable, groups of human crania are considered to be synonymous with breeding populations. When such a theoretical position is adopted then changes, or differences, in cranial morphology are viewed as being consequences of microevolution.

## Microevolution.

Ideally, an equilibrium distribution of alleles will occur within an infinite, random breeding, population. However, natural populations are finite entities and may be delineated by geographical or socio-cultural boundaries. Relative differences in allele frequencies may develop between regionalised populations as a result of genetic drift. Genetic drift occurs as genetic information is lost in a random fashion through failures of inter-generational transmission. There is a resultant decrease in intra-populational genetic variation. There is also, however, a corresponding decrease in inter-populational genetic similarity as allele frequencies are differentially maintained. This process is most marked in populations which are descended from a small group of individuals who carried only a portion of the genetic information available within a larger parent population. Such a situation may arise after a small scale migration (founder effect) or result from a drastic reduction in population after a natural disaster (bottleneck effect). Genetic drift is a microevolutionary process that promotes genetic diversification and heterogeneity. The reverse is true of gene flow which, as the name suggests, is a homogenising process whereby genes pass from a donor to a recipient population. This may occur in areas of population stasis where there are overlapping spheres of mate acquisition but it is more usual to consider gene flow in terms of an actual population migration, the population acting as a vector for gene transmission.

It is important to emphasise at this stage that microevolution is a principle, or set of principles, used by population geneticists to explain differences, or changes, in allele frequencies which they may observe to occur between populations. Microevolution operates at the level of the genotype, not the phenotype. Nevertheless, by using these principles to construct explanatory models it becomes possible to consider anatomical distance, or change, in terms of the presence or absence of contact between populations. Before such models are deployed, however, there are three simplifying assumptions which must be made. These are:

- That the cranial phenotype is a faithful reproduction of the cranial genotype. The environment must be assumed to exert no significant effect upon ontogenesis.

- That a multivariate, craniometric, data set is an accurate representation of cranial form.

- That a statistical measure of multivariate distance may be used as an analogue of genetic distance.

The validity of the first of these assumptions is examined during the remainder of this chapter, that of the second and third will be considered in subsequent chapters.

## Heritability of Cranial Form.

There have probably been hundreds of craniometric studies that have explained differences, or changes, in cranial morphology as being the visible manifestation of microevolutionary process. It is notable, however, that there have been significantly fewer studies of cranial heritability, studies which have attempted to assess the extent to which cranial form is heritable, and therefore genetically determined. Heritability studies commonly use a suite of measurements to represent skull form and the assumption is made that if the morphology of the cranium is determined by polygenic inheritance alone, with no environmental affects registered, then it is possible to arrive at a theoretical estimate of the degree to which morphology, expressed metrically, should correlate between genetically related individuals. By comparing observed with expected correlations the relative heritability of the cranial dimensions measured may then be assessed. Correlation coefficients between parent/child and sibling/sibling have been calculated, but rarely approach the theoretical norm (Susanne 1975; Bernhard et al 1980). In an attempt to reduce environmental interference to a minimum, Paganini-Hill et al (1981) carried out a study of 784 members of a religious isolate with a common lifestyle and reported a value of 60% expected correlation. Such heritability studies have been criticised as they are performed in relatively stable environmental conditions and marked changes in environment may induce correlative anatomical changes that completely override any heritability considerations. Thus, the significance of a 60% correlation in conditions of environmental stability is doubtful, the relative importance of the contributions made by the genotype and the environment to the final expression of cranial form remains to be defined.

The low estimates of correlation which attend studies of the heritability of cranial morphology are easier to understand when considered within their physiological context. Bone is popularly conceived of as being a functionally inert, structural, tissue; resembling in many ways its vegetative counterpart, wood. This conception is far removed from the truth, however. Bone is a living tissue and exists in a state of flux, it is continually renewing itself and in so doing has the potential to alter its shape. This mutability provides bone with the ability to morphologically "track" any changes in the conditions of its matrix, and a fuller understanding is fundamental for any comprehensive study of skull form, and its genesis.

## Bone Remodelling and Cranial Morphogenesis.

During growth, a bone maintains its required shape and proportions by a process of remodelling (Enlow 1990), which is well established in the foetal skull by the 14th week. This process entails the deposition of new bone on one surface being balanced by resorption on the opposite surface. The surfaces of growing bones are thus covered by a series of "depository" or "resorptive" growth fields. If a given periosteal surface of a bone has a resorptive field it will be balanced by an endosteal depository field and vice versa. Rates of resorption and deposition are not balanced, however. During growth, the rate of bone deposition exceeds that of resorption, thus allowing for both regional remodelling and overall enlargement. Growth remodelling allows bones to change location during growth, a process termed drift or transformation. Similarly, structurally important features of a bone can maintain their position or move as required. Despite constant remodelling, as a bone grows, it retains a basically recognisable shape. Remodelling occurs in response to forces acting upon the bone or its surrounding membrane, the periosteum. These forces may be passive in origin, arising out of surrounding tissue growth, or else result directly from the action of attached muscles. The physiology of bone growth and remodelling is discussed further in Appendix One.

The process of growth remodelling undermines any concept of bone which characterises it as being as a static, inert, tissue. Bone is, on the contrary, dynamic and capable of morphological response to a physiological challenge. This ability of bone to respond to changes in its microenvironment has enabled Moss to construct his "functional matrix" hypothesis (1969). This hypothesis suffers from a shifting terminology but essentially postulates that the size, shape and location of a cranial bone is determined as a response to its physiological matrix. This matrix includes "soft" tissues such as the brain, eyes, muscle and teeth, but also "functioning spaces" - the oral and nasal cavities and the pharynx. Thus, although bones would be continually displaced in space by alterations in the size parameters of their matrices, it is envisaged that the bones of the skull maintain their overall cohesion and correct anatomical configuration by growth remodelling (Figure 7.3). The functional matrix hypothesis, if accepted, has important implications for any study of cranial form and its heritability. It suggests that the adult cranium must be considered as the end product of a continuous sequence of morphological adjustments that began in the foetus. If this is the case, then adult cranial form cannot be considered to be a strict interpretation of a genetic "blueprint", it would not be significantly heritable and metric analyses would be of no value for estimations of biological distance.

There is a broad measure of agreement that the functional matrix theory provides an accurate model of calvarial growth; as the neural capsular matrix expands

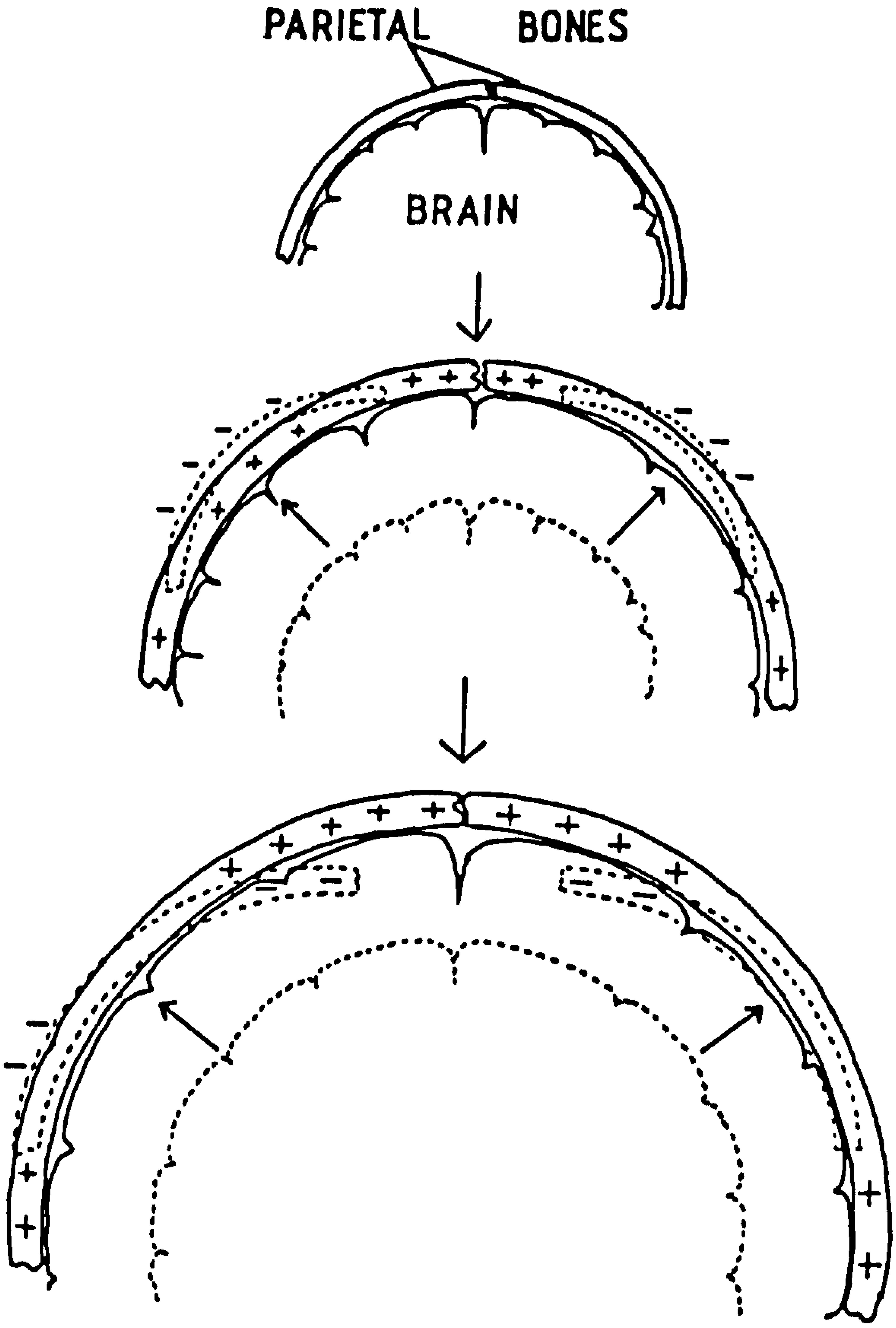



Figure 7.3. Growth Remodelling.

Schematic section of the growing cranium which illustrates the simultaneous reconfiguration and growth, by processes of selective resorption and deposition, of the two parietal bones in response to the expanding tissue mass of the brain.

(+ = deposition; - = resorption).

outwards the flat bones of the cranial vault are carried with it, maintaining contact with each other by appositional growth at sutures and conforming to alterations in brain shape by remodelling. However, although Moss denies bone-forming cartilage any primary role in the growth process, his view is disputed (van Limborgh 1972; Johnston 1979), for it is apparent that the cranial base retains the facility for independent growth and development. Its growth remains relatively normal in cases of congenital malformations of the brain such as hydrocephalus and anencephalus; furthermore, it has been shown experimentally that chondrocranial growth is only slightly influenced by mutilating other cranial structures. In contrast, syndromes which affect cartilage development may result in the underdevelopment of midline cranial base structures. Latham and Scott (1970) have pointed out that although several cartilage synchondroses are operational in the foetal and early post-natal chondrocranium they rapidly diminish in number, that although the sphenooccipital synchondrosis may play a principal role in cranial elongation, there is a progressive increase in the importance of growth by displacement, which might include muscle "pull" as well as the expansionary "push" of growing soft tissues. Thus, overall, cranial morphology is thought to be to some extent predetermined by the genetic control of chondrocranial growth, but it is also sensitive to the requirements of its tissue matrix.

Phenotypic Plasticity and Genetic Diversity.

It has already been noted that in studies of craniometric data episodes, or trajectories, of morphological change are often considered entirely in terms of the microevolutionary processes of genetic drift and gene flow. It has been argued, however, that it is not clear what, if any, empirical data can be mustered to support this assumption of genetic determinism; the assumption may be, as a major proponent of such studies has admitted, ungrounded:

> "One school of anthropologists, in fact, holds that such characters are too responsive to effects of selection and of the environment to be reliable indicators of the genetic sources or relations of a population. Indeed, we have no proof to the contrary."
>
> (Howells 1988: 98).

This statement is not surprising. It is no longer credible to regard the biological process of ontogenesis as being the victim of a strict genetic control. It is becoming increasingly clear that a single genotype is often able to produce a range of different, environmentally suited, phenotypes, a phenomenon known as phenotypic plasticity (Stearns 1982; Calow 1983). Thus, the structural or functional characteristics of a biological system may, in the first instance, be genetically determined but its ultimate physical manifestation is modulated by the environment. The genes, in effect, provide an outline plan. They define the mechanisms by which ontogenesis must proceed and the limits within which morphogenesis might occur. Within the confines of this outline plan, however, there remains much scope for variable development and the manifestation of environmental effects.

It must also be borne in mind that there is a large amount of genetic diversity maintained within the gene pool of a human population, it is a corollary of this that there must also be a range of different phenotypes expressed within a population, some of which will be better adapted to the environment than others, and which will therefore constitute the majority type, although there will always be present a range of less well adapted phenotypes. If the enviroment should change in any way, however, the relative fitness of the various phenotypes might alter accordingly, so that a previously minor type acquires better survival characteristics and becomes the predominant type. This process of genetically-based, morphological change is not absolute but, rather, it is a statistical phenomenon of changing allele percentages. It is not dependent upon ongoing chromosome mutation but instead shifting patterns of environmental selection act upon a range of pre-existing variation, it is therefore a potentially more rapid process of change than that of natural selection in its true, evolutionary, sense.

When it is realised that phenotypic plasticity may, in itself, be an attribute of the phenotype, and thus variable in its expression; when it is remembered that the cranial skeleton must, in part, conform to the configuration of its matrix; then the complexity of the mechanisms which underlie cranial morphogenesis is better appreciated. Any genetic influence upon cranial form would be remote and, in part, indirect. This is reflected in the relatively low correlations observed in heritability studies. It is overly simplistic, therefore, to consider inter-generational transformations of cranial form in terms of microevolution alone, there may also be immanent the effects of a changing environment.

## Conclusion.

The anatomy of the human cranium represents a structural compromise to the spatial demands of three autonomous physiological processes: respiration, mastication and neural function. An alteration in the operational characteristics of any one which necessitates a change in the physical dimensions of its skeletal support will necessarily result in compensatory changes to the complete structure. Thus, overall morphology is sensitive to a variety of environmental and evolutionary forces, of which it is unlikely that all have yet been identified. Some of the better characterised processes of morphogenesis will be considered in the next chapter.

## Chapter Eight.

# THE HUMAN CRANIUM II: MORPHOGENESIS.

### Introduction.

The idea that the human skull may be used as a stable indicator of genetic distance is a legacy of the cranial studies performed during the late 19th and early 20th centuries. It is disconcerting to discover that, since then, there has been no concerted programme of research initiated to investigate the veracity of this idea, and perhaps also to explode a myth. Nevertheless, several hypotheses have been developed in the literature which provide the material for a more systematic investigation of cranial form and its genesis. There follows, in this chapter, an attempt to gather together these hypotheses to produce a more coherent framework of investigation. In so doing tentative models of morphological change might be suggested and utilised in explaining the reasons for the morphological disparity thought to exist between the excavated crania of Neolithic and Bronze Age Britain.

### Artificial Cranial Deformation.

The physiological requirement for the calvarium to adapt to the conformation of its surrounding matrix renders it peculiarly vulnerable to deformation in response to the application of external pressure during childhood. Such deformation may be intentional or unintentional and may persist into adulthood. Intentional deformation is produced by tightly binding the head with bandages to produce a circumferential depression, or else inserting small hard boards to flatten particular areas of the skull, often the frontal and occipital bones (Ubelaker 1989: 96). Unintentional deformation usually occurs as a result of cradle-boarding, when an infant is bound to a flat board and kept immobile for long periods of time. The continual pressure of the board agaist the back of the head leads to occipital flattening. It has been observed that a round head, with a natural tendency towards brachycephaly, is more prone to this type of deformation than one with a projecting occiput (Ehrich & Coon 1948: 183). It has also been demonstrated that the crania of infants born prematurely have a tendency to dolichocephaly. The underdeveloped state of their neck musculature, together with their relatively large head mass predispose these infants to lay with their heads resting on their sides, and thus compressed laterally. Again, the dolichocephaly so produced persists into adulthood (Baum & Searls 1971).

## The Effects of Cultural Innovation upon Cranial Morphology.

Human teeth are functionally dimorphic. The incisors and canines, which comprise the anterior dentition, are used primarily to grip and to tear while the molars and premolars, the posterior dentition, are used more for actual mastication. A continuing process of dental reduction has been demonstrated to have occurred throughout the later Pleistocene and the Holocene (Brace et al 1987; Frayer 1977), a process which has affected the size of each individual tooth of both the lower, and upper, dental arcades (Figure 8.1). However, the aetiology of posterior dental reduction appears to have differed from that of anterior reduction. Molar diminution has been a long term evolutionary trend, a characteristic feature of hominid phylogenesis. It is thought that this was a consequence of the increasingly important role played by meat in the hominid diet, meat required less preparative grinding by the molars than poorer quality plant foods. In contrast, the anterior dentition tended to increase in size throughout the earlier Pleistocene, this trend of incisor size increase reached its apogee with the Neanderthal, thereafter incisor size decreased at a similar rate to that of the molars (Figure 8.1).

For earlier hominids, the anterior dentition had probably functioned as a "third hand", it is known from ethnographic sources that the incisors may be used for a variety of manipulative purposes including the holding of bone drills, straightening wooden spear shafts and stripping hides (Wolpoff 1980: 178). It has been argued that, from the beginning of the Upper Palaeolithic, the continuing elaboration of evermore specialised tool kits would have progressively reduced the need to use the front teeth for such purposes (Wolpoff 1980: 278; Brace et al 1987). The post-Neanderthal acceleration of incisor reduction is, therefore, best viewed as an epiphenomenon of increasing cultural complexity. At the same time, innovations in the field of food preparation , such as the adoption of "earth oven" cooking techniques and of ceramic vessels to boil or pulp food, would have reduced the need to intensively chew food and thus have allowed further molar diminution (Frayer 1977, Brace et al 1987).

Large tooth size would perhaps possess a selective advantage in that primitive methods of food processing would be associated with high rates of dental attrition. Small teeth would rapidly wear down and, without teeth, it would be difficult to orally macerate food. Additionally, once dental enamel is worn away the underlying pulp would be exposed and life threatening infection might ensue. It might even lead to suicide, dental abcesses are the only reported cause of suicide in some south seas communities (Davies 1972). In consequence, it has been suggested that an increasingly elaborate cultural repertoire allowed the relaxation of selective pressure acting to maintain large tooth size as a necessary adaptation, with concomitant

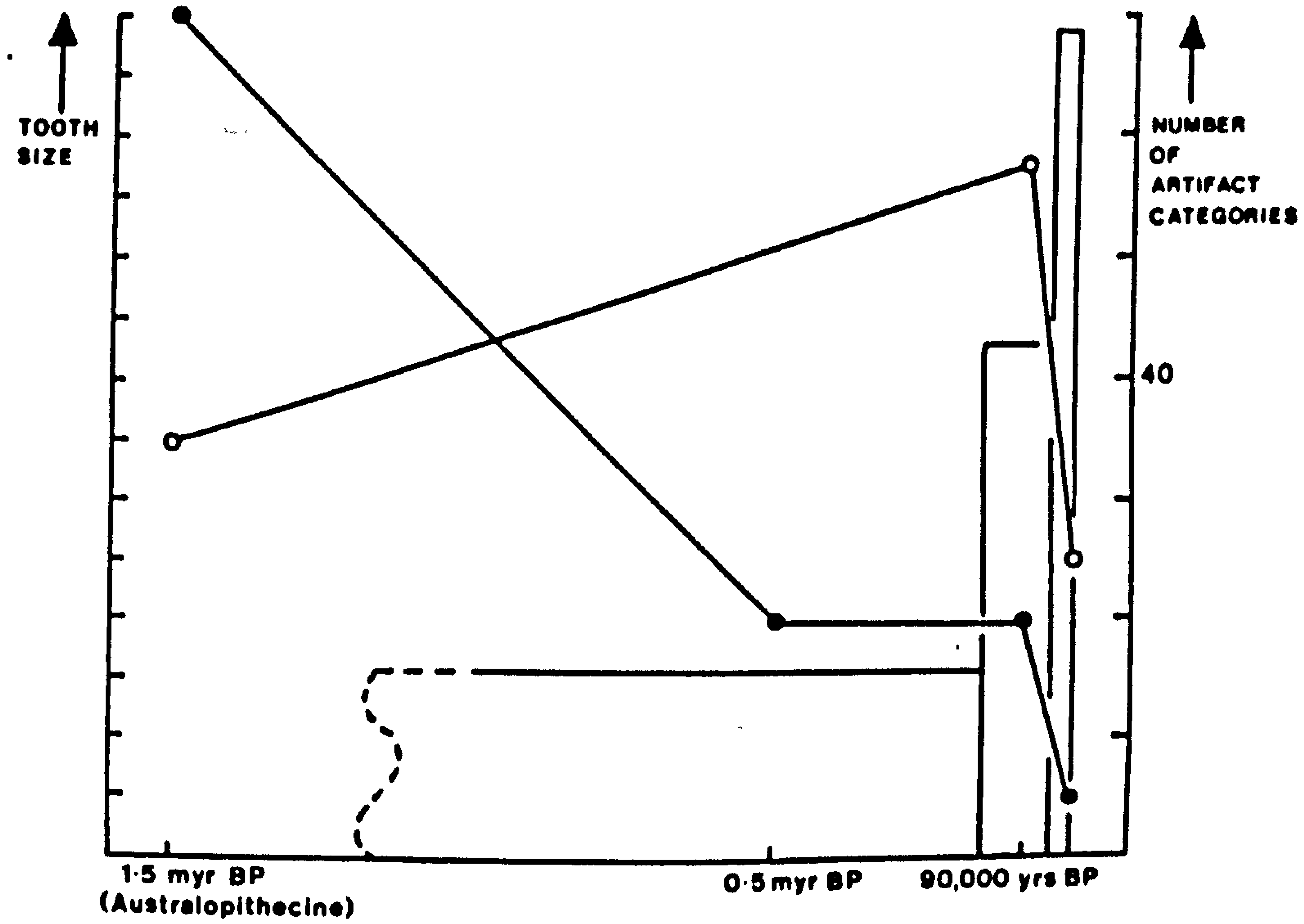



Figure 8.1.

Dental Reduction and Technological Elaboration.

Line graph - relative change in tooth size.
Filled circles = molars; open circles = incisors.
(After Brace & Montagu 1978: 361).

Histogram - number of distinct implements comprising cultures in Atlantic Europe.
(After Lewin 1989: 118).

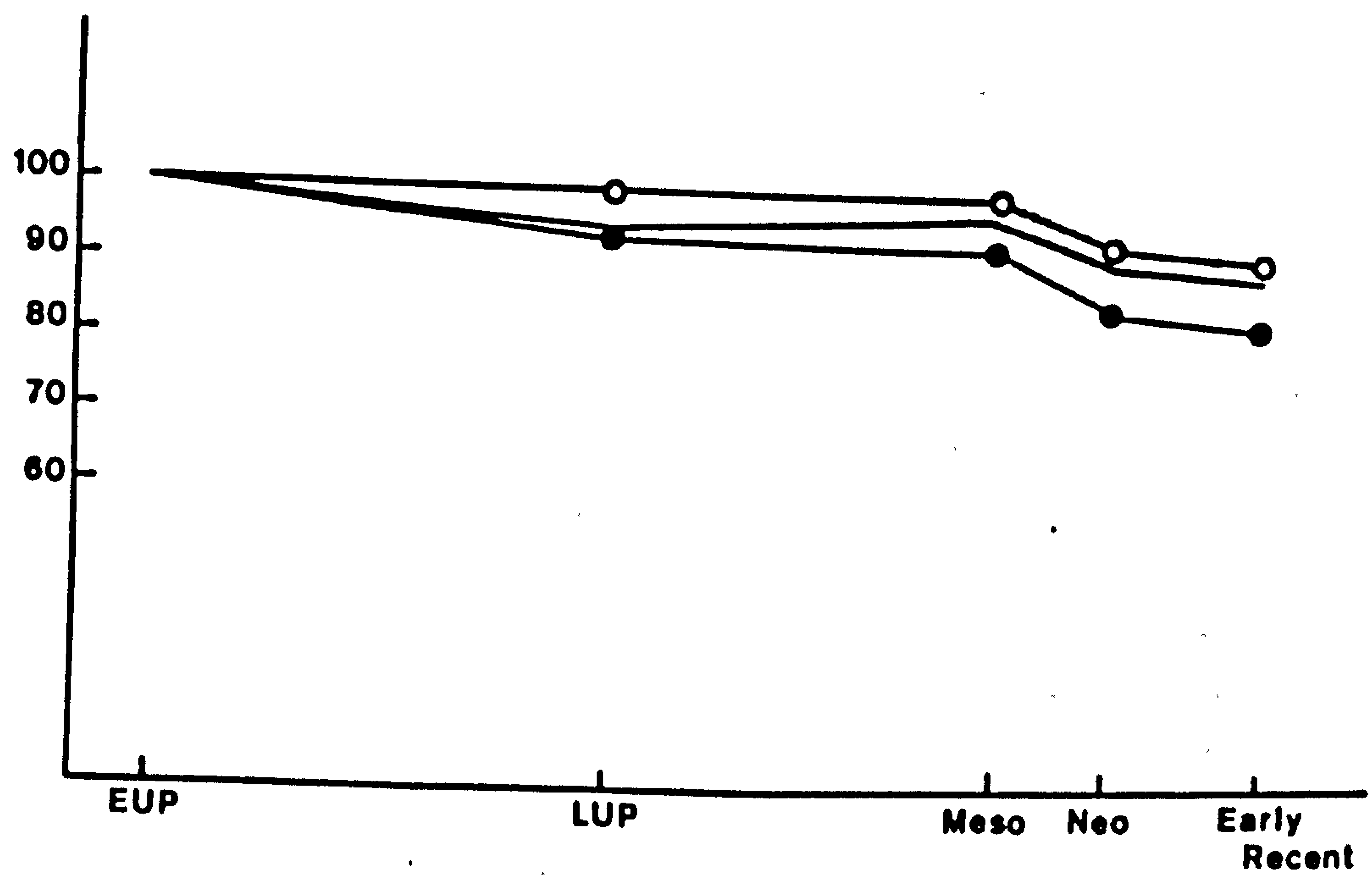



Figure 8.2.

Reduction in Tooth Size during the Later Pleistocene and the Holocene.

Filled circles = total occlusal area;
Open circles = maxillary incisor breadth;
Solid line = maxillary incisor length.

(Information from: Calcagano 1986; Frayer 1977; Brace et al 1987).

dental reduction (Brace et al 1987). Not all workers agree with this hypothesis, however. The rate of dental reduction that occurs from the Upper Palaeolithic onwards does not appear to be constant, there seems instead to be periods of more rapid reduction between the earlier and later upper Palaeolithic, and again between the Mesolithic and Neolithic (Figure 8.2) (Calcagano 1986; Frayer 1977). These periods of rapid reduction were coincident with horizons of cultural innovation (Frayer 1977: 118). An alternative proposal, therefore, is to see the trend to smaller teeth as being, in itself, a selective adaption (Frayer 1977: 118).

Although significant, dental reduction in itself is unlikely to have had a remarkable effect upon cranial morphology. Smaller roots, it is true, would allow accommodation within a mandible or maxilla of reduced dimensions, but the absolute volumes involved are small. However, the cultural advances which rendered teeth increasingly redundant for purposes of mastication and manipulation would also have caused a parallel redundancy of the cranial musculature, which would require less development for the efficient mechanical operation of the jaws. Alterations in muscle mass and size would be expected to exert a marked influence on cranial morphology, although dental dimorphism would again elicit a differential response.

Molar grinding is powered by the masseter and medial pterygoid muscles, which attach to the lateral and medial aspects, respectively, of the mandibular ramus (Figure 8.3). The two medial pterygoid muscles originate on each side of the sphenoid bone, a central component of the cranial base, while the origins of the masseters are to be found on the zygomatic, or cheek, bones. The dwindling of this musculature allows a corresponding gracilisation of its supporting skeleton. There is a trend towards reduction

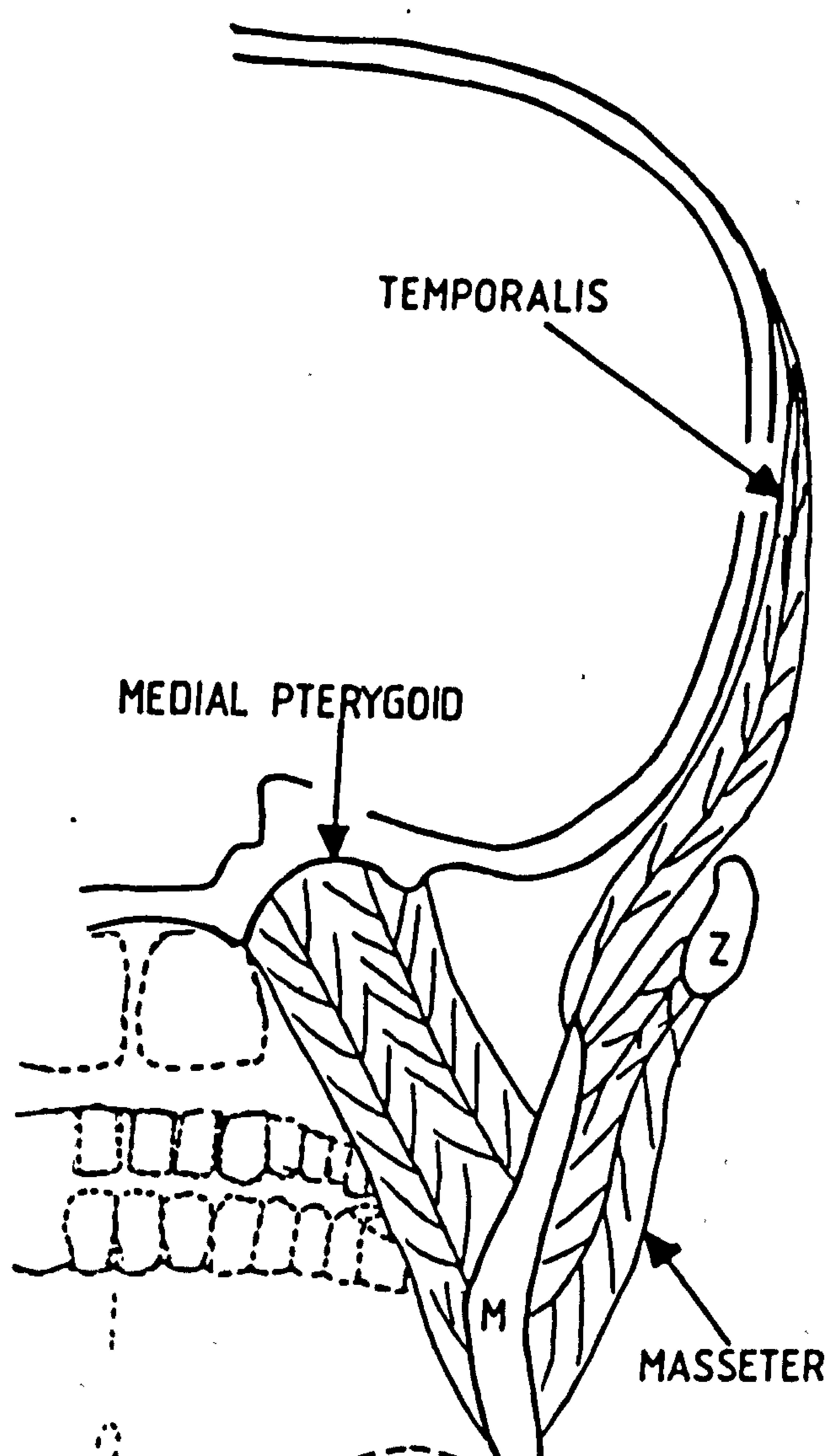



Figure 8.3.

Schematic Frontal Section of the Human Cranium showing the Major Muscles of Mastication.

in both size and lateral extension of the zygomatic arch to which the masseter is attached. Thus crania with a set of muscles suitable for prolonged and heavy chewing will have broader and heavier, perhaps also shorter, faces than those confronted by a soft food diet (Brace & Montagu 1978: 453). This has been confirmed by animal experiments where it has been shown that moderate differences in the hardness of diet provided for rats during their growth period affects the medio-lateral dimensions of the adult maxilla. It was suggested that the wider maxilla of the animals fed on a hard diet resulted from increased muscular stimulation during more prolonged, or more difficult mastication (Beecher & Corruccini 1981).

There is a different set of muscle relationships serving the needs of the anterior dentition when it is used to grip and to pull (Wolpoff 1980: 178). To counteract the anterior loading produced by a pulling action large forces are generated by the temporalis, particularly posteriorly, and also by the neck, or nuchal, musculature. Consequent enlargement of these muscles is accommodated by a backwards extension of the cranium, thus producing a longer, and narrower, skull (Figures 8.4 & 8.5). In addition, large forces are produced by enlarged masseters and anterior temporales to counteract the vertical loading produced by frontal bite. Again, any anterior enlargement of these muscles produces a larger, and more forwardly positioned, zygomatic arch. Although the diagram reproduced here is of an early hominid, the same set of mechanical/skeletal relationships has been used to explain the unique morphology of the present day Inuit cranium. Despite their arctic habitat, the Inuit possess one of the most dolichocephalic crania in the world, the legacy of the unusually large size of their temporales muscles. Their prominent zygomas are, similarly, associated with enlarged masseters and temporales. The Inuit habitually use their anterior dentition as a "third hand" and their well developed musculature enables them to generate a bite force double that of modern Europeans (Hylander 1977). Despite their powerful jaws, however, Inuit teeth are not particularly large, probably because of their high quality, largely meat, diet. This confirms that although reductive trends presenting in teeth and muscle may be parallel, they are not necessarily associated.

It is evident from the fossil record that, in the long term, the progressive decrease in both tooth and muscle size has been associated with an increasing gracilisation of the human cranium. Weidenreich (1945: 17) has shown that the differences between ectocranial and endocranial measurements, an estimate of bone robusticity, have decreased through time (Table 8.1). There has also been a corresponding anatomical modification of the cranium with a reduction in the size of the maxilla and mandible resulting in their more infero-posterior placement relative to the cranial vault which has, in turn, become relatively shorter, but broader (Wolpoff 1980: 299). Again, the relevance of these observations to more recent populations may be questioned but studies of Nubian material have monitored this process in crania dating from the Mesolithic period (c9000 BC) through to the early Christian period (c1100 AD) (Carlson & van Gerven 1977). These diachronic changes in both the structure and the morphology of the human cranium are no doubt propelled by the combination of genetic modification and phenotypic plasticity described in the previous chapter. The rate at which these changes might occur remains uncertain, however, there is no clear indication of how long a "lag phase" might exist between cultural innovation and physiological response. The empirical data necessary for establishing this rate of change remain currently unavailable.

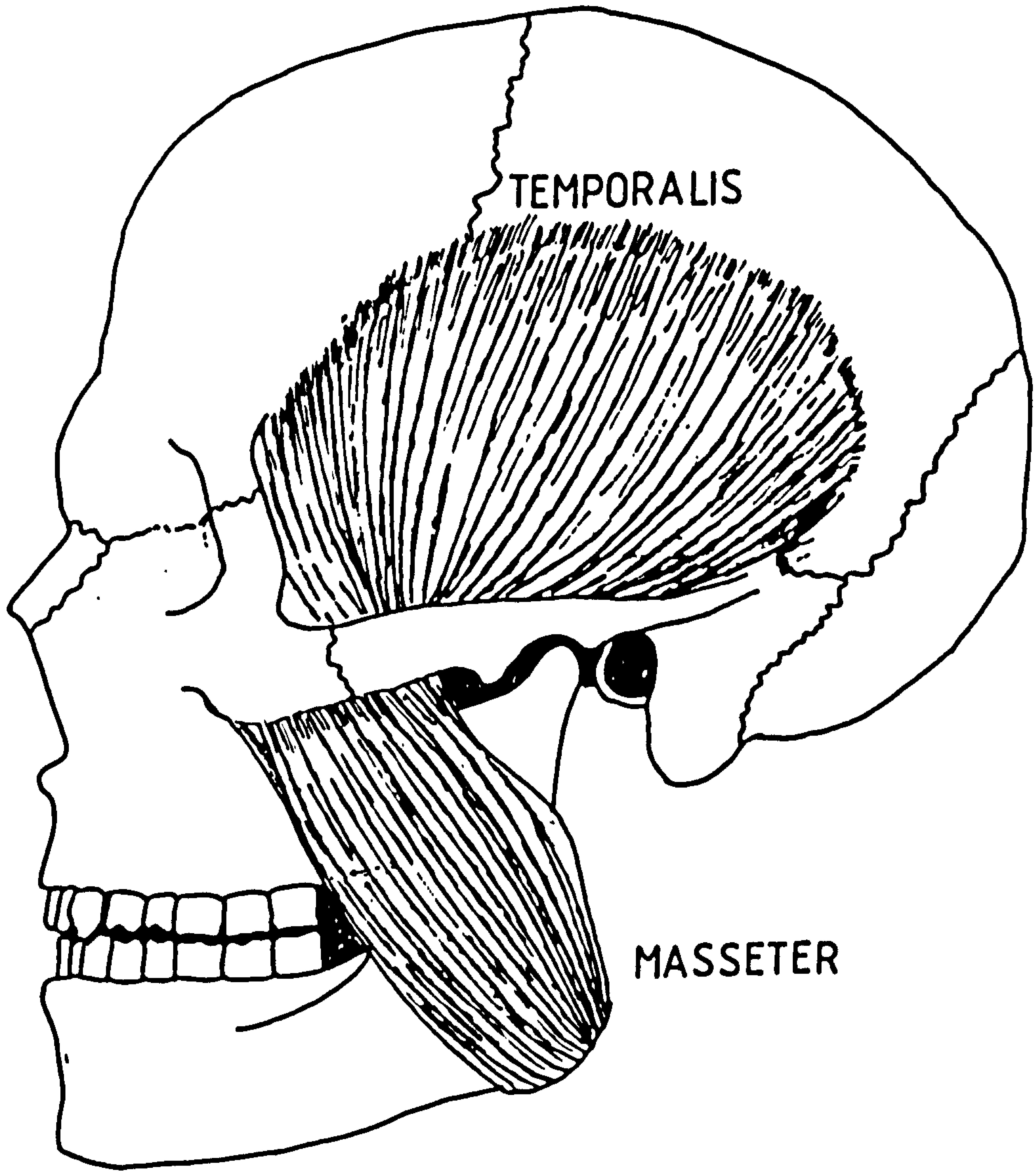



Figure 8.4. Temporalis and Masseter Muscles.

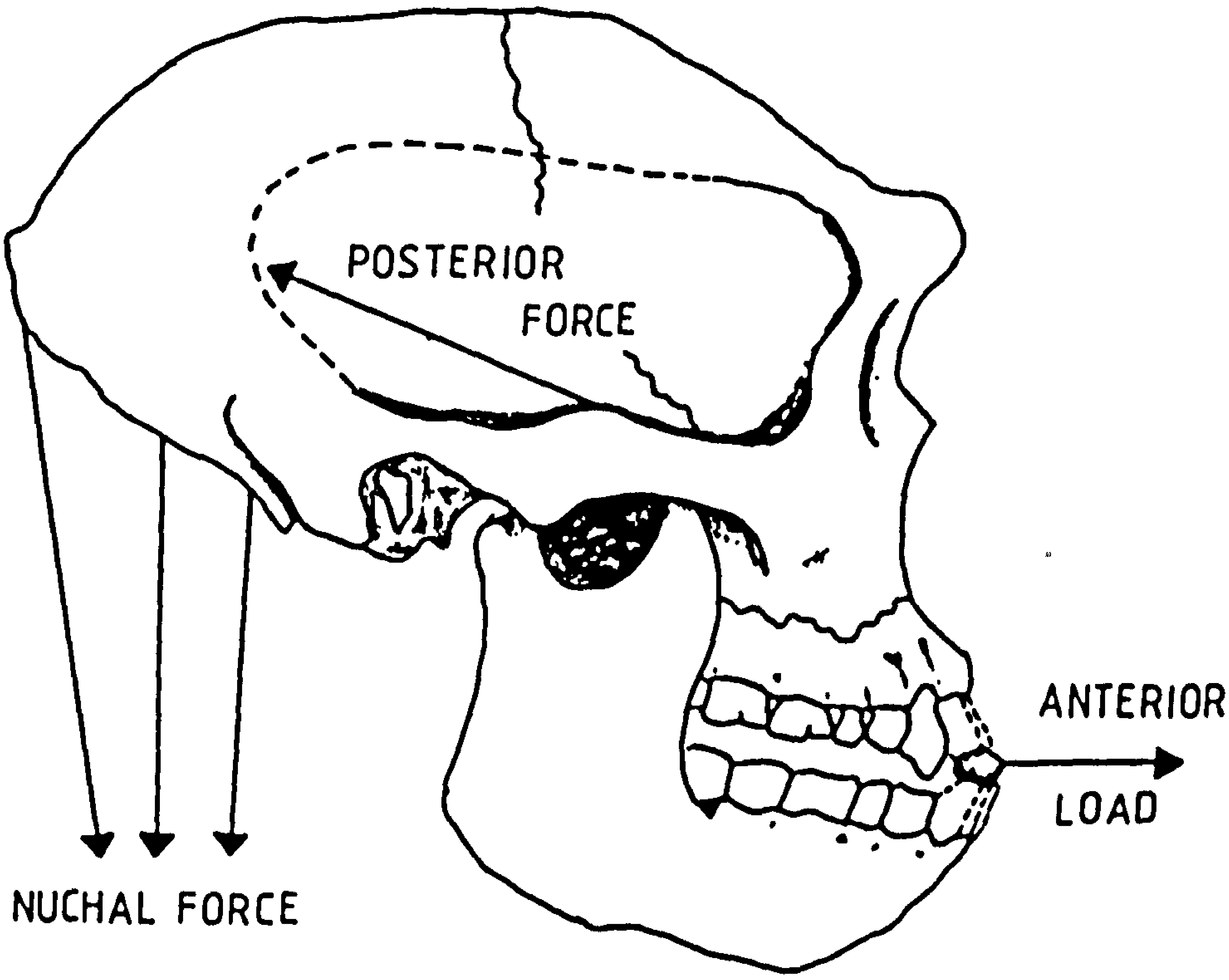



Figure 8.5.

Muscle Forces Generated by Using Anterior Dentition to Pull.

(After Wolpoff 1980: 178).

Table 8.1. Cranial Gracilisation.

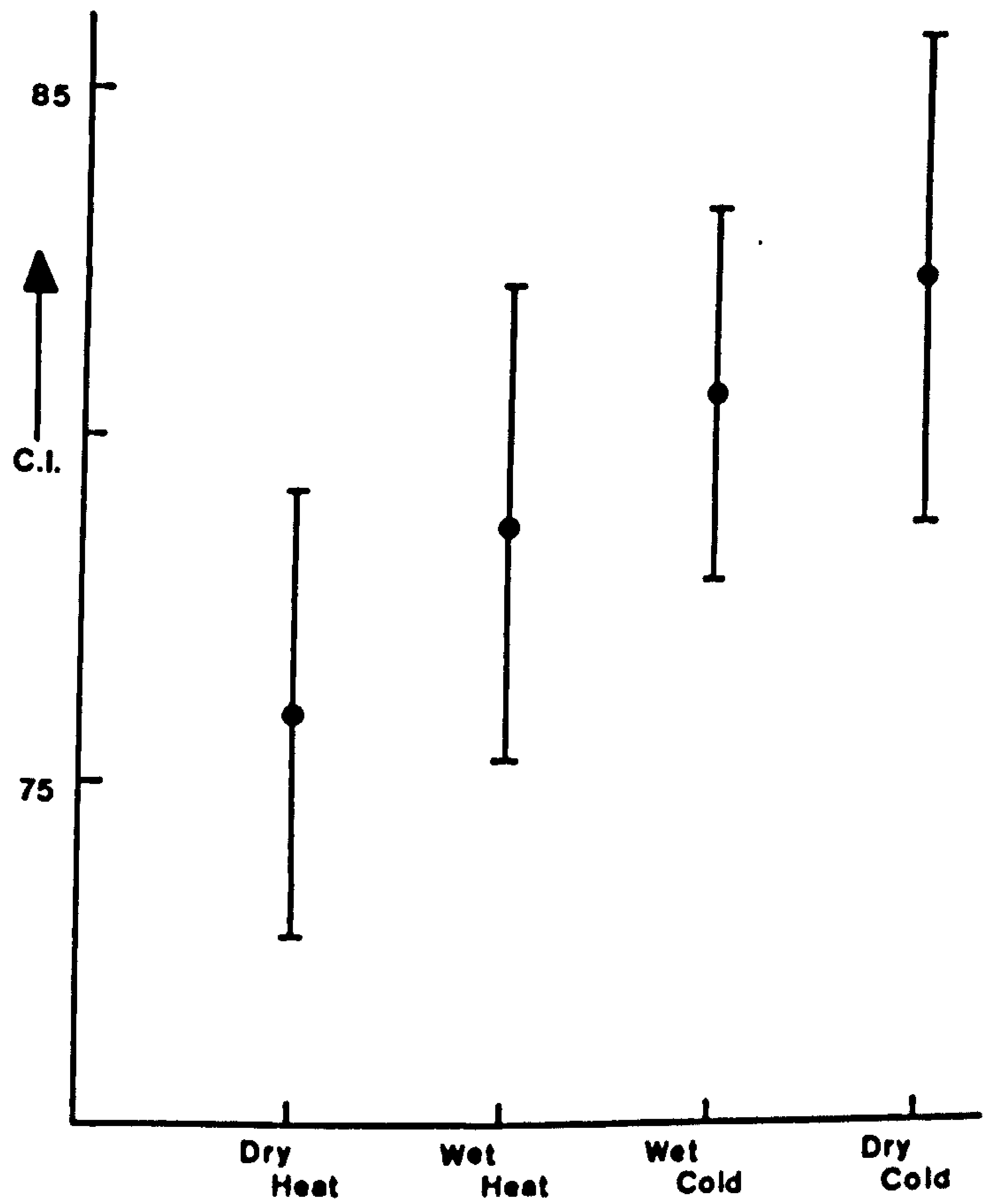
(After Weidenreich 1945: 17)

| | Homo erectus. | Early Homo sapiens. | Modern Homo sapiens. |
|---|---|---|---|
| % Difference between endocranial and ectocranial: | | | |
| length | 30.3 | 24.1 | 12.8 |
| breadth | 13.3 | 9.8 | 7.2 |

## Climate and Head Shape.

Cephalic, or Cranial, Index has been shown to covary with climate on both a continental and a global scale (Beals 1972; Beals et al 1983, 1984; Hiernaux 1977; Guglielmino et al 1979; Crognier 1981), with Cephalic Indices ranging from 76 in hot, dry, climates to 81 in glacial areas (Figure 8.6). Known distributions would suggest that both humidity and temperature are important determinants of cranial shape and this has been confirmed by a reanalysis , carried out by Guglielmino et al (1979), of the craniometric data collected by Howells (1973). Howells had used discriminant function analysis to organise his data set (derived from 17 populations from a variety of locations distributed globally) and had found that the first discriminant function (DF1), which produced maximum discrimination between samples, separated European, American and East Asian populations from Africans and Australians. This was in contradiction of genetic data derived from blood group, enzyme and other protein polymorphisms which suggested that African and European populations were more closely related to each other than to either Australians or Americans. Guglielmino and his co-workers showed that, in fact, DF1 was strongly correlated with temperature and that a subsidiary DF, number 9, was correlated with humidity. Thus dividing up the populations by means of DF1 was, in effect, grouping them together on the basis of climatic association. By using DF2 instead the structure of craniometric similarity that emerged matched that of genetic similarity. It was also demonstrated in this study that temperature was negatively correlated with vault breadth and facial height but positively correlated with alveolar prognathism. Humidity was positively correlated with cranial length.

Altered head shape may, in part, be representative of a more general, climate induced, somatic mutability (Brace




<u>Figure 8.6.</u>

<u>Positive Correlation of Cephalic Index with Climate.</u>

(After Beals 1972: 89).

et al 1978: 432; Hiernaux 1977; Ruff 1991). Human metabolic integrity is preserved by enzyme systems which achieve maximum activity at 37°C, body temperature is maintained at this optimum both by overall shape and by a series of physiological mechanisms, a combination which acts to increase thermal output after the catabolism of stored energy reserves during episodes of strenuous physical exercise, or else decrease thermal output in conditions of low ambient temperature. Considerations of shape generally revolve around alterations in the mass:surface area ratio of the body. Thus, in hot climates, the surface area is maximised to promote heat loss through direct radiation, air current convection and perspiratory evaporation. Conversely, in cold climates, these mechanisms are retarded by a reduced surface area. The effects of temperature on body shape may be confounded by those of humidity, however, with drier climates favouring a lower mass:surface area ratio than wetter climates. If the body and head are considered as straightforward energy conserving/dissipating structures, then changes in their mass:surface area ratios can be explained as simple anatomical adjustments towards geometrical optima. The relationships that exist between head shape, overall body shape and climate are complex, however. Realised cranial morphology is probably best considered as an expression of compromise, a compromise reached between two, contradictory, processes of climate-induced, anatomical, shape change.

Ruff (1991) has argued that, when considered in its entirety, the human body most closely approximates a cylinder in shape, and it is a property of cylindrical objects that their volume:lateral surface area ratio is a positive correlate of cylinder breadth, it is independent of height. Thus, in order for the human populations of colder climates to increase their body mass:surface area ratios, an increase in breadth-related body dimensions is required, expressed both antero-posteriorly and laterally. The bodies of people living in cold climates tend to be, on average, bulkier than those belonging to individuals from hot climates. When the head, particularly the calvarium, is considered in isolation, however, it is not cylindrical in shape but instead more closely resembles an ovoid sphere. As the highest possible volume:surface area ratio of any object is that achieved by a sphere, it is a prior expectation that, in cold climates, there would be a tendency for the calvarium to adjust in shape towards greater sphericity. This would require equalisation of the three linear dimensions of the calvarium, which remain unequal however in all human populations. The antero-posterior breadth (cranial length) exceeds the lateral breadth which, in turn, is greater than the height. Thus, to approach the proportionality of a sphere there would be a requirement for decreased length, increased height and an unchanged breadth. There is a conflict of geometry, therefore, between the morphological optima needed to be achieved by, on the one hand, the calvarium as a unique structure, and, on the other, by the calvarium as an integral component of the body. In consequence, there follows a morphological compromise which, in cold climates, permits lateral expansion of the calvarium with a smaller degree of longitudinal shortening and, perhaps, an increase in height. The resultant trend is towards brachycephaly . The opposite, of course, holds true for individuals living in hot climates.

It has long been maintained that the nose is, in itself, an anatomical structure which is responsive to climatic variation (Thomson & Buxton 1923; Brace & Montagu 1978: 427-431; Franciscus & Long 1991; Weiner 1954; Wolpoff 1968). Nasal regulation of somatic heat and moisture exchange with the environment is thought to be important, not only for the maintenance of body temperature at an optimal 37°C, but also for the protection of the mechanisms of gas exchange which proceed in the pulmonary alveoli and which are sensitive to departures of ambient temperature and humidity from physiological norms. The external nose and interior nasal fossa, together, provide a mucous secreting epithelial surface which serves to warm and humidify inspired air. A narrow, projecting, nose provides a relatively greater surface area of epithelium and is thus often present amongst the populations of cold, or arid, climates. By contrast, in hot, or humid, climates a broader, but shorter, nose presents a proportionately reduced amount of epithelial surface which acts to retard the recovery of heat and moisture from expired air. Alterations in the size or shape of the internal nasal fossa would need to be accommodated by a change in the conformation, or flexure, of the cranial base and might therefore be a contributory factor in the overall cranial response to an exigent climate.

In theory, nasal breadth should cline in association with climate, being positively correlated with heat and/or humidity, negatively correlated with cold and/or aridity. Several regional studies have indeed shown this to be the case (Wolpoff 1968; Hiernaux 1977), as have a number of more wide ranging ones (Weiner 1954; Thompson & Buxton 1923, Franciscus & Long 1991; Crognier 1981). However, when viewed globally the position is less clear, across the Eurasian land mass a reversal of the expected cline is revealed. The nasal breadth of the inhabitants of central Asia tends to be greater than that of those dwelling in more temperate, and thus warmer and wetter, areas of Europe. The reason for this is not clear, but the suggestion that the inhabitants of central Asia are but recent arrivals, having been resident for a few millenia only (Brace & Montagu 1978: 430), has more the appearance of special pleading than of explanation. There is then, at present, little evidence to suggest, in northern latitudes at least, that nose form can be considered to react to the vagaries of climate in an anatomically consistent manner, and its effect on cranial morphology must therefore remain questionable.

Beals (1984) has suggested that 30-40% of the variance known to exist between the Cranial Indices of various populations might be attributed to thermoregulatory response and has suggested that this variation in morphology is adaptive in nature and that the rate of change can be measured by reference to the New World, first colonised about 15000 years ago. Thus, the difference in Cranial Index between populations of the polar and tropical zones will have occurred within that timespan and a rate of change can be estimated. Unfortunately work with migrant populations has suggested that the response of head shape to climate may well be a developmental, not adaptational, feature. Kobyliansky (1983) has convincingly demonstrated that, in Israel, the first generation offspring of immigrants from eastern and central Europe are more dolichocephalic than their parents, and that their Cephalic Indices approximate the values found amongst Israelis of Middle Eastern extraction. In the eastern European case there was a shift in mean index from 83.6 to 77.7. A similar process may underlie Boas' (1910-13) observations that, in the United States, children of south Italian immigrants were more brachycephalic than their parents while the reverse was true of children with parents of east European origin. (There may have been other factors at work however. Keith observed that the head shapes of third generation immigrants of both western and eastern European descent were indistinguishable, and suggested it was the result of a uniform, American, diet (Keith, quoted in Davis 1972: 42)). Thus the rate of climatically associated cranial change is also uncertain, although immigrant data strongly suggests that it might be rapid, and should perhaps be considered as an inter-generational event.

## Conclusion.

Cranial morphogenesis is sensitive to a variety of environmentally derived modifiers which exert their influence both directly, during ontogenesis, and indirectly by altering the relative fitnesses of varying genotypes. In this chapter three aetiologies of morphological change have been discussed, these are:

- artificial constraint,
- cultural innovation,
- thermoregulatory response.

It is unlikely, however, that all such modifiers have been identified. The effects of childhood malnutrition on developing cranial form are not known, although studies on rats have suggested that muscle development might be sacrificed in order to maintain the integrity of the brain. There is an associated underdevelopment of the facial skeleton with reorientation of the cranial base and calvarium (Pucciarelli 1980, Pucciarelli & Oyhenart 1987). The possible influence of geology, transmitted through diet, on cranial form also remains to be investigated; although Kobyliansky has, somewhat enigmatically, referred to a Russian study in which significant correlations were shown to exist between head shape and the soil concentrations of various elements. Without a detailed catalogue of cranial morphogens, and in the absence of any substantial body of empirical evidence relating to the rates of morphological change, it might be claimed that any study of cranial variability is flawed from the outset, perhaps fatally so. Indeed, Renfrew has recently suggested as much:

> "Craniometry, the study and measurement of human skulls, has in recent years enjoyed about as much prestige in scientific circles as phrenology."
> (Renfrew 1987: 4).

In the following chapters, it will be shown that such a suggestion is unduly pessimistic and that, on the contrary, it is indeed possible to derive some meaningful, if limited, conclusions from a craniometric study of the prehistoric inhabitants of Britain.

## Chapter Nine.

## CRANIOMETRY I: METHODS.

### Measurement Technique.

There is a wide range of internationally defined and standardised measurements available for use in the definition of cranial morphology, but it was realised from the outset of this study that selection from the available repertoire would be severely constrained by the generally poor state of preservation of the material under study. A suite of 20 measurements was eventually chosen which provided overall description of the calvarium and naso-maxillary complex (Figures 9.1 - 9.3). The choice of measurements was influenced both by their discriminatory potential (Sokal et al 1987: 18) and by the survival characteristics of the necessary landmarks in the material under study (Brothwell & Krzanowski 1974). In multiple inhumation deposits the cranium and associated mandible are often separated and it is difficult to ascertain correct, matching, identities; measurements of the mandible were therefore not included in this study.

To achieve comparability with previously published studies of British crania the measurements taken were as described in Brothwell (1981). To facilitate the computer handling of the data the abbreviations used in describing the measurements follow the system introduced by Howells (1973) although they differ in their details. The accepted British equivalent is given in parentheses after each measurement definition. The measurements used were as follows:

GOL - Maximum cranial length. Greatest length in median saggital plane from glabella to the most posterior point on the occipital. (L).

XCB - Maximum breadth. Greatest bi-parietal breadth, taken at right angles to the mid-saggital plane. (B).

WCB - Minimum frontal breadth. Smallest diameter between the temporal crests on the frontal bone. (B').

ASB - Bi-asterionic breadth, the diameter between the asterions. (Biast.B.).

BBH - Basi-bregmatic height, from the basion to bregma. (H').

BNL - Basi-nasal length, from the nasion to the alveolare. (LB).

FRK - Frontal arc. The surface distance from nasion to bregma. (S1).

PAK - Parietal arc. The surface distance from bregma to lambda. (S2).

OCK - Occipital arc. The surface distance from lambda to the opisthion. (S3).

FRC - Frontal chord. Minimum linear distance from nasion to bregma. (S'1).

PAC - Parietal chord. Minimum linear distance from bregma to lambda. (S'2).

OCC - Occipital chord. Minimum linear distance from lambda to the opisthion. (S'3).

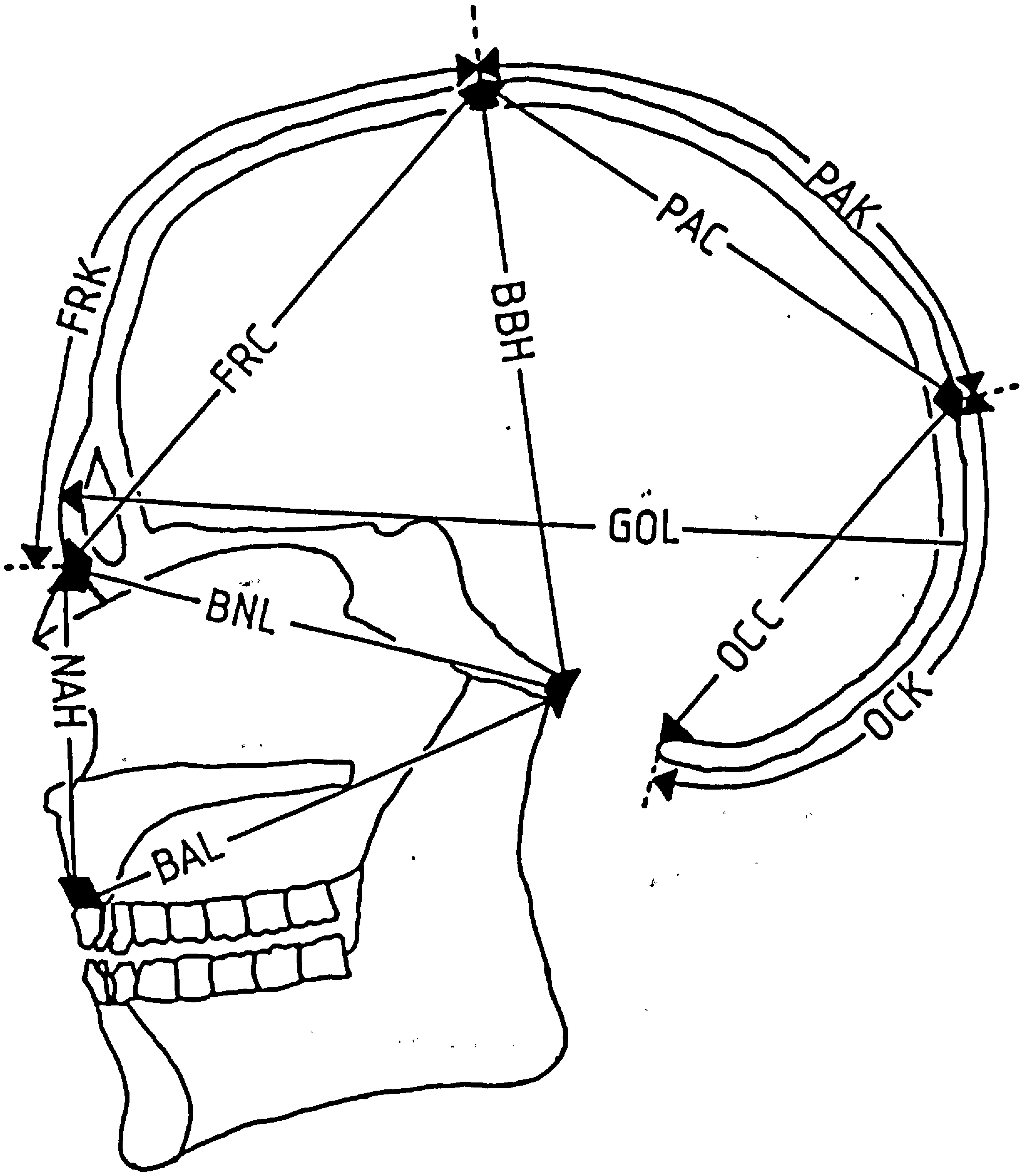



Figure 9.1. Cranial Measurements.

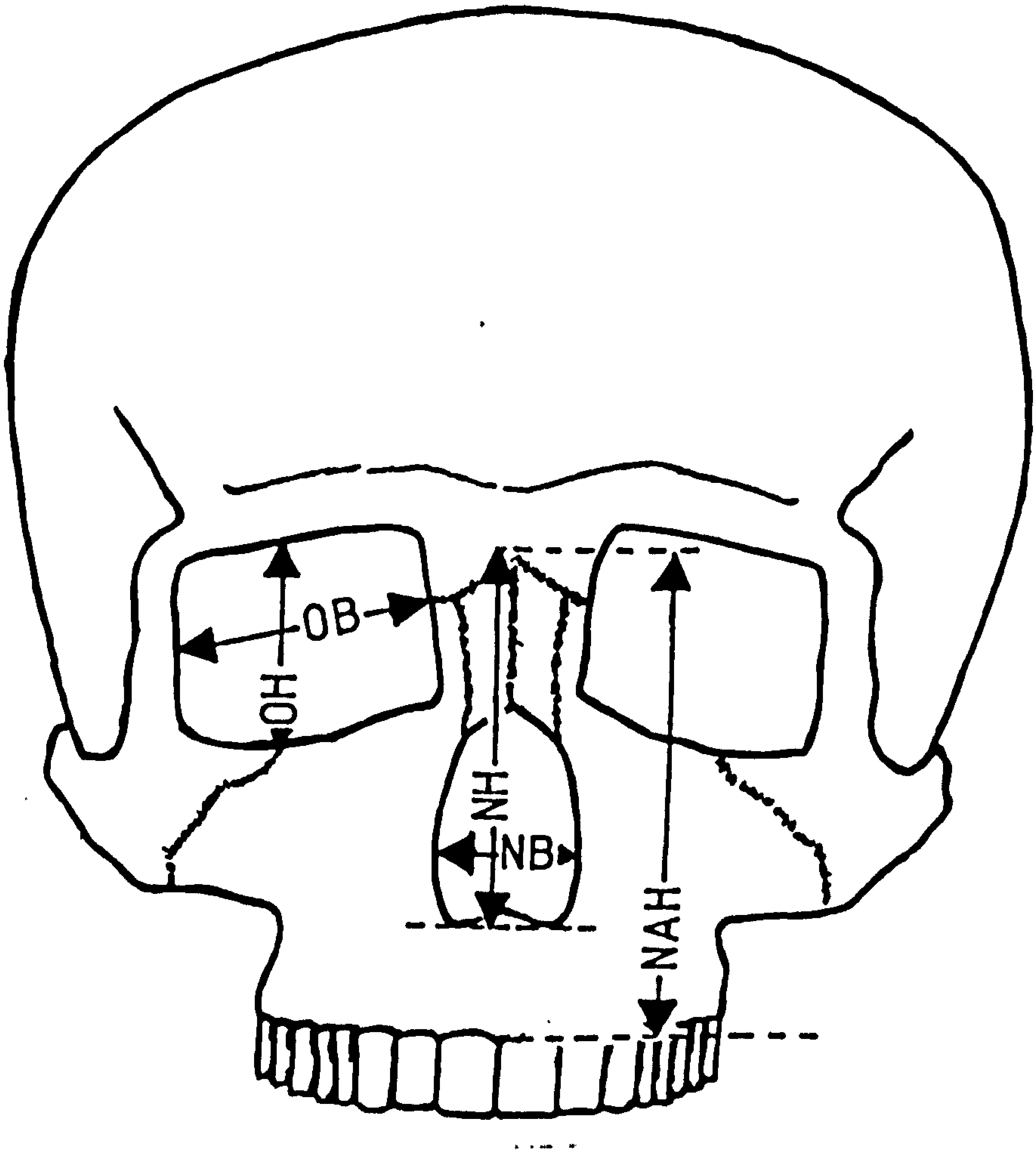



Figure 9.2. Cranial Measurements.

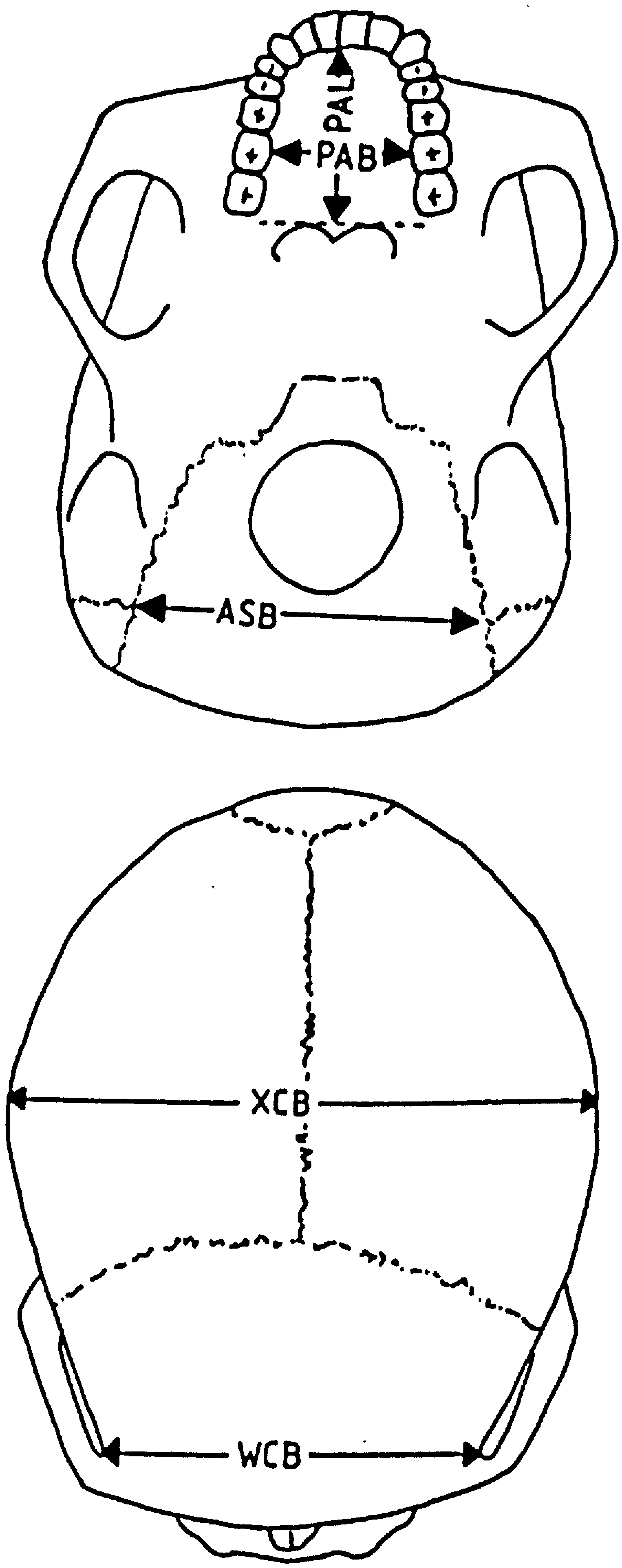



Figure 9.3. Cranial Measurements.

BAL - Basi-alveolar length, from the basion to the alveolare. (GL).

NAH - Upper facial height, from the nasion to the alveolare. (G'H).

NLH - Nasal height, from the nasion to the nasospinale. (NH').

NLB - Nasal breadth. The maximum breadth of the nasal aperture between the anterior surfaces of its lateral margins, perpendicular to the mid-sagittal plane. (NB).

OH - Orbital height. Greatest distance between the anterior surfaces of the upper and lower margins, perpendicular to the long axis of the orbit. (O2).

OB - Orbital breadth. Greatest breadth of the orbit measured from the dacryon to the anterior surface of its lateral margin. (O'1).

PAL - Palatal length, from the staphylion to the orale. (G'1).

PAB - Palatal breadth, from one endomolare to the other. (G2).

The cranial landmarks utilised when taking the above measurements are defined as follows (Brothwell 1981):

Glabella - The most prominent point between the supraciliary arches in the median sagittal plane.

Basion - The lowest point on the external surface of the anterior margin of the foramen magnum in its median plane.

Bregma - The point on the frontal bone at which the coronal and sagittal sutures meet.

Alveolare - The lowest point on the alveolar process between the sockets of the two central incisor teeth.

Nasion - The midpoint of the suture between the frontal and the two nasal bones.

Lambda - The point at which the sagittal and lambdoid sutures meet.

Opisthion - The point at which the external and internal surfaces of the occipital bone meet on the posterior margin of the foramen magnum in its median plane.

Nasospinale - A point in the median saggital plane and situated on a line between both nariale; usually it is at the base of the nasal spine.

Dacryon - The point at which the sutures between the frontal, maxillary and lacrimal bones meet.

Endomolare - The midpoint on the inner margin of the socket of the second upper molar tooth.

Staphylion - The point at which a line tangential to the two curves in the posterior border of the palate crosses the inter-palatine suture.

Orale - The midpoint of a line tangential to the posterior margins of the sockets of the two upper central incisor teeth.

Asterion - The point at which the sutures between the temporal, parietal and occipital bones meet.

It was often the case that landmarks formed by sutural conjunction were obscured by the presence of a wormian bone or a complex suturation pattern. Where this occurred the correct position of the landmark was estimated by extending the lines of the relevant sutures to an intersecting point.

Measurements were obtained by the use of either vernier callipers, spreading callipers or tape measure, whichever was most appropriate. Precision was evaluated by remeasuring 10 skulls after intervening lapses of time which varied from a few days to several months. It was not possible to establish the accuracy of the measurement techniques used but comparisons with measurements taken by more recent workers were generally good.

As a result of post-depositional damage or decay a major proportion of the crania studied proved to be lacking in some of the anatomical landmarks necessary for obtaining a complete set of measurements. Several strategies were adopted in an attempt to surmount this problem, some methodological and some statistical. If a landmark was missing as a result of localised injury then its position was estimated. Although this might diminish the accuracy of the individual measurement the approximation would be good and likely to be better than any provided by subsequent statistical manipulation of the data. The values of ASB for crania #25,#86,#170 & #228 were estimated by their regression on XCB. The values of measurements OH and OB for skull #98 were assumed to be the group means. More often however damage to a skull was widespread so that a limited "fallback suite" of measurements was obtained. These measurements described the anatomy of the calvarium and were as follows: GOL, XCB, WCB, FRK, PAK, OCK, FRC, PAC, OCC. From badly damaged skulls, where possible, the measurements GOL and XCB only were obtained, these measurements being necessary for the calculation of Cranial Index.

## Cranial Grouping.

For purposes of comparison the crania were divided into several chronological and/or cultural groups. Group identity was determined by either burial practice or artefact associations, more rarely by stratigraphy. The major groups constructed were as follows:

Early Neolithic - All crania recovered from primary deposits in long barrows and chambered tombs. (EN).

Later Neolithic - All burials with associations of a Grooved Ware or Peterborough type. Specifically, these include jet sliders, antler maceheads, edge ground "Seamer" axes and "Duggleby" adzes and transverse arrowheads. This group corresponds largely to Kinnes' (1979) stages D and E. (LN).

Other Neolithic - Neolithic burials not able to be included in either of the two preceding groups. Although, in the main, corresponding to Kinnes' (1979) stages A, B and C it might be mistaken to attribute to them all an earlier Neolithic date as they are often distinguished solely by the association of a leaf-shaped arrowhead, an artefact type which continued in use for the duration of the Neolithic (Green 1980: 92). (ON).

Bell Beaker - Burials associated with either a Beaker, tanged copper dagger or arm bracer. Burials with barbed and tanged arrowheads only were not included in this group as the artefact is often associated with ceramic types other than Beaker. (BB).

Weapons Group - After Piggott (1963: 82). This is a late Beaker group of burials furnished with either late Beaker vessels (Clarke's S3,S4), bronze or copper flat axes, stone shaft-hole battle axes (Roe's III, IV, V) or rivetted bronze daggers (Piggott's II, III, IV; Gerloff's Masterton, Butterwick, Milston, Merthyr Mawr). (WG).

Food Vessel - Burials accompanied by either a Food Vessel, plano-convex flint knife, jet bead necklace or single pointed copper or bronze awl. The inhumations from Folkton with Collared Vessels are included in this group, as is the burial from Mill Hill which was provided with an Armorico-British B bronze dagger (Gerloff's Cressington). (FV).

The chronological and cultural relationships of the preceding three groups remain to be fully defined but they can regarded as forming an approximate, if overlapping, chronological sequence with the Bell Beaker group being the earliest and the Food Vessel latest. This particular interpretation of early Bronze Age chronology is not currently accepted by all workers in the field but the supporting evidence is fully described and discussed in Appendix 2.

Bronze Age - All apparently early Bronze age burials not able to be accomodated in any one specific group. This might be because of the absence of any grave goods or else the presence of non-specific, long lived, items such as double pointed metal awls and single jet buttons or beads. (BA).

A descriptive catalogue of all crania measured is presented in Appendix 3, with the craniometric data in Appendix 4.

## Statistical Methods.

There are a number of statistical methods available which may be used to facilitate the display and analysis of a multivariate data set. They fall into two categories, depending upon the nature of the data set to be analysed. If the data are derived from two or more predefined groups, groups whose membership criteria are external to the data under consideration, then methods are available which may define the extension of group structure into the data set. If, on the other hand, no external grouping information is available then exploratory methods may be used to search the data set for any structure that may be present. Although the craniometric data collected in this study were open to prior grouping by reference to cultural or chronological criteria, it was not a necessary concomitant that such generated groups would find expression in the craniometric data. It might be, as diffusionist explanation demands, that the different cultural groups are to be considered as the material detritus of changing patterns of cultural expression, projected into the archaeological record by a biologically steady-state population. A null hypothesis was adopted therefore: that the cranial morphology of the inhabitants of prehistoric Britain remained relatively stable from the beginning of the Neolithic through to the late Bronze Age. The craniometric data could then be analysed using exploratory methods to ascertain the presence, or absence, of any morphological groupings, independently of external, archaeological, information. The two, separate, grouping structures, archaeological and craniometric, would then be available for comparison. The exploratory methods chosen were principal components analysis and cluster analysis, both available within the commercial SPSSX software package.

## Hierarchical Cluster Analysis.

When considered as multivariate data points, individuals differ from one another to a greater or lesser extent. The magnitude of this difference, or dissimilarity, can be computed and is a measure of the distance that exists between individuals in a multi-dimensional space. There are several methods available for the calculation of this distance, the algorithms used in the present analysis both used Euclidean distance, or "d". Euclidean distance is the linear distance that exists between two individuals in a multi-dimensional space and may be calculated by reference to Pythagoras' theorem, as shown in Figure 9.4. In 2 dimensions therefore:

$$d = \sqrt{(dx1^2 + dx2^2)}$$

This may be extended by the simple addition of more variable distances, so that in an n-dimensional hyperspace:

$$d = \sqrt{(dx1^2 + dx2^2 + \ldots\ldots. + dxn^2)}$$

The calculation of "d" assumes that the variables are uncorrelated and that therefore their vectors are orthogonal, at right angles to each other. Measures of "d" are distorted by scaling of variables in that distances measured on high magnitude variables will make an excessive contribution to overall distance. It is conventional, therefore, before calculation of "d", to transform variable values to their Z-scores, whereby each variable is standardised to a mean of 0 and a standard deviation of 1. The value of a variable is then expressed as number of standard deviation units away from the mean of the variable distribution. Z-scores are calculated as follows:

$$Zx = x - \bar{x} / \sigma x$$

where $x$ = variable value
$\bar{x}$ = variable mean
$\sigma x$ = variable std. deviation.

Methods of hierarchical cluster analysis (HCA) utilise this measure of distance to form groups, or clusters, of individuals on the basis of their relative proximity. There are two methods of HCA: divisive and agglomerative. Divisive methods proceed in stages by dividing a single group into an increasing number of progressively smaller groups which possess shorter, within group, distances. Divisive methods of HCA require a large amount of computation and are not generally available within commercial software packages. The more popular agglomerative methods are also stadial and combine individuals to form decreasing numbers of groups marked by progressively larger internal distances. The results of agglomerative HCA are normally presented graphically in the form of a dendrogram.

At each stage in an agglomerative HCA the two groups which are closest together in multivariate space are combined. Using the distance measures available there are several ways to estimate the relative "closeness" of groups, but a comparative review has suggested that for the study of crania, and skeletal remains generally, two are optimal (Wilmink and Uytterschaut 1984: 151). These are the unweighted pair group method using arithmetic average (UPGMA), and Wards method. In UPGMA the overall distance between two groups is considered to be the average of all the distances that exist between each and every individual of one group and each and every individual of the second group. In Wards method the two groups closest together are considered to be those whose merger causes the smallest overall increase in within group distances.

An HCA will routinely produce a dendrogram of individuals apparently clustered by virtue of similarity, but there is no guarantee that this clustering reflects a real discontinuous distribution, it might instead arise from a partitioning of a relatively continuous field of uniform variation. The validity of generated clusters needs

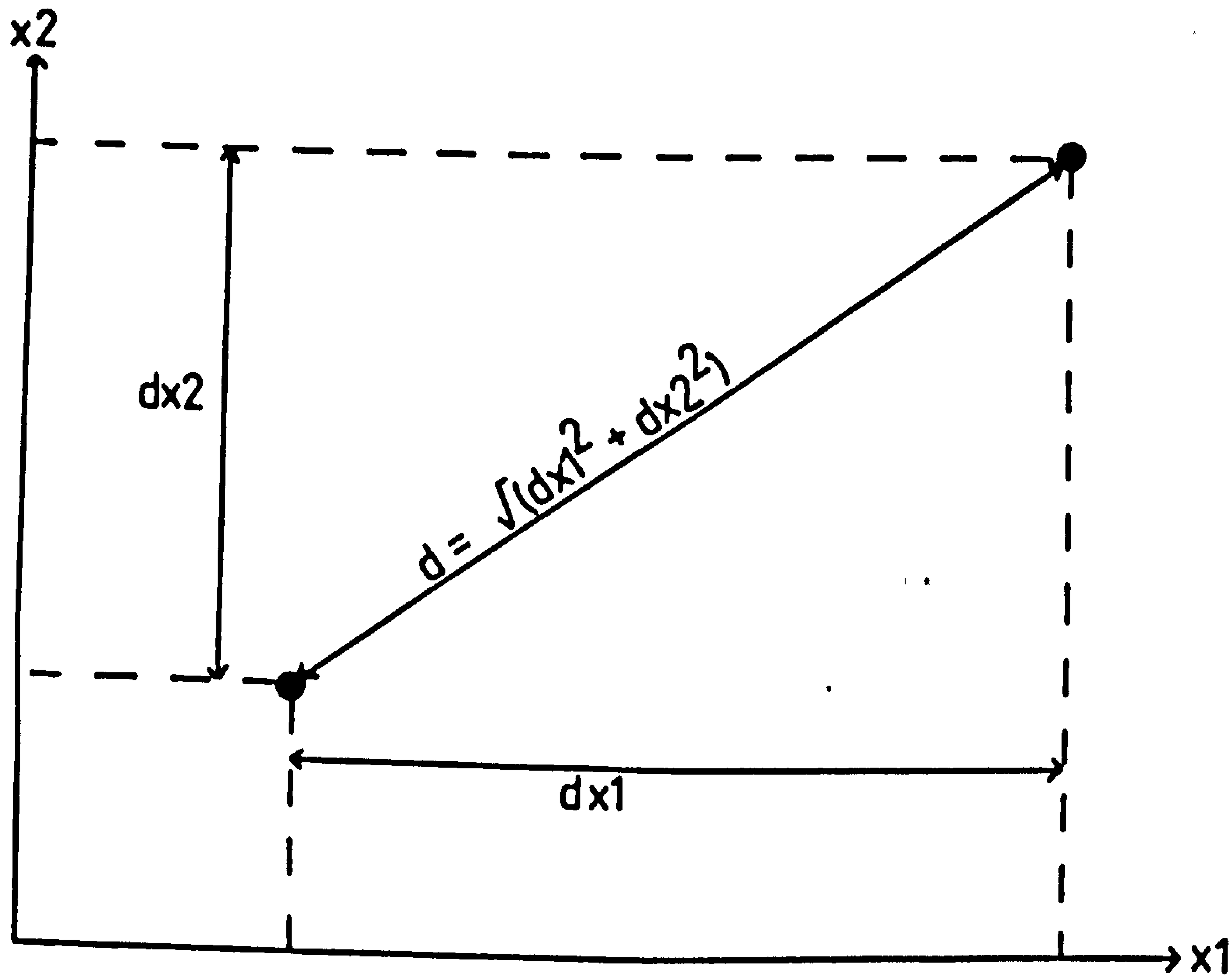



Figure 9.4. Derivation of Euclidean Distance.

to be assessed by comparison with bivariate scatterplots of the raw data or, preferably, derived principal components.

Principal Components Analysis.

The aim of a principal components analysis (PCA) is to reduce a complex, multi-dimensional data set to a more easily visualised entity by calculating a small number of novel variables, or principal components, which encompass a major part of the variation exhibited by the data distribution. If a PCA is succesful, it suggests that a number of the original variables are correlated. It may also, therefore, provide information about the underlying causes of variation by providing an estimate of the correlation of each variable with each individual principal component (PC).

If a sample of individuals are considered as a distribution of data points in a multi-dimensional space then new, uncorrelated, axes, or variables, are computed from linear combinations of the initial variables. PC1 describes the axis of maximum variation, PC2 must be both at right angles (orthogonal) to the first and projecting along the line of maximumum remaining variance, subject to the constraint of orthogonality. The basic concept is illustrated two-dimensionally in Figure 9.5, where the variation in a sample, as expressed by two highly correlated variables, is largely described by PC1, with PC2 accounting for a small amount of residual variation. The advantages of representing a two-dimensional data array in only one dimension may not be immediately apparent but are better appreciated when the method is extended into multi-dimensional space.

Principal components are computed in such a way as to minimise the sum of the perpendicular displacements of data points from the component. This is geometrically equivalent to projecting the PC through the axis of maximum variation. Each PC is computed as a linear combination of original variables, with the form:

$$PC1 = P1X1 + P2X2 + P3X3 + \ldots\ldots\ldots + PnXn.$$

Where X = variable
P = principal components coefficient

It is therefore possible to calculate the PC value of an individual from its initial variable values. This derived value is termed the PC score and enables the data to be projected graphically onto PC axes.

PC1 has the maximum possible overall correlation with all variables, subsequent PC's may possess a higher correlation with some individual variables but a lower overall correlation. The correlations of the variables with a PC are known as the component loadings (r), the square of a loading ($r^2$) indicates how much of the total variance of a particular variable is accounted for by that PC. The sum of all its loadings is known as the "eigenvalue" of a PC and may be divided by the number of variables and multiplied by 100 to provide the percentage of total sample variation embodied within that PC.

Assessing the significance of a PC is a matter of subjective evaluation. However, only PCs with an eigenvalue greater than 1.0 will account for more variation in the data distribution than would one of the original variables. There is otherwise no statistical method available for deciding how many PCs represent meaningful data reduction and how many represent residual "noise". If a scree diagram is plotted, which is a histogram of PCs plotted against their eigenvalues, it has been suggested that, as a rule of thumb, only the initial components which show a steep fall-off should be selected for further consideration, the remaining components, which form the "scree" of the diagram, are less likely to be meaningful.

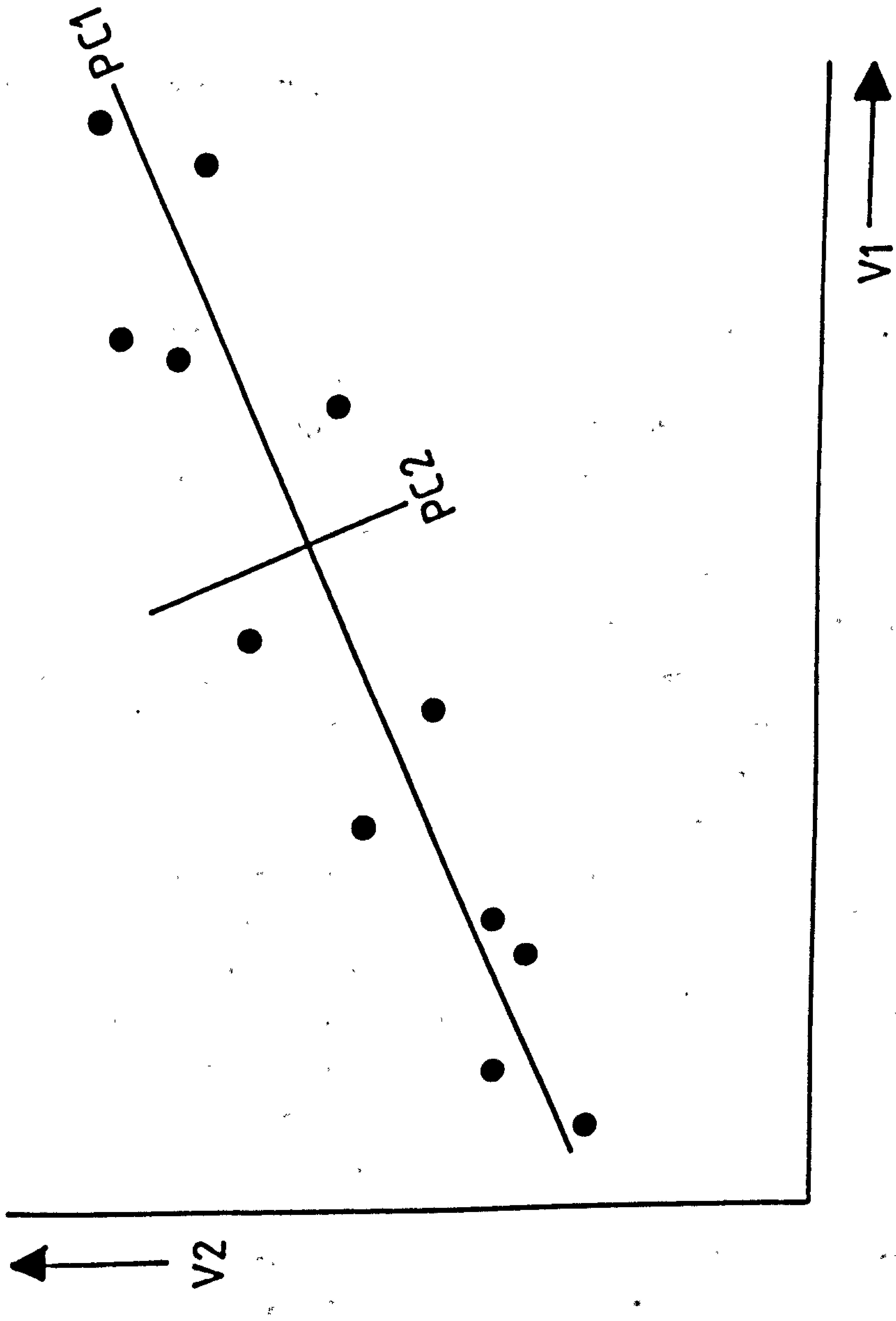



Figure 9.5. Principal Components Analysis.

## Chapter Ten.

## CRANIOMETRY II: RESULTS.

### Univariate Statistics.

Before submitting the craniometric data to multivariate analysis the differences between the mean values of each individual measurement obtained from the Bronze Age and Neolithic series were first tested for significance, using Student's T-Test. Included in the Neolithic series were all crania from groups EN and ON. Those from groups BA, BB, FV and WG were included in the Bronze Age series. For male crania, most significant differences occurred between measurements of the calvarium, both longitudinal and lateral. The pattern was consistent, no matter whether only those crania which possessed a complete set of measurements were chosen for testing (Table 10.1) or else if all crania were included (Table 10.2). The Neolithic skulls were significantly longer than those of the Bronze Age, the major contribution to this increased length being derived from the central and posterior parts of the calvarium as measured by PAK, PAC and, to a lesser extent, OCK and OCC. Bronze Age crania were wider than Neolithic ones, both anteriorly as measured by WCB and posteriorly as measured by XCB. However, this increased width of Bronze Age skulls was not demonstrated by the measurement ASB. The differences between the mean nasal breadths (NLB) of both series achieved significance when all available measurements were considered. A similar pattern of differences was revealed when the measurement means of female skulls were inspected (Table 10.3). The Cranial Indices for all individuals were calculated when

Table 10.1. Univariate Statistics.

All male crania with a full set of measurements available for analysis one.

Neolithic - 17 crania.
Bronze Age - 39 crania.

| Measurement | Neolithic (Mean±1SD) | Bronze Age (Mean±1SD) | Significance |
|---|---|---|---|
| GOL | 196±6 | 186±7 | <0.005 |
| XCB | 139±5 | 146±7 | <0.005 |
| WCB | 98±3 | 101±4 | 0.008 |
| ASB | 115±4 | 113±6 | N.S. |
| BBH | 140±7 | 139±6 | N.S. |
| FRK | 135±8 | 132±7 | N.S. |
| PAK | 136±7 | 127±8 | <0.005 |
| OCK | 129±11 | 118±8 | <0.005 |
| FRC | 117±6 | 114±5 | 0.025 |
| PAC | 123±4 | 114±6 | <0.005 |
| OCC | 105±7 | 96±6 | <0.005 |
| NAH | 69±3 | 70±5 | N.S. |
| BNL | 105±4 | 106±6 | N.S. |
| BAL | 99±5 | 98±6 | N.S. |
| OH | 33±2 | 33±3 | N.S. |
| OB | 40±2 | 41±2 | N.S. |
| NLH | 52±3 | 53±3 | N.S. |
| NLB | 23±2 | 25±2 | N.S. |
| PAL | 45±3 | 46±3 | N.S. |
| PAB | 40±4 | 41±3 | N.S. |

Table 10.2 Univariate Statistics.

All male crania with all available measurements included.

Figures in parentheses refer to the the number of crania available for each particular measurement.

| Measurement | Neolithic (Mean±1SD) | Bronze Age (Mean±1SD) | Significance |
|---|---|---|---|
| GOL | 197±6 (42) | 187±8 (108) | <0.005 |
| XCB | 138±5 (42) | 145±7 (108) | <0.005 |
| WCB | 98±4 (34) | 100±4 (103) | 0.029 |
| ASB | 114±5 (30) | 114±6 (78) | N.S. |
| BBH | 139±6 (21) | 139±7 (58) | N.S. |
| FRK | 134±7 (34) | 132±7 (103) | N.S. |
| PAK | 136±7 (34) | 128±7 (102) | <0.005 |
| OCK | 127±10 (34) | 118±7 (97) | 0.042 |
| FRC | 116±5 (34) | 114±6 (95) | N.S. |
| PAC | 123±5 (34) | 115±6 (95) | <0.005 |
| OCC | 103±3 (34) | 96±6 (92) | N.S. |
| NAH | 69±4 (20) | 69±5 (74) | N.S. |
| BNL | 105±4 (21) | 106±6 (58) | N.S. |
| BAL | 99±5 (17) | 98±6 (51) | N.S. |
| OH | 33±2 (21) | 33±3 (61) | N.S. |
| OB | 40±2 (21) | 41±2 (60) | N.S. |
| NLH | 52±2 (21) | 52±3 (69) | N.S. |
| NLB | 23±2 (21) | 25±2 (66) | <0.005 |
| PAL | 46±3 (20) | 46±3 (64) | N.S. |
| PAB | 40±4 (20) | 40±3 (65) | N.S. |

Table 10.3. Univariate Statistics.

All female crania with all available measurements included.

Figures in parentheses refer to the number of crania available for each particular measurement.

| Measurement | Neolithic (Mean±1SD) | Bronze Age (Mean±1SD) | Significance |
|---|---|---|---|
| GOL | 186±7 (28) | 179±7 (49) | <0.005 |
| XCB | 133±6 (28) | 141±5 (48) | <0.005 |
| WCB | 93±5 (24) | 97±5 (45) | <0.005 |
| ASB | 108±6 (14) | 108±5 (25) | N.S. |
| BBH | 132±7 (14) | 133±6 (32) | N.S. |
| FRK | 127±4 (22) | 126±7 (46) | N.S. |
| PAK | 130±6 (23) | 124±8 (46) | <0.005 |
| OCK | 121±7 (20) | 114±8 (44) | <0.005 |
| FRC | 110±3 (22) | 109±4 (39) | N.S. |
| PAC | 117±4 (23) | 110±6 (39) | <0.005 |
| OCC | 98±6 (20) | 94±6 (38) | 0.024 |
| NAH | 64±4 (12) | 63±4 (29) | N.S. |
| BNL | 98±2 (11) | 101±7 (29) | N.S. |
| BAL | 93±7 (8) | 95±7 (24) | N.S. |
| OH | 32±2 (11) | 32±2 (27) | N.S. |
| OB | 40±2 (11) | 39±2 (25) | N.S. |
| NLH | 49±3 (12) | 48±3 (30) | N.S. |
| NLB | 23±2 (12) | 24±2 (27) | 0.03 |
| PAL | 44±5 (9) | 43±3 (21) | N.S. |
| PAB | 38±7 (28) | 40±4 (23) | N.S. |

Table 10.4. Mean Cranial Index.

Neolithic Male - 70.1 ±3.2 (42)

Neolithic Female - 71.3 ±3.7 (28)

Late Neolithic Male - 71.5 ±4.8 (11)

Bronze Age Male - 78.1 ±5.3 (108)

Bronze Age Female - 78.8 ±4.2 (48)

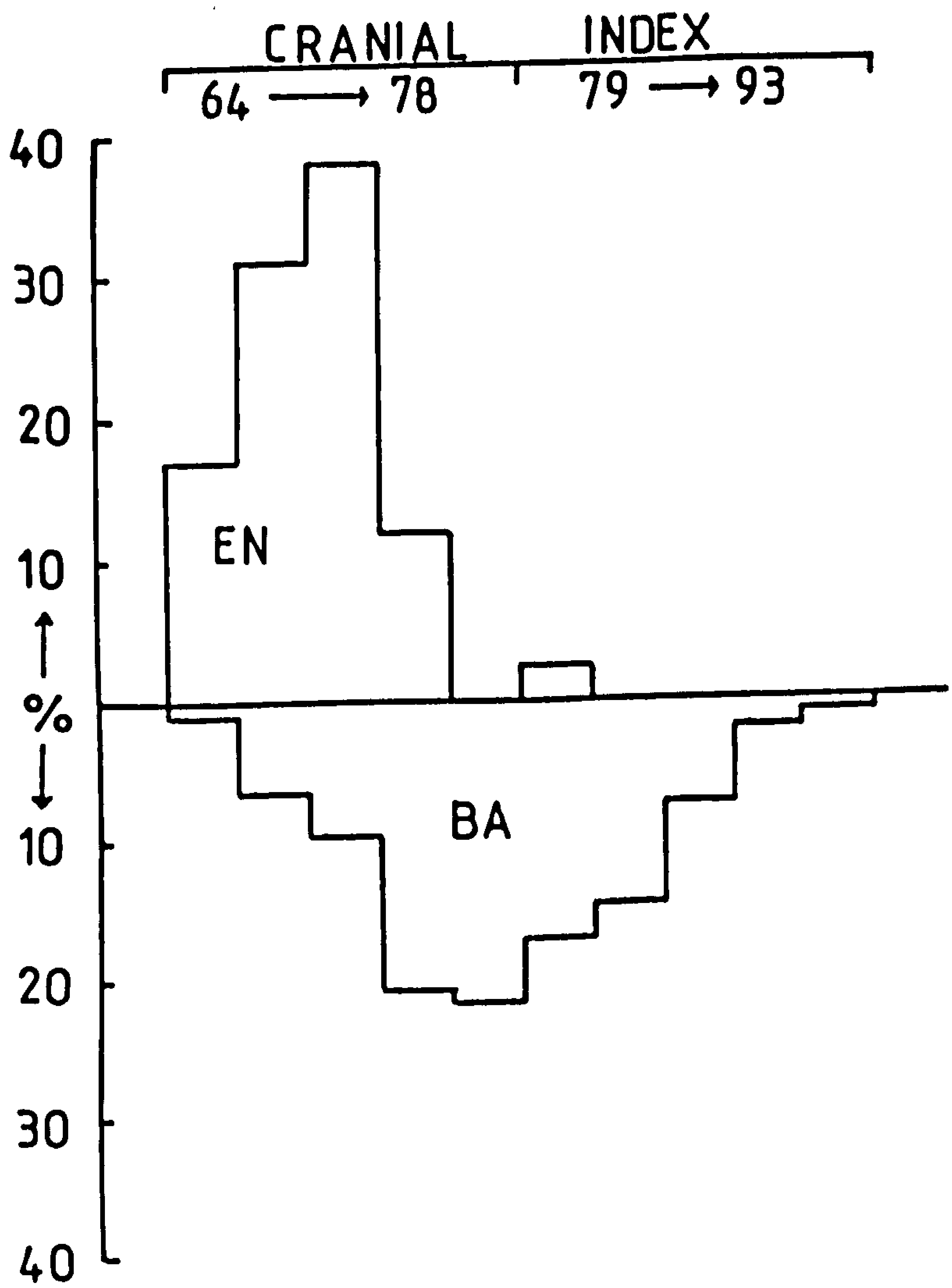



Figure 10.1.

Histograms of Male Cranial Indices.

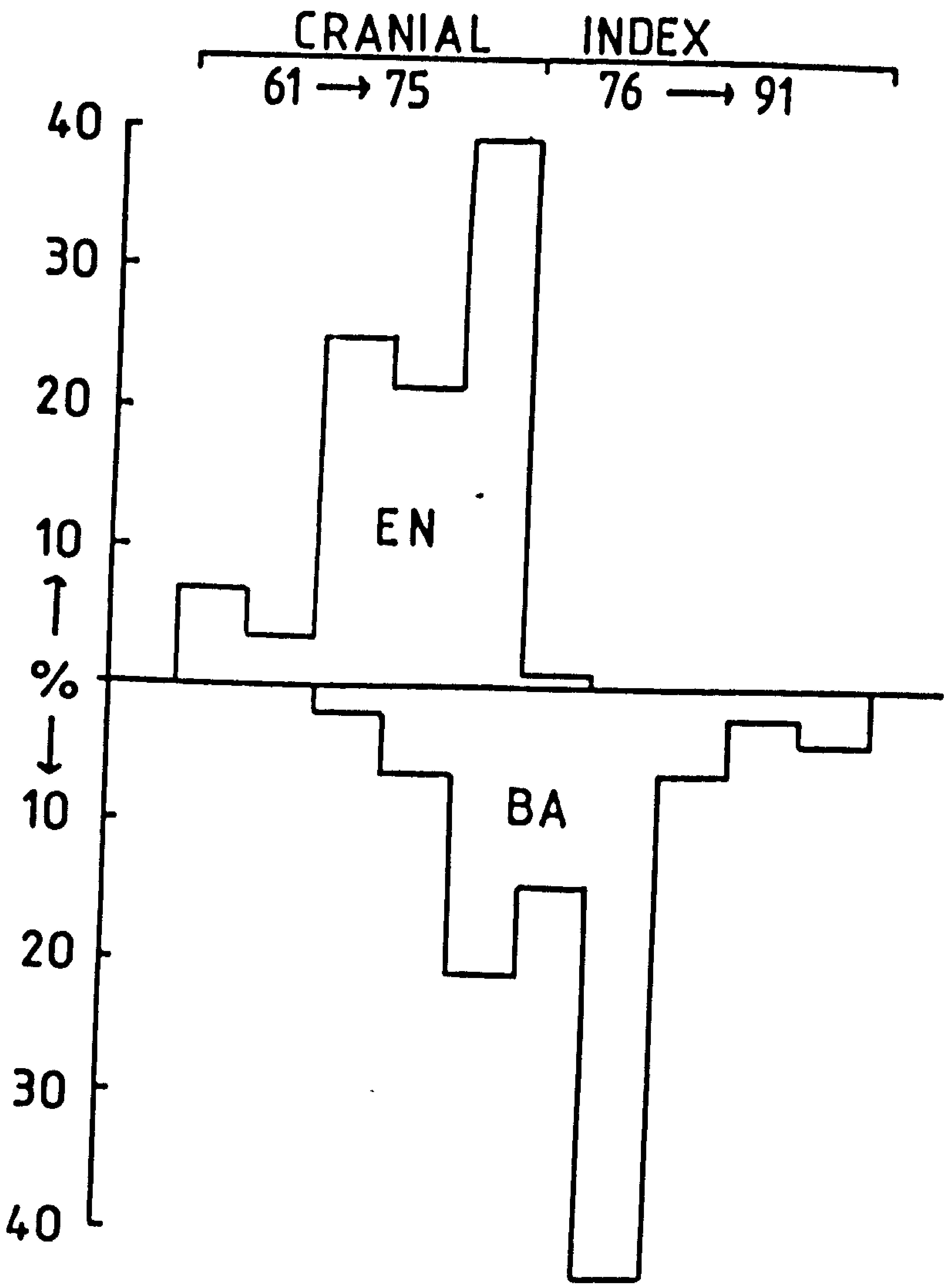



Figure 10.2.

Histograms of Female Cranial Indices.

the requisite measurements were available. The results are presented in Table 10.4 and the distributions shown in Figure 10.1. The mean Cranial Index of the Bronze age series was significantly higher than that of the Neolithic series, and also than that of the Late Neolithic sample. Female crania displayed the same pattern of differences for both single measurements and the Cranial Index (Table 10.4, Figure 10.2).

## Size and Shape.

Inter-relationships between size and shape were briefly touched upon in the discussion of statistical methods. Shape may scale with size either allometrically or isometrically. That is to say, shape can alter in a consistent fashion in conditions of increasing absolute size (allometric scaling) or else it may remain constant (isometric scaling) (Corruccini 1987). To test for evidence of allometry in the prehistoric crania under investigation a simple measure of cranial size, the Cranial Module (Sankas 1930), was computed as follows:

$$\text{Cranial Module} = \text{GOL}+\text{XCB}+\text{BBH}/3.$$

The mean Cranial Module of the Neolithic Series was not significantly different from that of the Bronze Age one, suggesting that the crania of both series were of a similar size. Furthermore, when compared to Cranial Index, which is a measure of proportionality and hence shape, there were no intra-sample correlations (Table 10.5). Thus, any effect size might have upon the crania under study would be isometric. This conclusion is supported by the close agreement between the mean Cranial Indices of both sexes within each series; assuming in each case that the females would, on average, be smaller than males. An important corollary of this property of isometry is that, in future, it would prove possible to standardise cranial measurements against an overall measure of body size, thus removing any size-related variance from the data set. This was not possible in the present study as there was not sufficient reliable information available pertaining to the stature of the skeletons from which the cranial measurements were obtained.

Although the relationship between size and shape was isometric for both of the cranial series studied, it might be expected that absolute body size would intrude into the statistical analyses by causing all measurements to correlate in a positive manner, each size-associated increase in any single measurement would be associated with similar size associated increases in all other measurements. To assess the extent to which this phenomenon might have interfered with the collected data the correlation matrices of the male samples were inspected, as shown in simplified form in Figures 10.3 and 10.4. If absolute size was influential there would be a large number of positive correlations. This was not the case with the Neolithic series, only 26 pairs out of a total of 190 were positively correlated. For the Bronze Age series the situation was less satisfactory, with 50 pairs of measurements being positively correlated. A large number of these correlations appeared to possess an underlying anatomical rationale, however; for instance the positive correlations seen amongst measurements of length, or else the nasal measurements which were correlated with supero-anterior measurements from adjacent areas. As in the Neolithic series there were several negative correlations. This suggests that the majority of correlations reveal relationships of shape, not size, and that the interference of size in the data analysis would not be too marked.

Table 10.5a. Mean Cranial Module.

Neolithic Male - 158.2 ±4.0 (21)

Bronze Age Male - 156.9 ±4.1 (58)

Table 10.5b. Cranial Index/Module Correlation.

Neolithic males:

$r = 0.088$
$r^2 = 0.008$
Not significant.

Bronze Age males:

$r = -0.237$
$r^2 = 0.056$
Not significant.

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NLH | NLB | PAL | PAB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GOL | ● | | | | | | | | | | | | | | | | | | | |
| XCB | | ● | | | | | | | | | | | | | | | | | | |
| WCB | | | ● | | | | | | | | | | | | | | | | | |
| ASB | | + | | ● | | | | | | | | | | | | | | | | |
| BBH | | | | | ● | | | | | | | | | | | | | | | |
| FRK | | | | | | ● | | | | | | | | | | | | | | |
| PAK | | | | | | | ● | | | | | | | | | | | | | |
| OCK | + | | | | | | − | ● | | | | | | | | | | | | |
| FRC | + | + | | | + | + | | | ● | | | | | | | | | | | |
| PAC | | | | | | | + | − | | ● | | | | | | | | | | |
| OCC | | | | | + | | − | + | | − | ● | | | | | | | | | |
| NAH | + | | | | | | | | | | | ● | | | | | | | | |
| BNL | + | | + | | | | | | | | | | ● | | | | | | | |
| BAL | + | | | | | + | | | + | | | | | ● | | | | | | |
| OH | | | | | | | | | | | | + | + | | ● | | | | | |
| OB | | | | | | | | | | | | | | | | ● | | | | |
| NLH | | | | | | | | | | | | + | | | + | | ● | | | |
| NLB | | | | | | | | | | | | | | | | | | ● | | |
| PAL | | | | | | | | | | | | + | | | | | | | ● | |
| PAB | | | | | | | | | | | | | | | | | + | | + | ● |

Figure 10.3.

Early Neolithic Male Crania: Correlation Matrix.

(Simplified, only significant correlations shown).

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NLH | NLB | PAL | PAB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GOL | ● | | | | | | | | | | | | | | | | | | | |
| XCB | | ● | | | | | | | | | | | | | | | | | | |
| WCB | + | + | ● | | | | | | | | | | | | | | | | | |
| ASB | | + | | ● | | | | | | | | | | | | | | | | |
| BBH | + | | | | ● | | | | | | | | | | | | | | | |
| FRK | + | + | + | + | + | ● | | | | | | | | | | | | | | |
| PAK | + | | + | | | + | ● | | | | | | | | | | | | | |
| OCK | + | | | | | | | ● | | | | | | | | | | | | |
| FRC | + | + | + | + | + | + | + | | ● | | | | | | | | | | | |
| PAC | + | | + | | | + | + | | + | ● | | | | | | | | | | |
| OCC | + | | | | + | | | + | | | ● | | | | | | | | | |
| NAH | + | | | | | | | + | + | | + | ● | | | | | | | | |
| BNL | + | − | | | + | | | | | | | + | ● | | | | | | | |
| BAL | + | − | | | + | | | | | | | | + | ● | | | | | | |
| OH | | | | | | | | | | | | + | | | ● | | | | | |
| OB | + | | | | | | | | + | | | + | | | | ● | | | | |
| NLH | | | + | | | + | | | | | | + | | | + | | ● | | | |
| NLB | | | + | | | + | | + | + | | | | | | | | | ● | | |
| PAL | | | | | | | | | | | | | | | | | | | ● | |
| PAB | | | | | | | | | − | | − | | | | − | | | | | ● |

Figure 10.4.

Bronze Age Male Crania: Correlation Matrix.

(Simplified, only significant correlations shown).

Multivariate Analysis One.

In this analysis all male crania which possessed a complete set of measurement data were submitted to principal components and cluster analyses. Seven of the extracted principal components had eigenvalues in excess of 1 (Table 10.6), although inspection of the scree plot suggested that only the first four of these components were significant (Figure 10.5), together they accounted for 55.3% of the total variance exhibited by the sample. The principal component loadings are shown in Table 10.7.

Principal component 1 (PC1) was, in effect, a measure of cranial length. It had high positive correlations with all longitudinal measurements, particularly overall length (GOL) and, to a lesser extent, the chord and arc measurements (FRC, PAC, OCC, FRK, PAK, OCK). PC1 was also positively correlated with vault height (BBH) and negatively with palatal breadth (PAB).

PC2 was harder to interpret, demonstrating both positive and negative correlations. There was a moderate degree of positive correlation with most measures of the facial skeleton, paricularly upper facial height (NAH). The minimum frontal breadth (WCB) was also positively correlated with this component, perhaps on account of its close association with the zygomatic, or cheek, bones. PC2 therefore seems to be a measure of facial height, or robustness, although there are also negative correlations with measures of parietal length (PAC, PAK).

PC3 measured calvarial breadth, correlating positively with both maximum biparietal breadth (XCB) and biasterionic breadth. Both of these measurements are taken posteriorly but the measure of anterior calvarial breadth (WCB) was not correlated with this component. On the other hand, frontal arc (FRK), which is a composite length/height measure of

| FACTOR | EIGENVALUE | PCT OF VAR | CUM PCT |
|---|---|---|---|
| 1 | 3.95916 | 19.8 | 19.8 |
| 2 | 3.03718 | 15.2 | 35.0 |
| 3 | 2.38933 | 11.9 | 46.9 |
| 4 | 1.66904 | 8.3 | 55.3 |
| 5 | 1.61468 | 8.1 | 63.3 |
| 6 | 1.36140 | 6.8 | 70.2 |
| 7 | 1.22376 | 6.1 | 76.3 |
| 8 | .96454 | 4.8 | 81.1 |
| 9 | .86212 | 4.3 | 85.4 |
| 10 | .79008 | 4.0 | 89.4 |
| 11 | .65254 | 3.3 | 92.6 |
| 12 | .46954 | 2.3 | 95.0 |
| 13 | .30753 | 1.5 | 96.5 |
| 14 | .22383 | 1.1 | 97.6 |
| 15 | .19468 | 1.0 | 98.6 |
| 16 | .12143 | .6 | 99.2 |
| 17 | .05419 | .3 | 99.5 |
| 18 | .04735 | .2 | 99.7 |
| 19 | .03054 | .2 | 99.9 |
| 20 | .02710 | .1 | 100.0 |

Table 10.6.

Multivariate Analysis One: Eigenvalues.

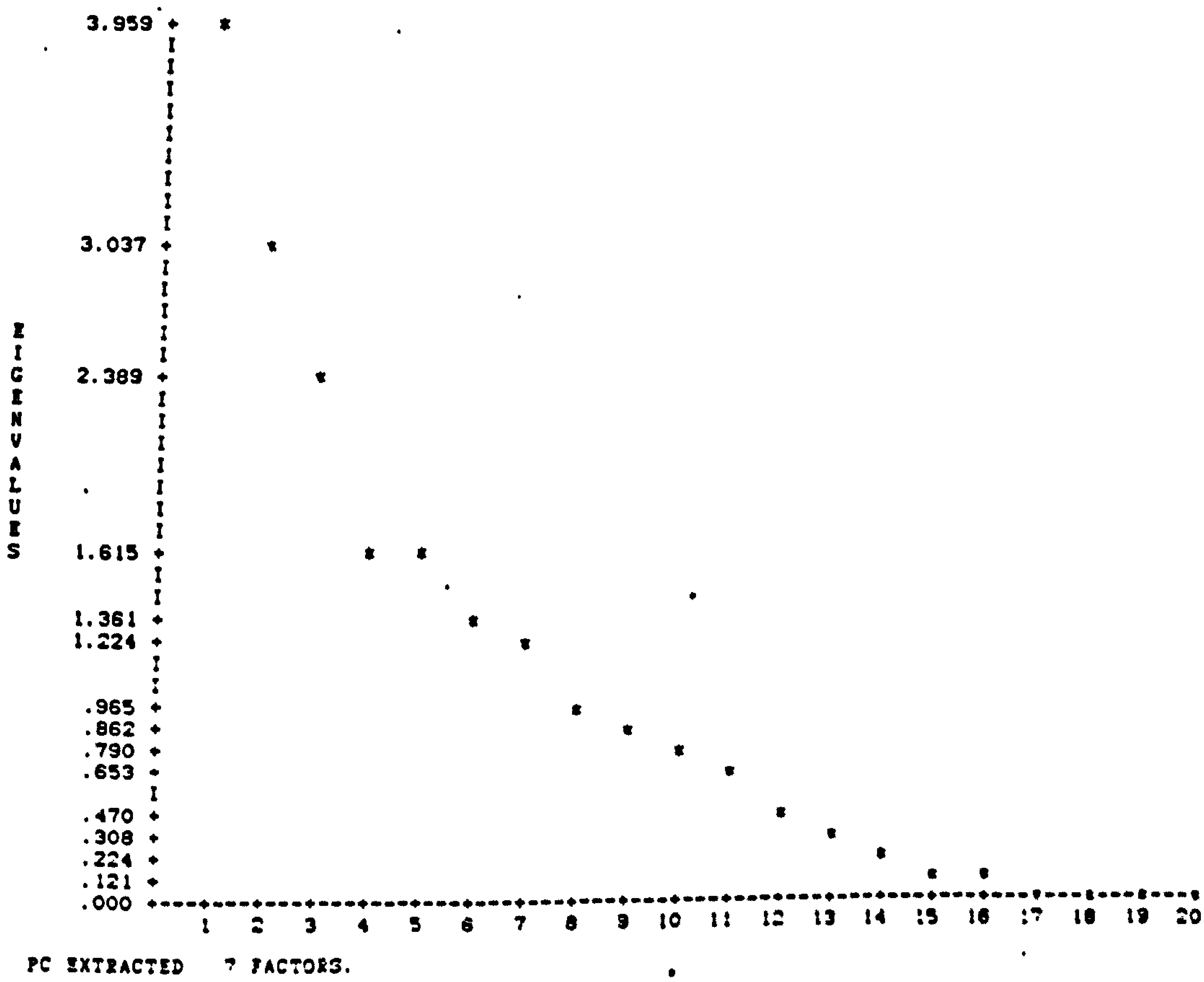



Figure 10.5.

Multivariate Analysis One: Scree Plot.

| | FACTOR 1 | FACTOR 2 | FACTOR 3 | FACTOR 4 | FACTOR 5 | FACTOR 6 | FACTOR 7 |
|---|---|---|---|---|---|---|---|
| GOL | .88630 | .04210 | -.16143 | .11021 | -.11400 | .04883 | .11166 |
| XCB | -.22422 | .30479 | .67579 | .35369 | .15099 | .22202 | .01424 |
| WCB | .01488 | .44662 | .23114 | .20290 | .50042 | -.00188 | .36511 |
| ASB | .34437 | .05399 | .42897 | .08755 | -.23276 | .41945 | -.27659 |
| BBH | .41131 | .36180 | -.25286 | -.10058 | .48031 | -.10354 | .03214 |
| FRK | .58150 | .19689 | .48989 | .03409 | .30033 | -.11612 | -.31893 |
| PAK | .51273 | -.44681 | .24663 | -.40247 | .20948 | .32254 | .26624 |
| OCK | .65139 | -.03047 | -.30035 | .56400 | -.25766 | .05425 | .19819 |
| FRC | .72768 | .21709 | .34562 | -.03261 | .21860 | -.17471 | -.32772 |
| PAC | .65228 | -.43590 | .19777 | -.31818 | .11485 | .32733 | .19873 |
| OCC | .66427 | -.01783 | -.36491 | .49755 | -.22050 | .05132 | .23401 |
| NAH | .01548 | .76414 | .08878 | -.17647 | -.40389 | .17354 | .02169 |
| BNL | .24434 | .57220 | -.54772 | -.36284 | .22813 | -.02400 | -.02183 |
| BAL | .18287 | .42874 | -.61875 | -.18046 | .15262 | .13188 | -.26136 |
| OH | .21649 | .47616 | .23200 | -.39507 | -.45235 | -.24855 | .13492 |
| OB | .05547 | .40344 | .11763 | .19691 | -.24212 | -.02283 | -.27190 |
| NLH | -.06380 | .65638 | .25612 | -.19936 | -.24387 | .15465 | .43872 |
| NLB | -.25976 | .39070 | .08504 | .39517 | .37752 | -.14157 | .28601 |
| PAL | -.16690 | .23014 | -.22480 | .21984 | .09770 | .60894 | -.35609 |
| PAB | -.41356 | .10659 | -.20170 | -.08549 | .14244 | .58063 | .15574 |

Table 10.7.

Multivariate Analysis One: Component Loadings.

(Factor = Principal Component).

the anterior calvarium was. PC3 also demonstrated strong negative correlations with basi-nasal length (BNL) and basi-alveolar length (BAL), both of which are measures of maxillary prognathism. PC3 seems, therefore, to be a measure of the relations of brachycephaly. Crania with high scores on PC3 would be characterised by lateral enlargement of the calvarium in association with retrusion of the maxilla as a result of an increased angle of flexure of the cranial base, and perhaps with a compensatory lengthening, or at least curvature, of the frontal bone.

PC4 is a measure of cranial vault proportions, positively correlated with the occipital measurements (OCC,OCK) while being negatively correlated with parietal measurements (PAC,PAK). PC4 was also negatively correlated with basi-nasal length (BNL) and orbital height (OH), positively correlated with nasal breadth (NLB). It is unfortunate that NLB did not achieve a high correlation with any one particular principal component but instead demonstrates low levels of correlation with several different components, thus making its contribution to cranial morphology difficult to assess.

When the component scores of individual crania are projected onto the principal component axes it can be seen that the greatest separation of Bronze age and Neolithic crania is provided by the first three components (Figures 10.6 - 10.8). Neolithic crania tend towards higher scores on PC1. Where their scores on PC1 are equal to those of Bronze Age examples the Neolithic crania have lower scores on PC2. Bronze age crania are equally distributed along PC3 while those of Neolithic date have mainly negative scores. Thus, in relative terms, the tendency is for Neolithic skulls to have higher scores on PC1 with lower scores on PC2 and PC3. Overall however, Bronze Age crania are distinguished by a greater degree of morphological heterogeneity. This analysis suggests that, on average, Neolithic skulls are more dolichocephalic than those of the Bronze age, but that if crania of equivalent length are compared then those of Bronze Age date have higher, or more robust, faces together with shorter parietal bones.

The results of the cluster analysis are presented in Figure 10.9. Although a clearcut structure emerges using the method chosen the clusters do not appear to possess an absolute reality, they instead represent a partitioning of a continuous morphological distribution. Thus, if four well defined clusters are recovered by dividing the dendrogram at the rescaled distance of 20, and their membership superimposed upon a plot of PC1 vs PC2, it may be seen that the clusters effectively divide up the distribution into four parts, apparently using information derived only from PC1 and PC2 (Figure 10.10). Important information from PC3 is disseminated between clusters. This exercise highlights the dangers inherent in the use of an uncorroborated cluster analysis for the exploration of an unknown data set. The cluster analysis did not provide any information not already available, in more useable form, from the principal components analysis.

The apparent failure of the cluster analysis may have been due, in part, to the highly correlated nature of the craniometric data set. It is possible to compensate for these correlations by performing a cluster analysis on extracted principal components, which are by definition orthoganol; but as this then assigns equal weight to all PCs it is not at all clear that the remedy is in any way superior to the malady. More sophisticated measure of distance, such as that of Mahalonobis, may have improved the resolution of clusters but were not available in the SPSSX software package.

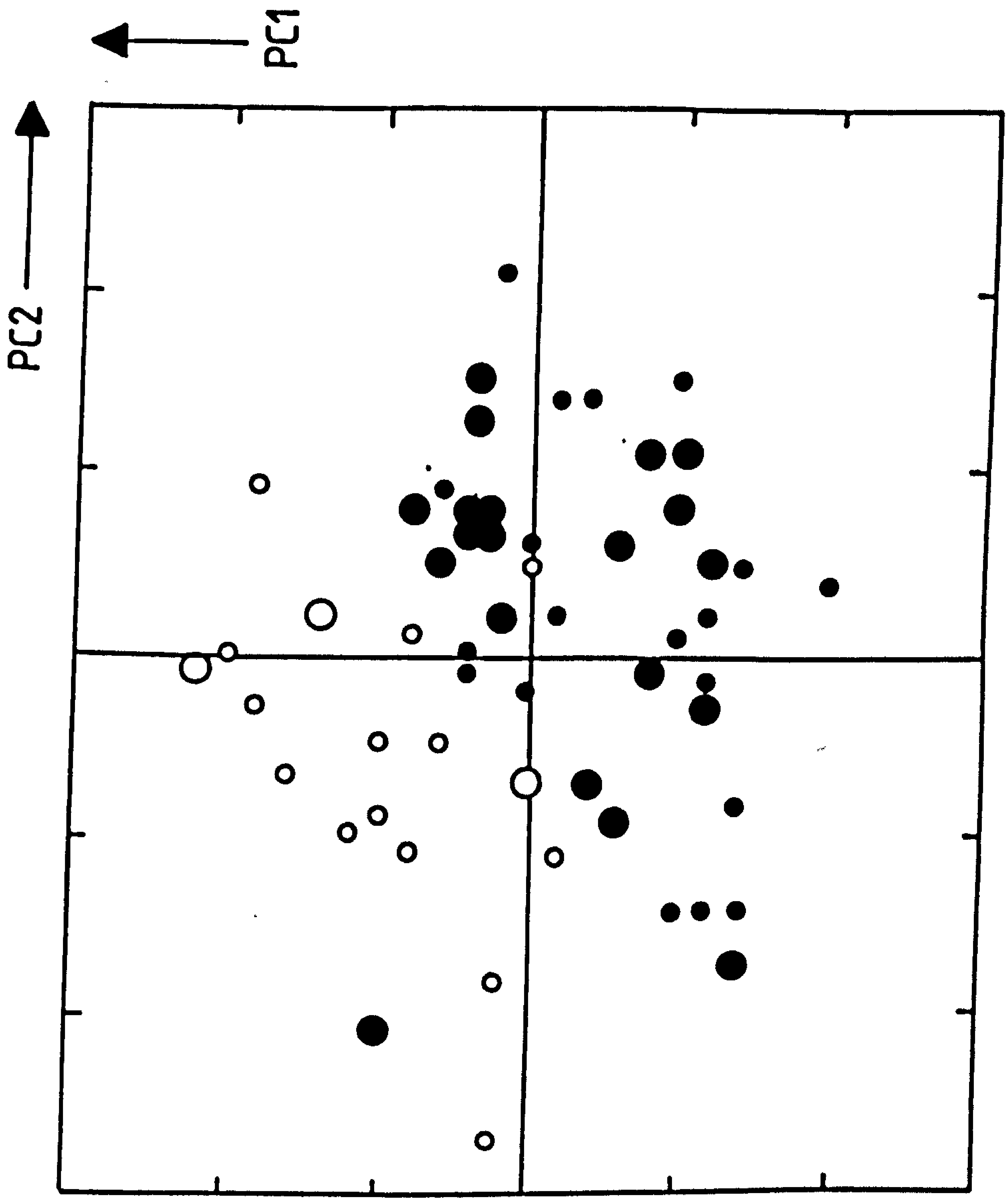



Figure 10.6.

Multivariate Analysis One: Principal Components Plot.

Open circles = Neolithic series.
Filled circles = Bronze age series.

Small circles = -ve PC3.
Large circles = +ve PC3.

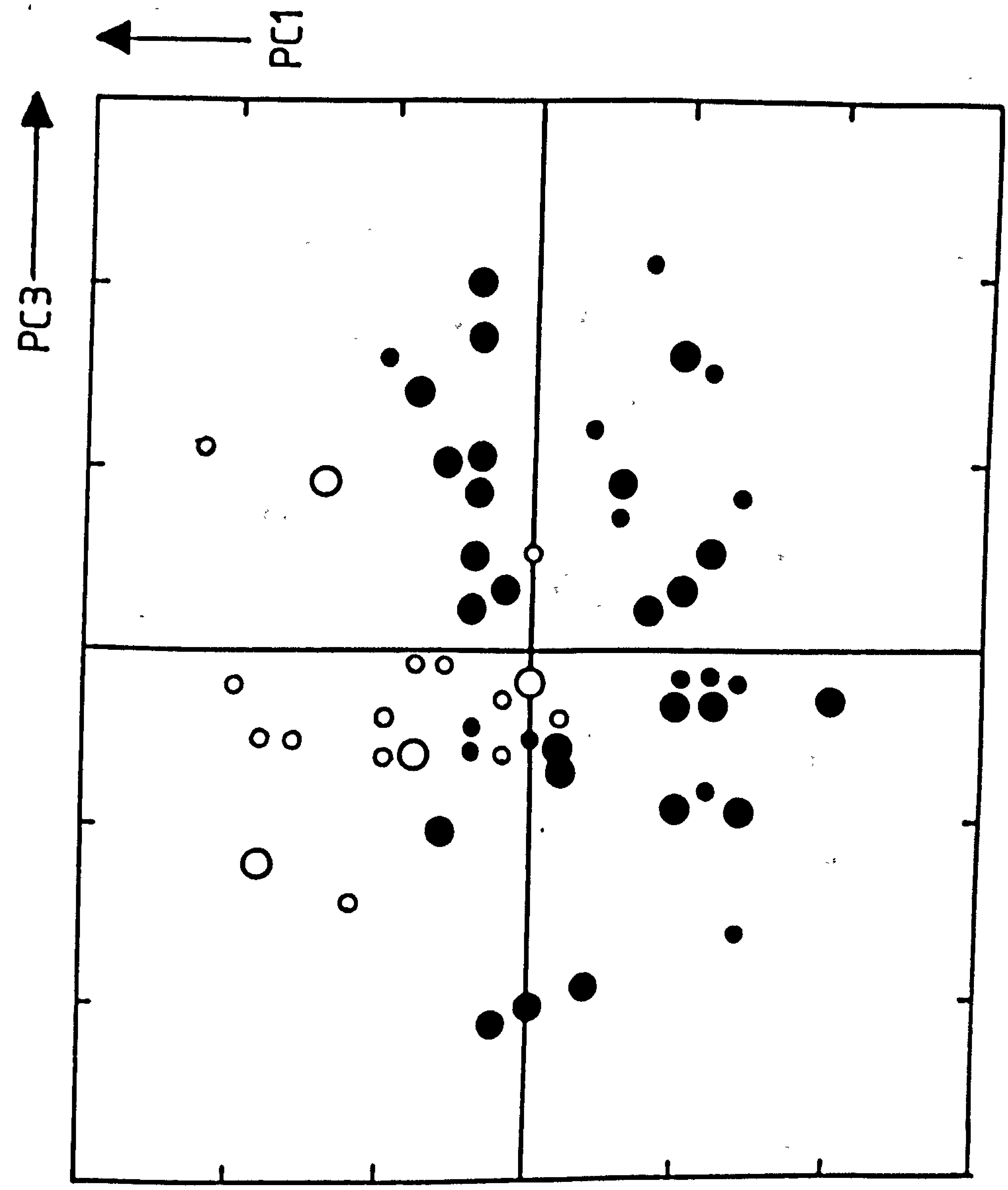



Figure 10.7.

Multivariate Analysis One: Principal Components Plot.

Open circles = Neolithic series.
Filled series = Bronze Age series.

Small circles = -ve PC2.
Large circles = +ve PC2.

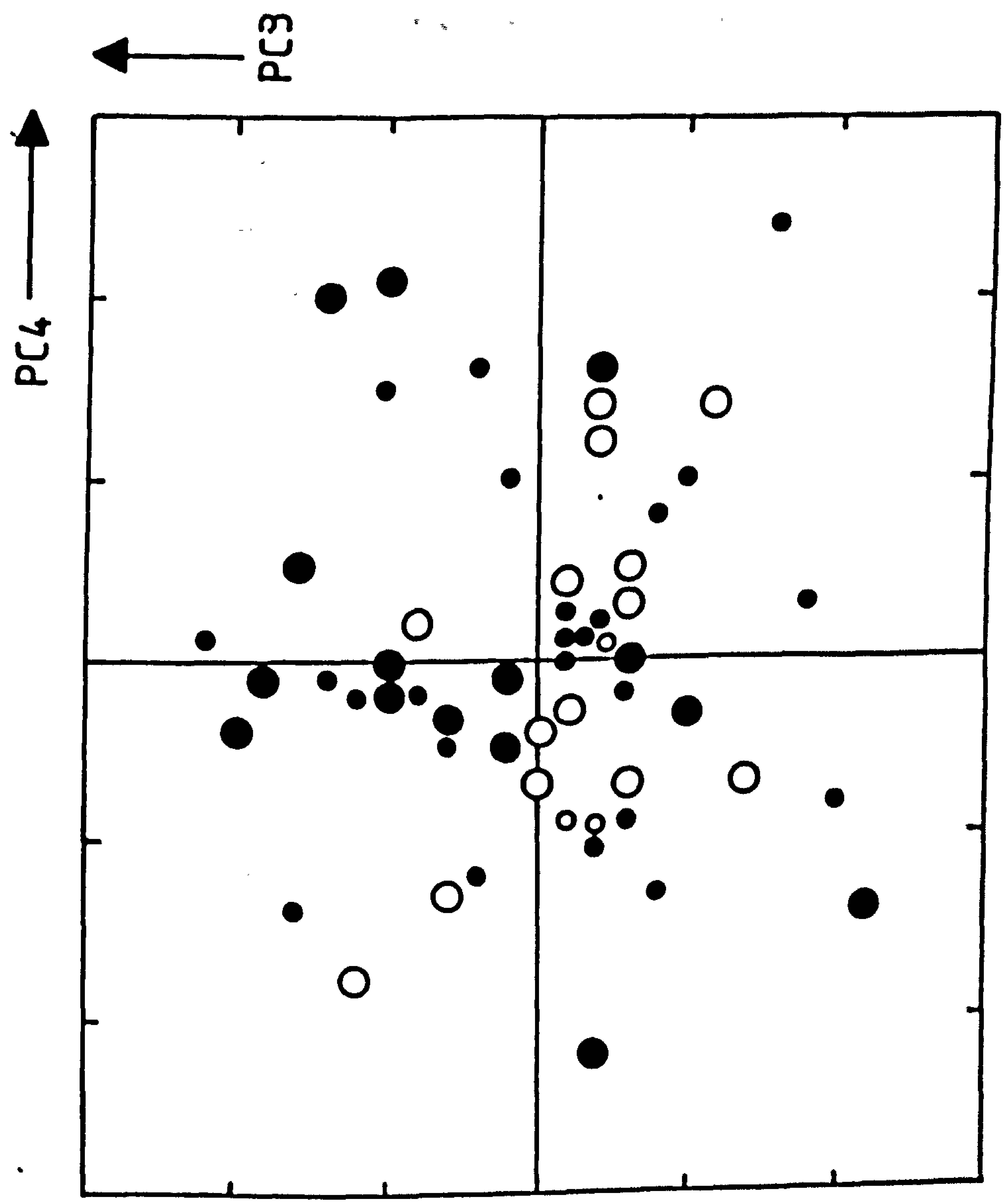



Figure 10.8.

Multivariate Analysis One: Principal Components Plot.

Open circles = Neolithic series.
Filled circles = Bronze Age series.

Small circles = -ve PC1.
Large circles = +ve PC1.

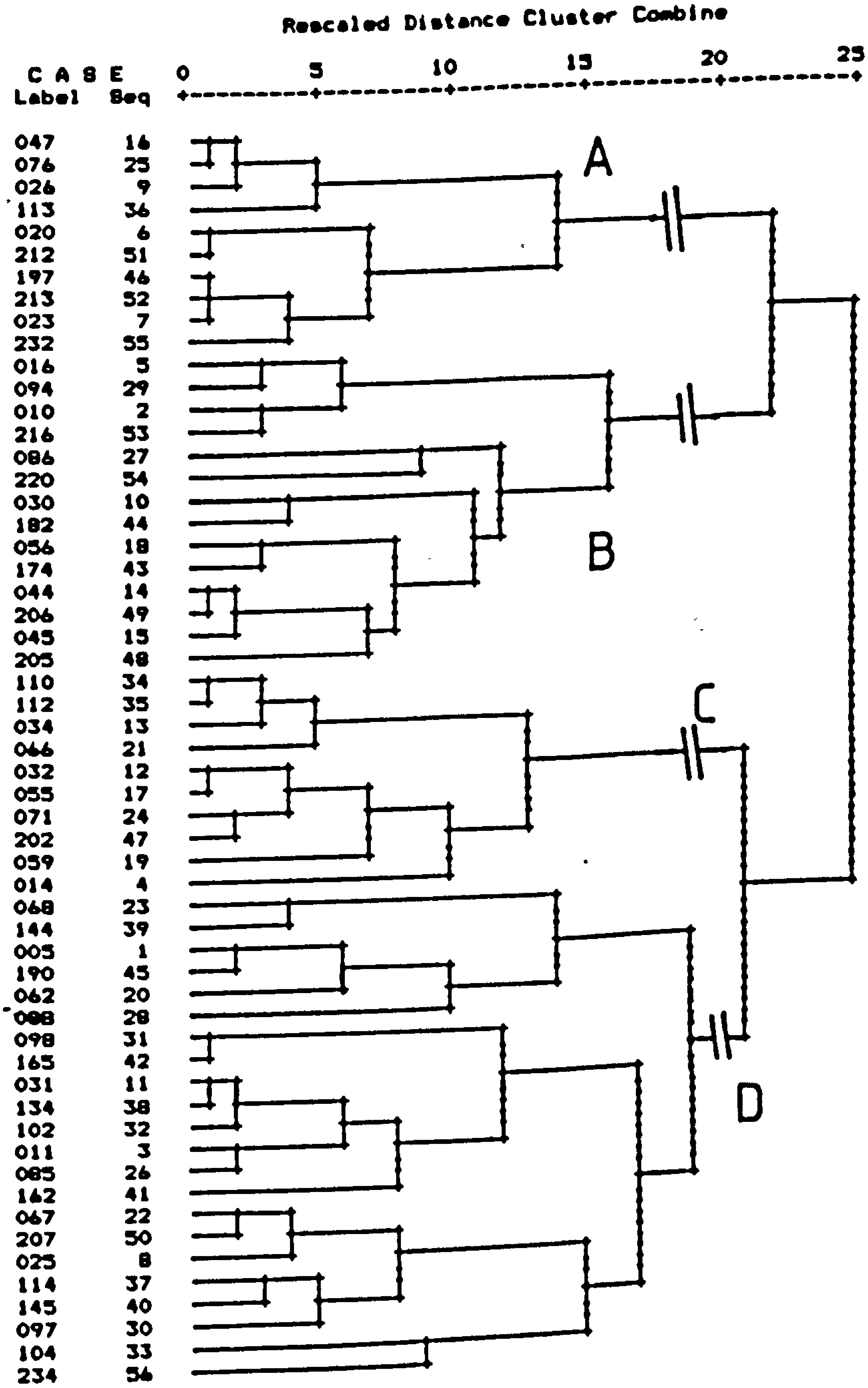



Figure 10.9.

Multivariate Analysis One: Cluster Analysis.

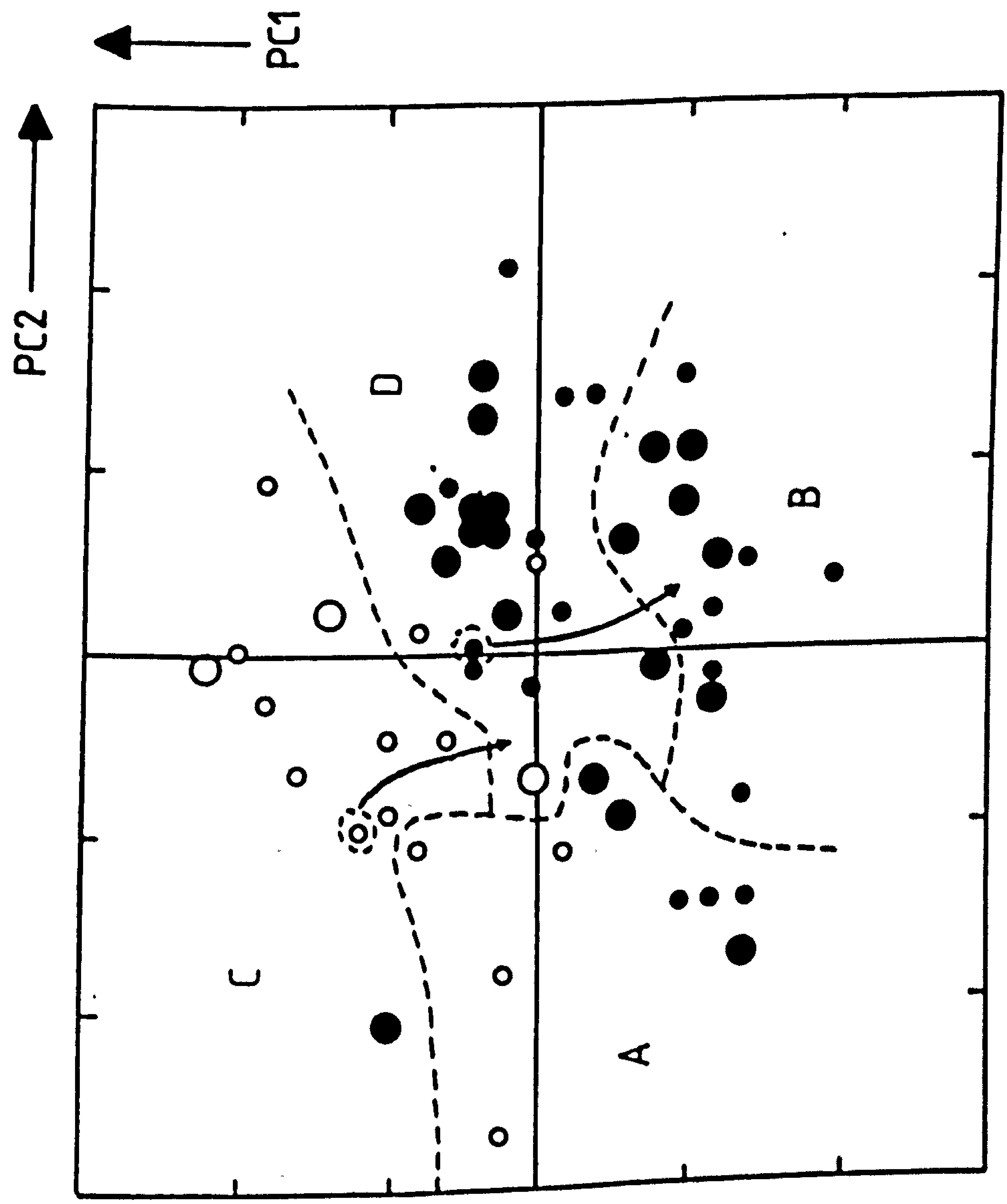



Figure 10.10.

Multivariate Analysis One: Superimposition of Cluster Structure onto Principal Component Plot.

Multivariate Analysis Two.

In this analysis, all male crania with a reduced set of measurements were examined. These measurements were GOL, XCB, WCB, FRK, OCK, PAK, PAC, and OCC; which, together, provided overall coverage of the calvarium. Although this reduced set of measurements diminished the descriptive potential of the analysis, this was compensated for by the increased number of crania able to be included.

Four of the principal components extracted from the data had an eigenvalue in excess of 1, although the scree plot suggested that only the first three were of any significance (Figure 10.11). The principal component loadings are presented in Table 10.8.

PC1 was, as in analysis 1, a measurement of length.

PC2 was marked by strong negative correlations with both measurements of occipital length (OCK,OCC) and by corresponding positive correlations with the measurements of parietal length (PAC,PAK). It was probably the equivalent of PC4 as extracted in analysis 1.

PC3 had a marked positive correlation with maximum breadth (XCB), it was also positively correlated with WCB, FRK and FRC. This pattern is similar to that represented by PC3 in analysis 1 and interpreted there as being representative of brachycephaly.

The projections of the component scores of individual crania onto the principal component axes are shown in Figures 10.12 - 10.13. As in analysis 1, separation of Bronze age and Neolithic series was achieved by PC1 and PC3, albeit with a greater degree of overlap. PC2 did not discriminate between samples, both sets of calvaria demonstrated a balanced distribution although the Neolithic

| FACTOR | EIGENVALUE | PCT OF VAR |
|---|---|---|
| 1 | 3.50773 | 39.0 |
| 2 | 1.75543 | 19.5 |
| 3 | 1.68338 | 18.7 |
| 4 | 1.03737 | 11.5 |
| 5 | .54065 | 6.0 |
| 6 | .21016 | 2.3 |
| 7 | .14578 | 1.6 |
| 8 | .08243 | .9 |
| 9 | .03707 | .4 |

```
        3.508 +    *
              I
              I
  E           I
  I           I
  G           I
  E           I
  N           I
  V           I
  A     1.755 +         *
  L     1.683 +              *
  U           I
  E           I
  S     1.037 +                   *
              I
              I
         .541 +                        *
         .210 +                             *
         .000 +----+----+----+----+----+----*----*----*
                   1    2    3    4    5    6    7    8    9
```

PC EXTRACTED    4 FACTORS.

Figure 10.11.

Multivariate Analysis Two: Eigenvalues and Screo Plot.

| | FACTOR 1 | FACTOR 2 | FACTOR 3 | FACTOR 4 |
|---|---|---|---|---|
| COL | .90131 | -.10245 | -.09467 | .06304 |
| XCB | -.20976 | .28243 | .72517 | .27606 |
| WCB | .14137 | .33499 | .44682 | .70680 |
| FRK | .61518 | .32917 | .51118 | -.42041 |
| PAK | .64035 | .52173 | -.48481 | .16137 |
| OCK | .65086 | -.67604 | .14014 | .17441 |
| FRC | .70892 | .18427 | .47076 | -.40609 |
| PAC | .73760 | .42094 | -.44395 | .16198 |
| OCC | .61045 | -.71009 | .11920 | .18241 |

Table 10.8.

Multivariate Analysis Two: Principal Component Loadings.

(Factor = Principal Component).

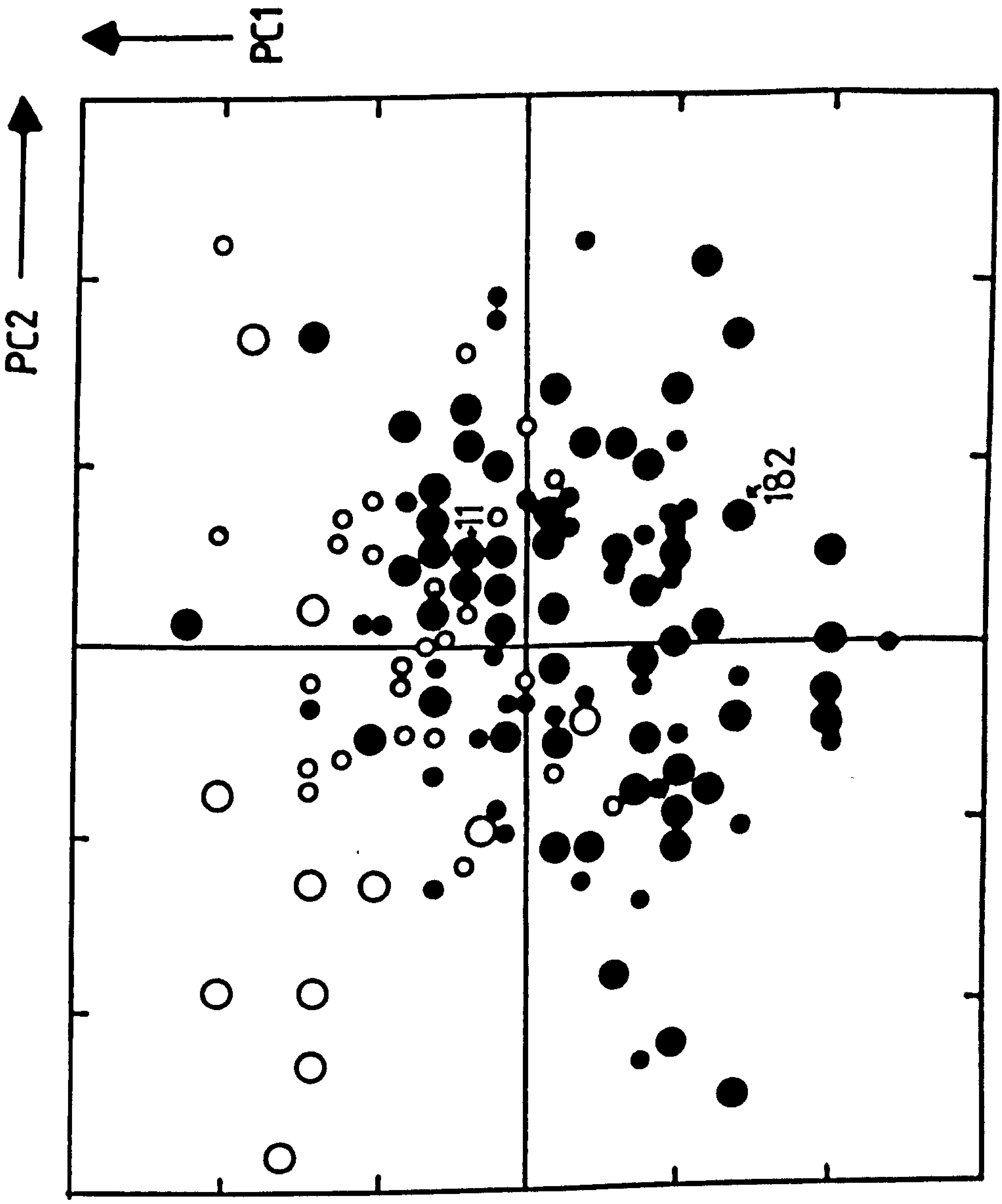



Figure 10.12.

Multivariate Analysis Two: Principal Components Plot.

Open circles = Neolithic series.
Filled circles = Bronze age series.

Small circles = -ve PC3
Large circles = +ve PC3

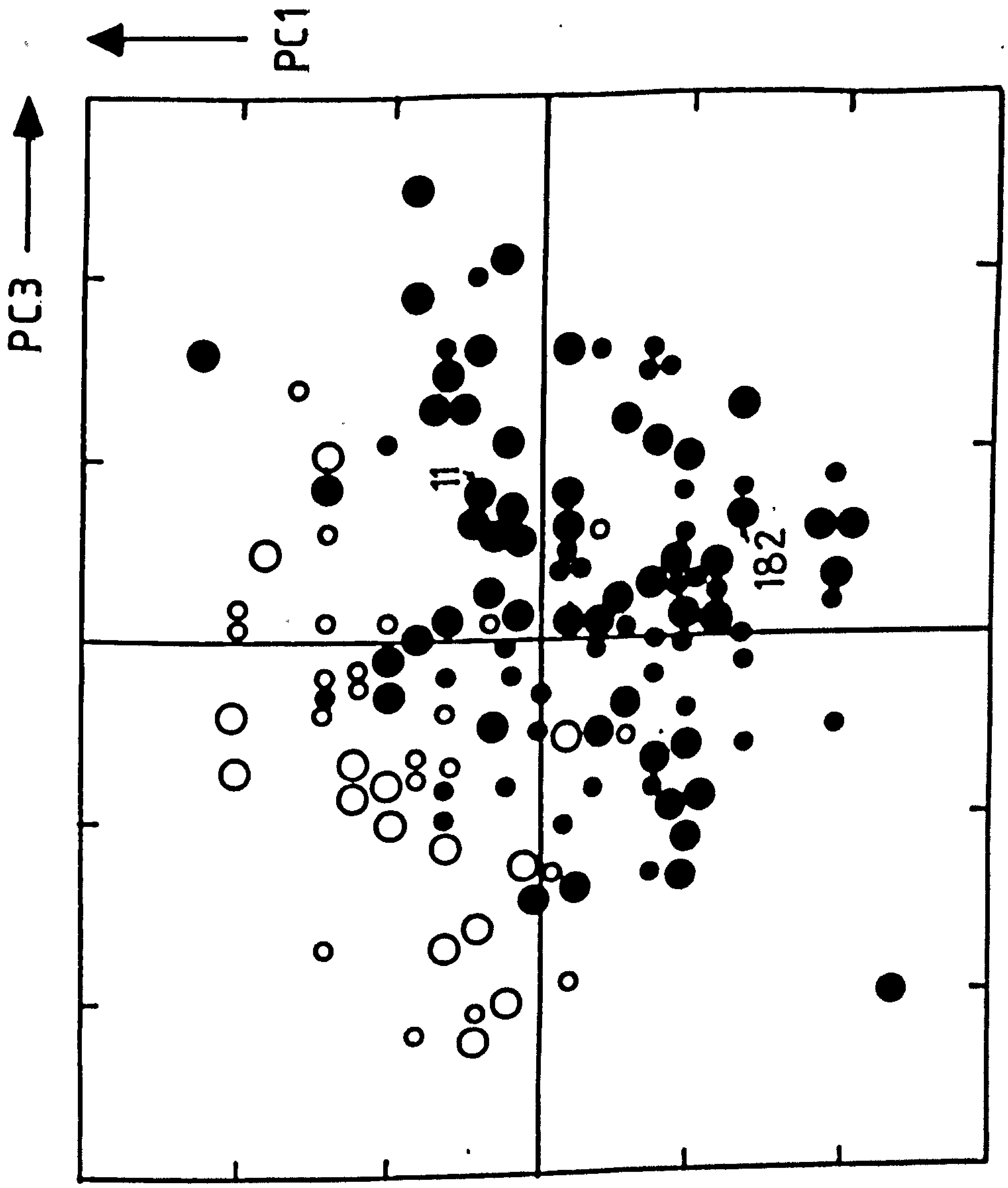



Figure 10.13.

Multivariate Analysis Two: Principal Components Plot.

Open circles = Neolithic series.
Filled circles = Bronze Age series.

Small circles = -ve PC2.
Large circles = +ve PC2.

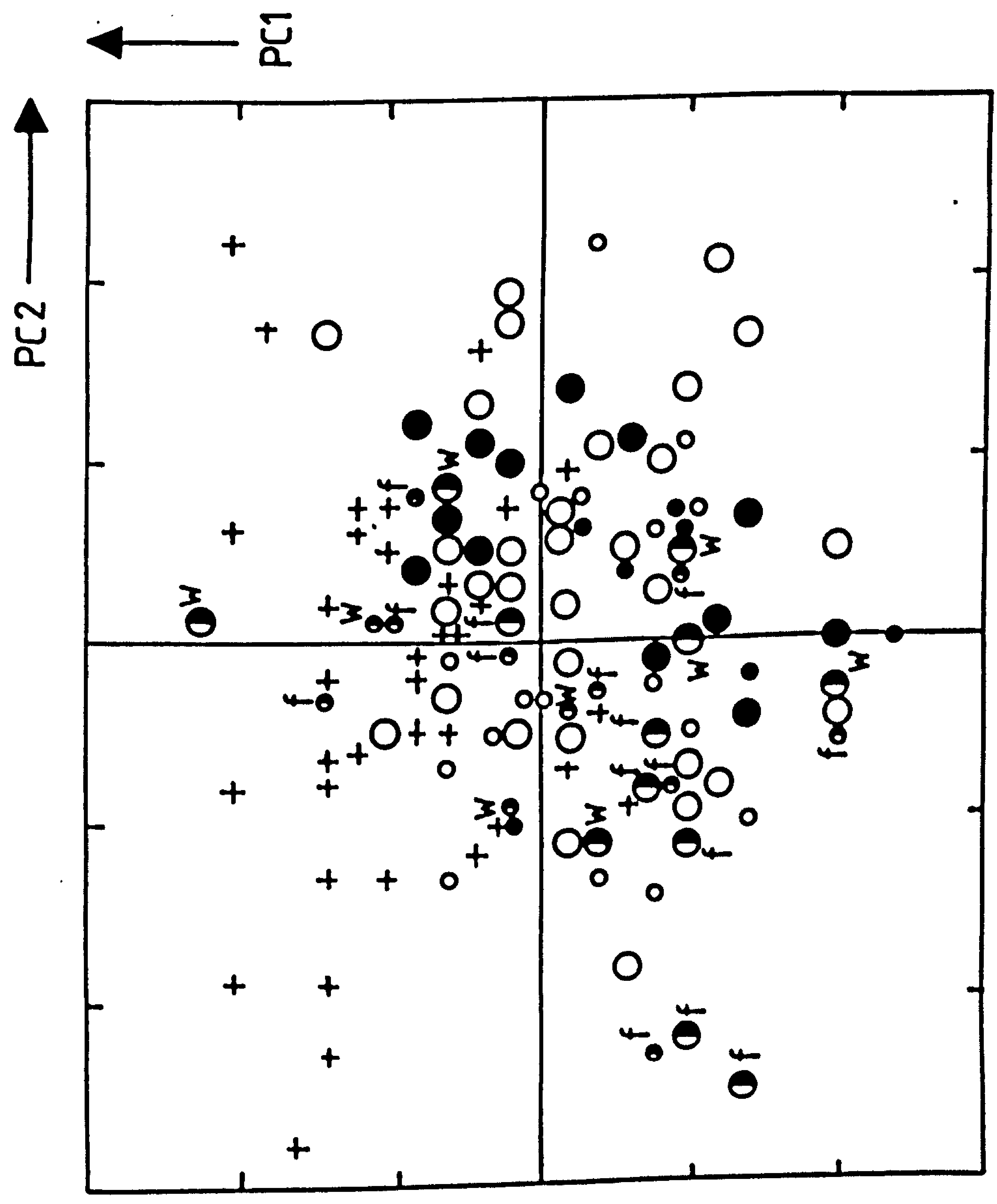
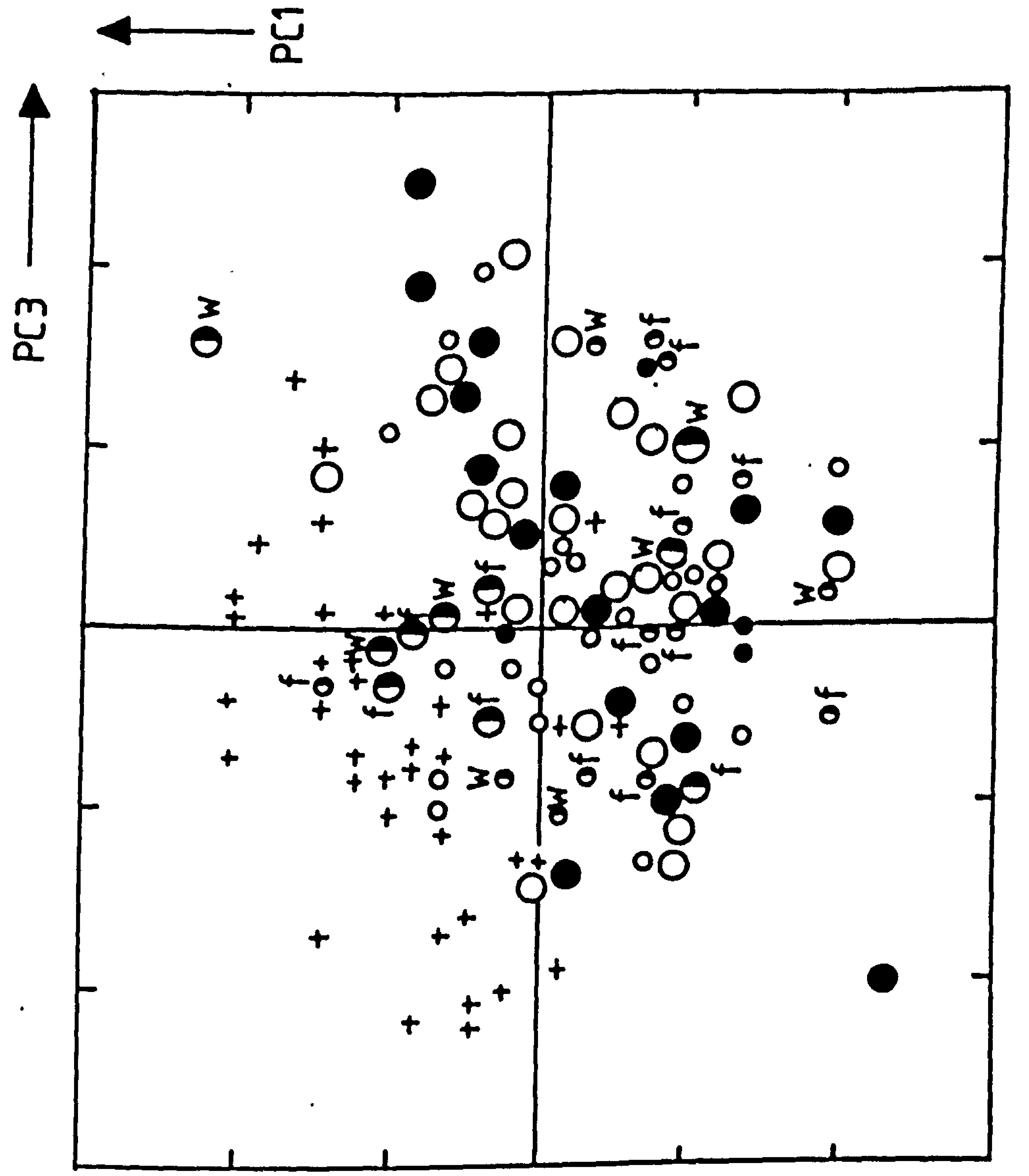



Figure 10.14.

Multivariate Analysis Two: Principal Components Plot.

Crosses = Neolithic series.
Open circles = group BA.
Filled circles = group BB.
Two-tone circles = groups WG/FV.




<u>Figure 10.15.</u>

<u>Multivariate Analysis Two: Principal Components Plot.</u>

Crosses = Neolithic series.
Open circles = group BA.
Filled circles = group BB.
Two-tone circles = groups WG/FV.

examples were marked by a trend not apparent within the Bronze Age series. The Neolithic skulls tended towards a negative correlation between PC2 and PC3, that is between length of the parietal bone, as measured along the saggital suture, and cranial width. This relationship, hinted at in analysis 1, was not present in the Bronze Age series.

Figures 10.14 and 10.15 show the principal component scores of the constituent groups of the Bronze Age series. They do not form discrete clusters, but there is a suggestion that groups FV and WG have positions on the PC2 axis midway between the EN and BB groups. This positioning will be discussed more fully in the next chapter.

Prior visual examination of the crania included in this study suggested that the physical conformation of two, at least, may have been unduly affected by cradleboarding. There was a marked flattening of the posterior surface of the calvarium. These crania were numbers 11 and 182 and might have been expected to show an extreme positioning in relation to other crania, but this was not the case (Figures 10.12 - 10.13), their positioning was not in any way remarkable. This suggests that the measurements used in this study were not ideally suited to the demonstration of cranial deformation arising out of the use of a cradle board, and that the absence of any evidence for this practice in this study should not be considered conclusive.

## Multivariate Analysis Three.

In this analysis, all female crania with the reduced set of measurements (GOL, XCB, WCB, FRK, OCK, PAK, PAC, OCC) were examined. The results were in broad agreement with those obtained from male crania in multivariate analysis two (Tables 10.9 & 10.10, Figures 10.16 & 10.17).

| FACTOR | EIGENVALUE | PCT OF VAR | CUM PCT |
|---|---|---|---|
| 1 | 3.22625 | 35.8 | 35.8 |
| 2 | 1.97712 | 22.0 | 57.8 |
| 3 | 1.68769 | 18.8 | 76.6 |
| 4 | 1.06444 | 11.8 | 88.4 |
| 5 | .55201 | 6.1 | 94.5 |
| 6 | .21712 | 2.4 | 96.9 |
| 7 | .19020 | 2.1 | 99.1 |
| 8 | .05685 | .6 | 99.7 |
| 9 | .02832 | .3 | 100.0 |

Table 10.9.

Multivariate Analysis Three: Eigenvalues.

| | FACTOR 1 | FACTOR 2 | FACTOR 3 | FACTOR 4 |
|---|---|---|---|---|
| GOL | .87595 | .07749 | -.06018 | .23848 |
| XCB | -.25120 | -.19517 | .69161 | .39936 |
| WCB | -.03130 | .36370 | .56062 | .62313 |
| FRK | .56531 | -.26917 | .58950 | -.42951 |
| PAK | .55327 | .78079 | -.04592 | .00510 |
| OCK | .66728 | -.55336 | -.28759 | .31305 |
| FRC | .63580 | -.12409 | .61518 | -.33948 |
| PAC | .69512 | .66086 | -.14822 | -.00947 |
| OCC | .66068 | -.60026 | -.24226 | .24890 |

Table 10.10.

Multivariate Analysis Three: Component Loadings.

(Factor = principal component).

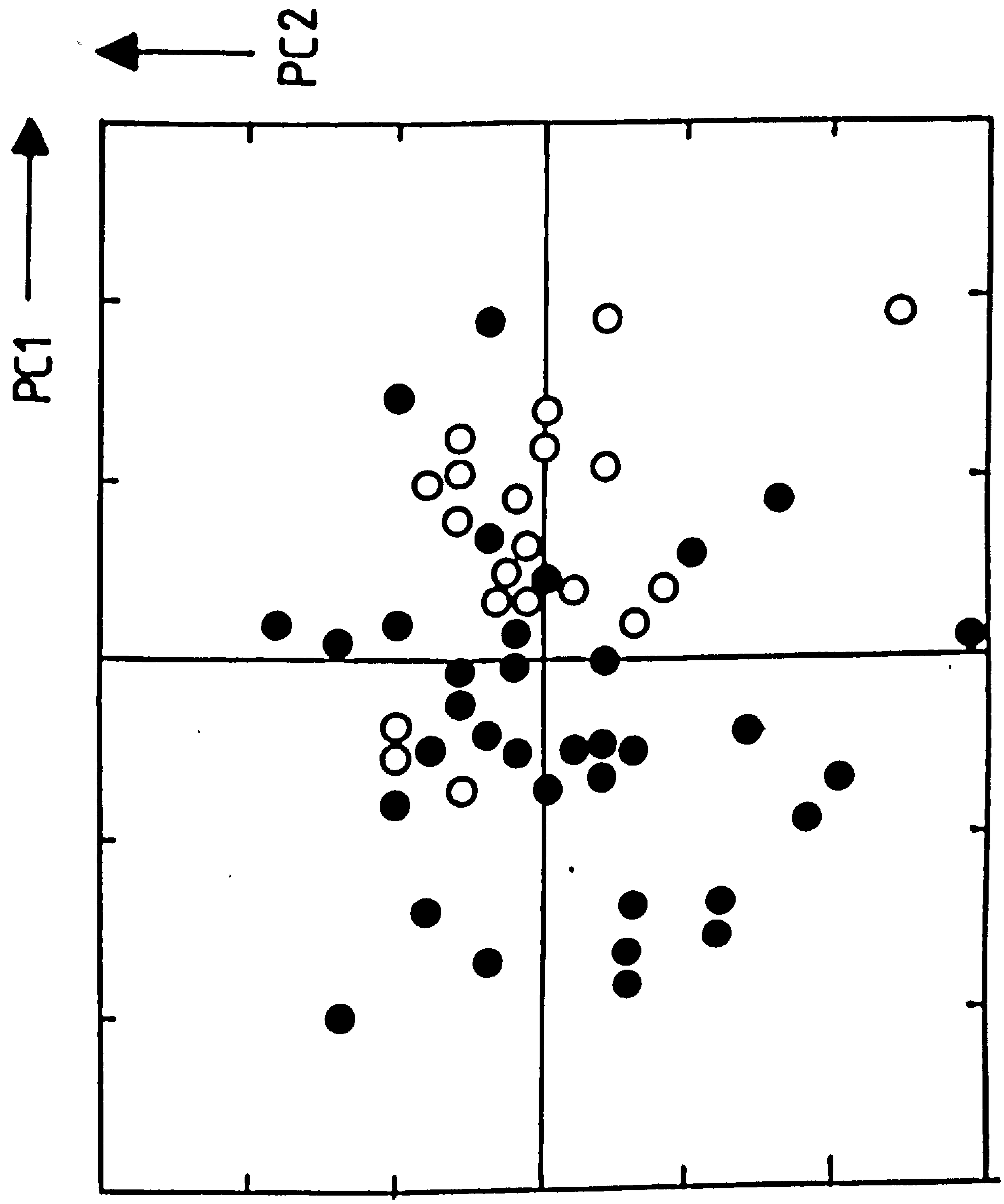



Figure 10.16.

Multivariate Analysis Three: Principal Component Plots.

Open circles = Neolithic series.
Filled circles = Bronze Age series.

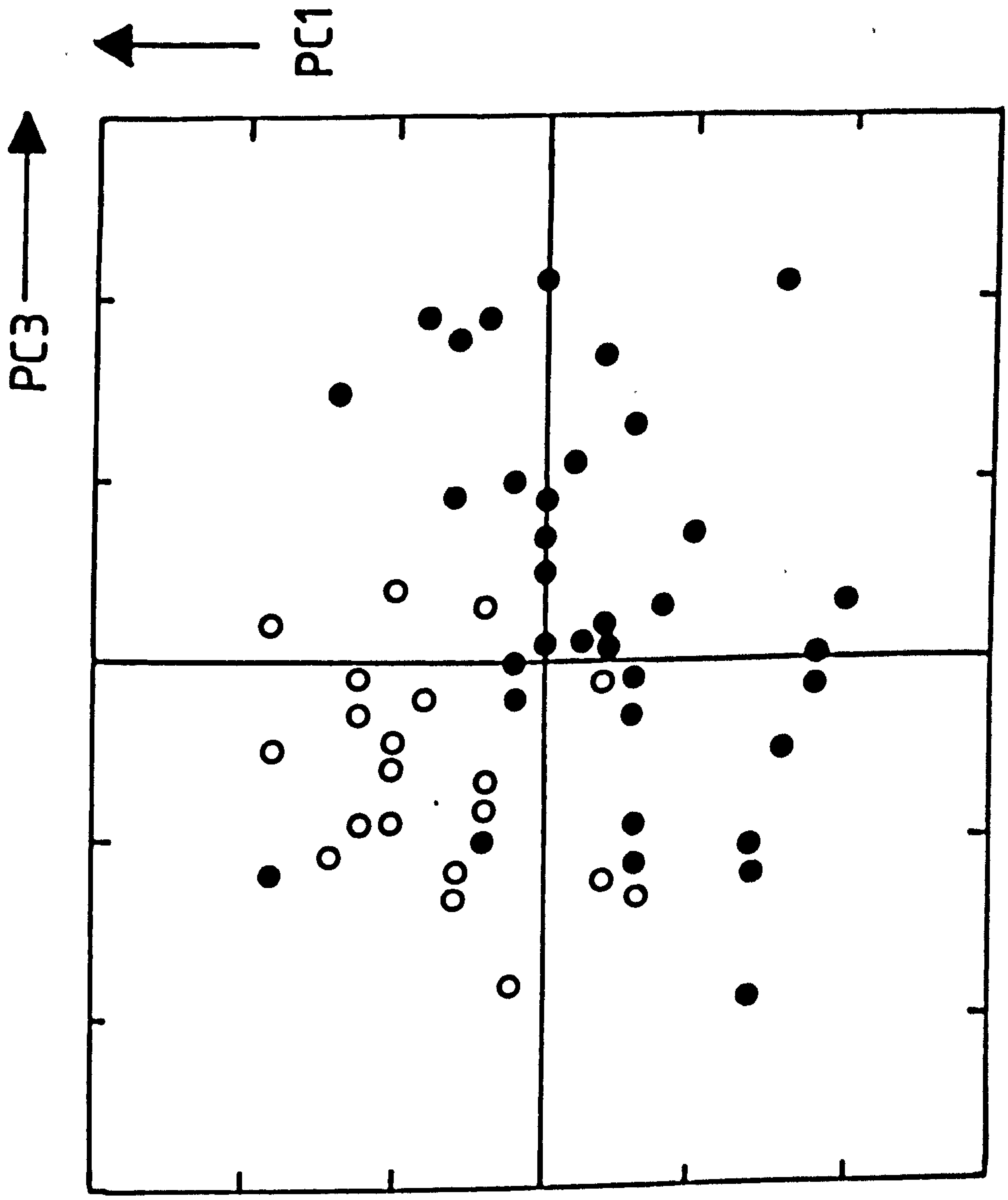



Figure 10.17.

Multivariate Analysis Three: Principal Component Plots.

Open circles = Neolithic series.
Filled circles = Bronze Age series.

Summary of Results.

The statistical analyses presented here largely, perhaps not surprisingly, corroborated earlier work. The main difference between the series was shown to be one of shape, represented in both analyses by PC1, a measure of length or dolichocephaly; and PC3, a measure of breadth or brachycephaly. The skulls of the Neolithic series were markedly dolichocephalic while those of the Bronze Age were more variable but tended towards brachycephaly. This apparently trivial finding is significant as it demonstrates, perhaps for the first time, that the use of the Cranial Index to discriminate between samples of crania drawn from different prehistoric populations is a meaningful exercise. The index embodies a large amount of real, morphological, information and is not to be viewed merely as a random combination of two, readily available, measurements. The importance of this finding is magnified when it is realised that it allows the comparison of the derived results with a larger body of data drawn from the literature. These comparisons are considered further in the next chapter, and are crucial for the investigation of the patterns, and causes, of diachronic change in cranial morphology.

Further features of anatomical differentiation were noted. The facial skeletons of the Bronze Age crania were shown to be higher, or more robust, than their Neolithic equivalents and associated with increased nasal breadths. The greatest contribution to the increased length of the Neolithic skull was made posteriorly by the parietal bones; within the Neolithic sample itself it was observed that the narrower skulls possessed longer parietal bones. Overall the Bronze Age crania were more variable in morphology than those of the Neolithic. The significance of these findings will be considered more fully below.

## Conclusion.

At the end of Chapter 6 it was proposed that this craniometric study was designed to answer three questions, which were:

1) Are the anatomical differences reported to exist between crania of the Neolithic and early Bronze Age real?

2) Assuming the answer to question (1) to be affirmative, then what are the possible aetiologies of such differences?

3) In the light of the answers to questions (1) and (2), is it possible to apprehend the intrusive presence of a "Beaker Folk" from amidst the human crania of prehistoric Britain?

It has been shown in this chapter that the answer to question (1) is indeed affirmative. The answers to questions (2) and (3) will be considered in the next chapter.

# Chapter Eleven.

## THE CRANIA OF PREHISTORIC BRITAIN.

### Introduction.

It has been confirmed that Neolithic skulls do tend to be, on average, longer and narrower than their Bronze Age counterparts. Traditionally, it has been assumed that this difference in morphology is a realisation of a difference in genotype - with a population of Bronze Age "round heads" supplanting one of Neolithic "long heads". Alternative explanations were proposed in Chapter 8, however. It was suggested instead that cranial morphogenesis might be determined, or at least affected, by cultural or natural aspects of the extra-cranial environment. It is proposed, during the course of this chapter, to assess the relative merits of these two opposed hypotheses of cranial morphogenesis - genetic and environmental - when explaining the results of the craniometric study. Comparative data drawn from the literature will also be used to create synchronic and diachronic contexts within which these hypotheses may be better considered.

### Genetic Determinism.

At its simplest, genetic determinism assumes that cranial form is determined by the action of a multiple gene system, and that the expression of this gene system is resistant to environmental perturbation. It follows that the range of cranial morphologies present within a population can change only by means of microevolution, and in particular by gene flow. Thus, following population, and therefore genetic, admixture a hybrid cranial morphology should emerge which encompasses that of both parent populations but, on average, presents as intermediate in form.

It has already been argued that there is little hard evidence to support the case for genetic determination of cranial morphology. If it is accepted for the time being, however, and if it is assumed that an immigrant "Beaker Folk" interbred with an indigen ous, insular, population; then the results of the craniometric study are perhaps in accord with such a hypothesis. When the individual PC scores which were obtained during Multivariate Analysis Two are projected onto their respective axes there is a suggestion that the crania of the early Bronze Age WG and FV groups may be separated from those of the BB group and that they may be intermediate in form between groups EN and BA.(Figures 11.1, 11.2, 11.3, 11.4).

This observation is, by itself, relatively inconclusive. However, it is possible to further test the hypothesis of genetic determinism if Cranial Indices alone are considered, which allows the utilisation of a large body of comparative data. If the brachycephalic skull type was characteristic of a "Beaker Folk", and if it is proposed that the brachycephalisation of a region's population followed on from the penetration of Beaker migrants, then those regions which did not witness Beaker immigration should not show equivalent evidence of brachycephalisation. This is not the case. Late Neolithic/early Bronze Age crania have been recovered from two areas of north-west Europe which retain few, if any, traces of the Beaker Culture. These areas are Denmark and the part of north-eastern France that was home to the S.O.M. culture. In both these areas there is a trend towards early Bronze Age brachycephaly. Indeed, the Cranial Indices of the contemporary English, French and Danish groups are virtually indistinguishable (Figure 11.5, Table

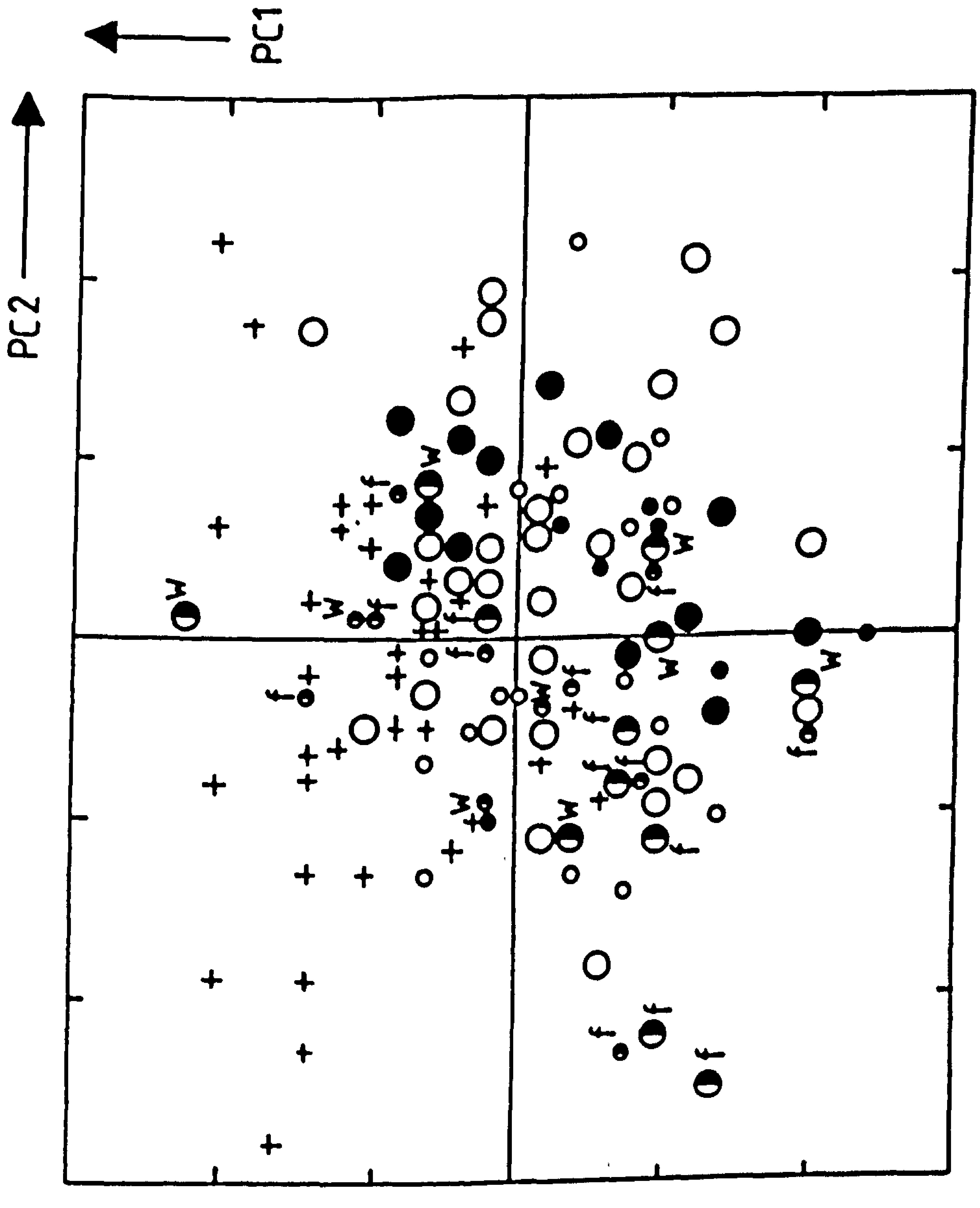



Figure 11.1.

Multivariate Analysis Two: Principal Components Plot.

Crosses = Neolithic series
Open circles = early Bronze Age group BA.
Filled circles = early Bronze Age group BB.
Two-tone circles = early Bronze age groups WG/FV.
(After Figure 10.14.)

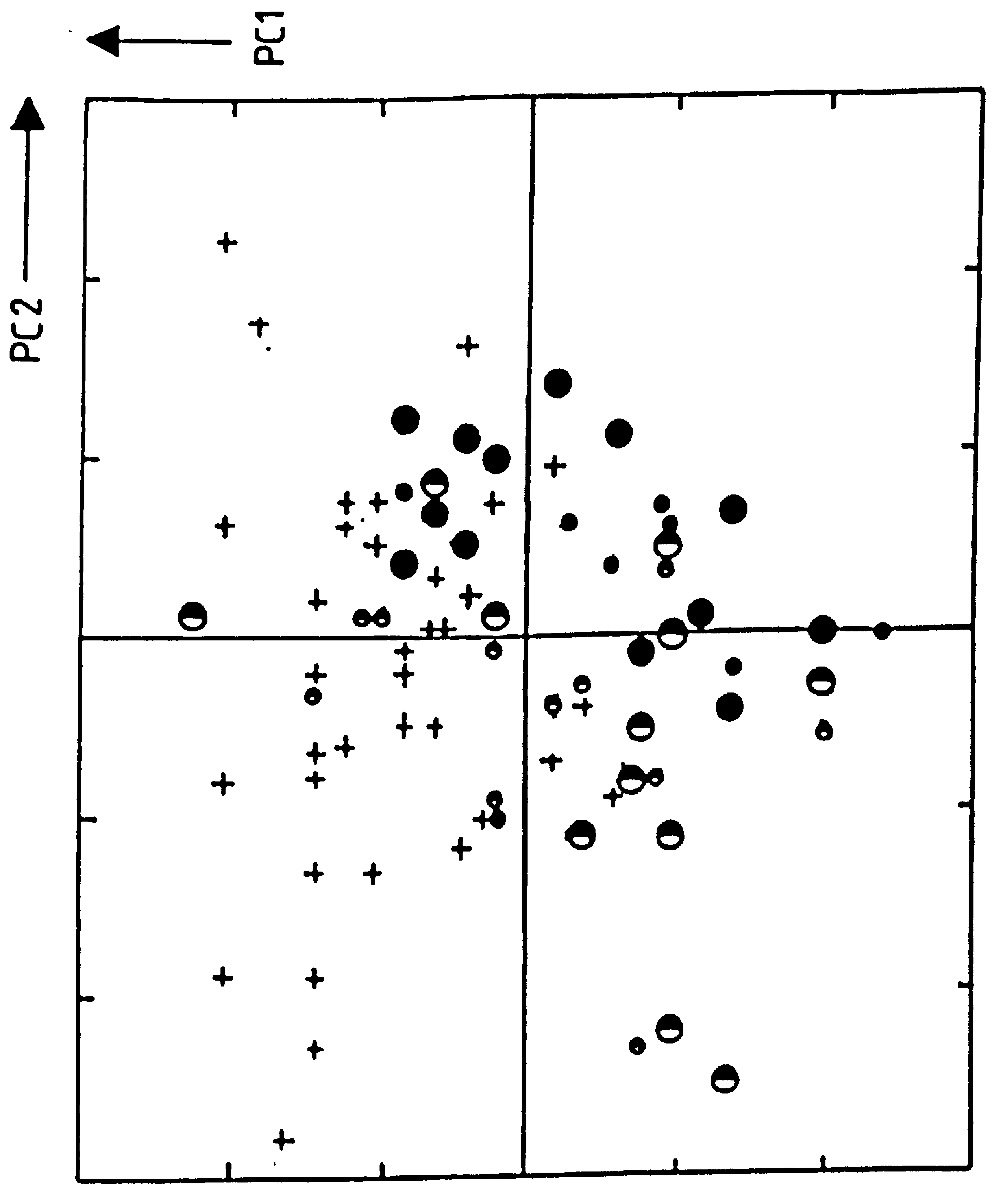



Figure 11.2.

Multivariate Analysis Two: Principal Components Plot with Non-Specific Bronze Age Crania (Group BA) Removed for Purposes of Clarity.

Crosses = Neolithic Series.
Filled circles = early Bronze Age group BB.
Two-tone circles = early Bronze Age groups FV/WG.

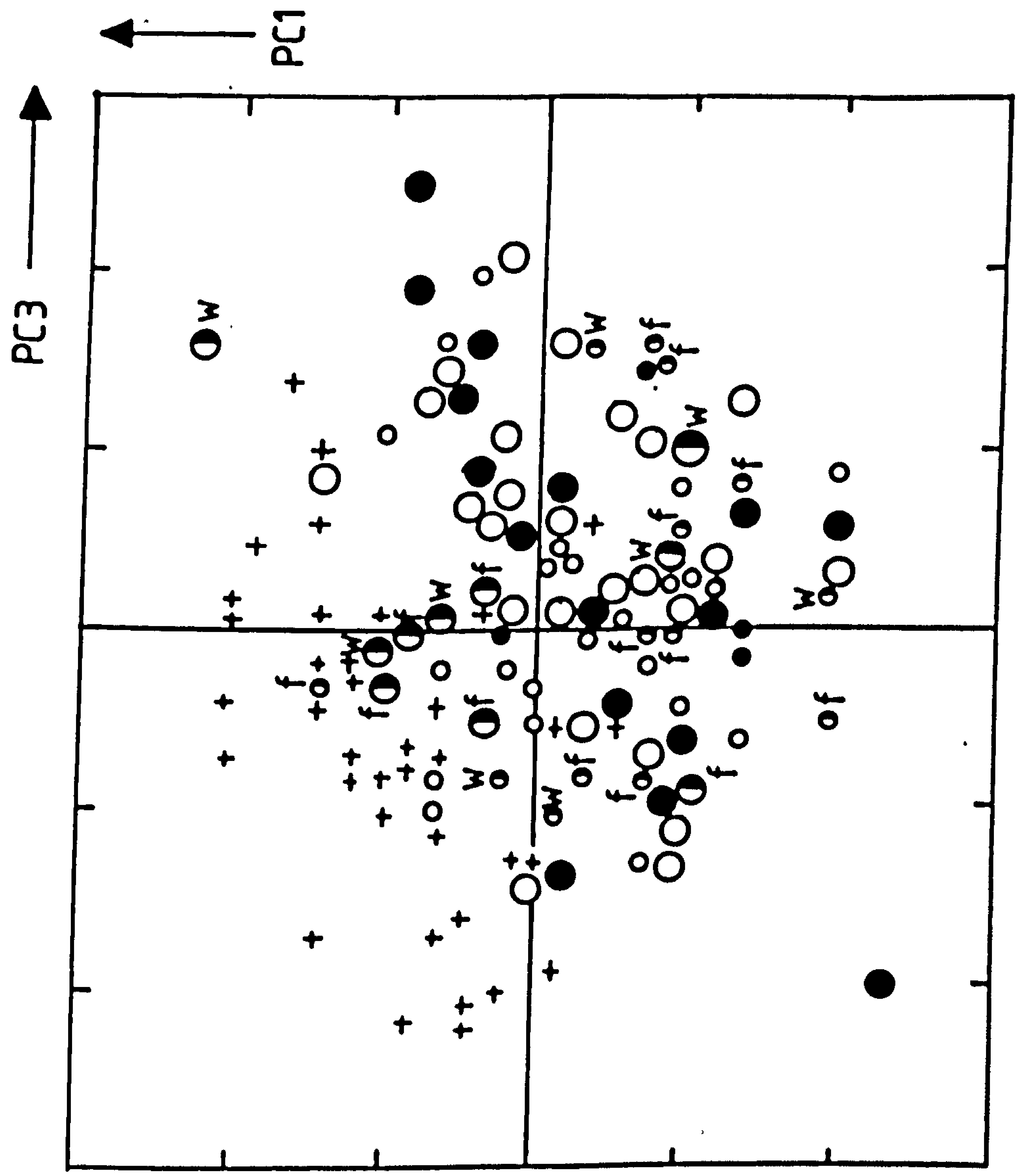



Figure 11.3.

Multivariate Analysis Two: Principal Components Plot.

Crosses = Neolithic series.
Open circles = early Bronze Age group BA.
Filled circles = early Bronze Age group BB.
Two-tone circles = early Bronze Age groups WG/FV.
(After Figure 10.15.)

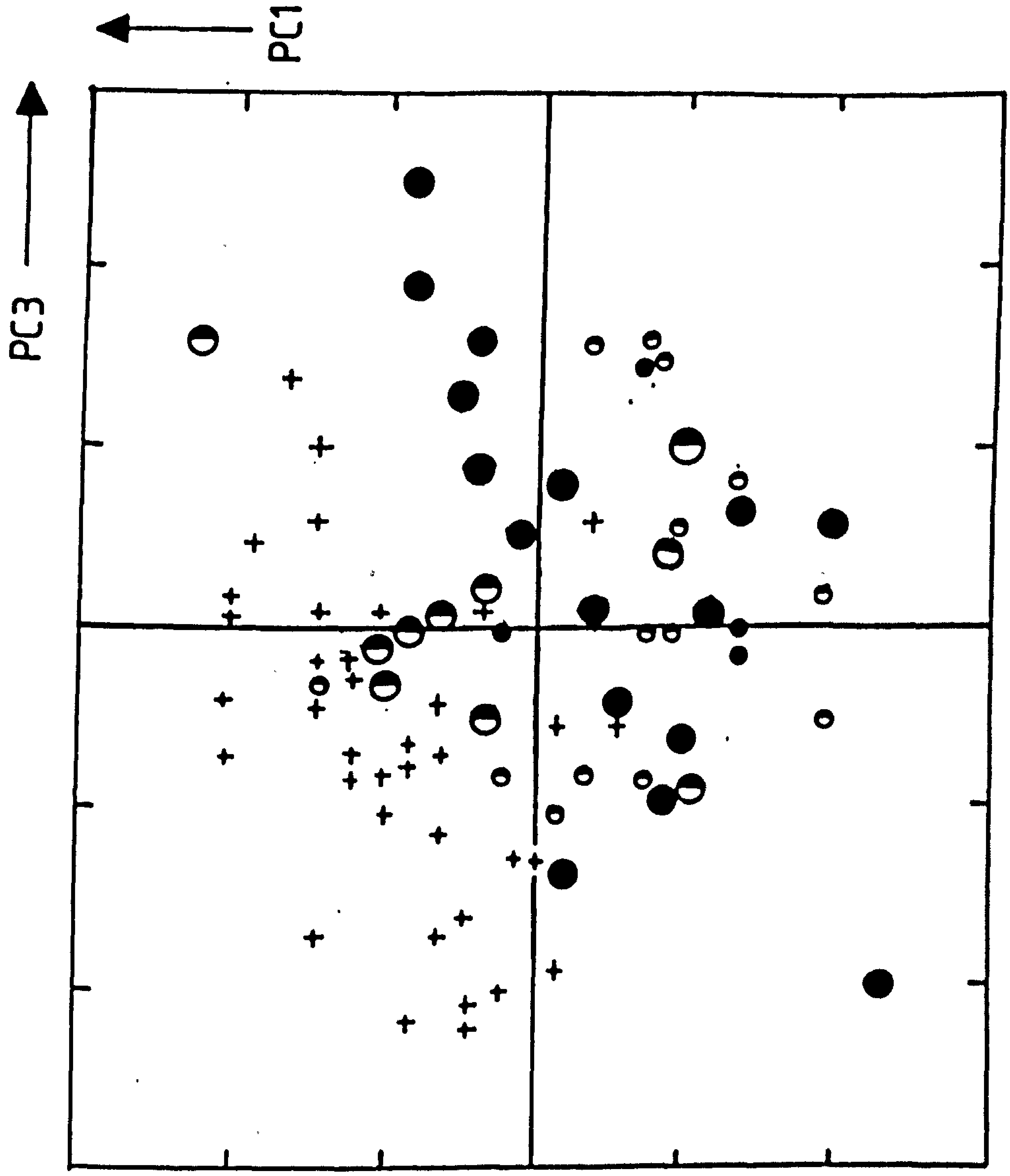



Figure 11.4.

Multivariate Analysis Two: Principal Components Plot with Non-Specific Bronze Age Crania (Group BA) Removed for Purposes of Clarity.

Crosses = Neolithic series.
Filled circles = early Bronze Age group BB.
Two-tone circles = early Bronze Age groups WG/FV.

11.1). If the English data are in any way remarkable, then, it is for the degree of early Neolithic dolichocephaly, not early Bronze Age brachycephaly.

This trend to brachycephaly which manifests itself in the crania of Neolithic and early Bronze Age north-west Europe suggests further that cranial form is not genetically determined, and that it might alter through time by mechanisms other than those of microevolution. A similar conclusion is reached after inspection of historical British data (Figure 11.6, Table 11.2). It is evident that mean Cranial Index increased from the moderately dolichocephalic Anglo-Saxon-Scandinavian skulls of the early medieval period until a degree of brachycephaly was reached in the the later middle ages which equalled, or even exceeded, that of the preceding Bronze Age population. By the 17th century the mean Cranial Index had declined. This oscillation in mean Cranial Index was not accompanied by any major population influx and it is unlikely that any other process of microevolution could effect such a change. There must have been factors other than genes at work. Again, however, in this long term historical context, it is the extreme dolichocephaly of the early Neolithic crania that excites comment, not the brachycephaly of the Bronze Age.

## The Natural Environment: Climate.

In Chapter 8, literature was cited to suggest the existence of an intimate association between climate and cranial form. It seems possible, then, that changes in climate might induce corresponding alterations in cranial morphology. Over the past millenium the British climate has been anything but stable, and the pattern of its variability is reasonably well known, in outline form at least. This allows comparison of climatic data with the historical cranial data presented in Table 11.2.

Table 11.1. European Cranial Data.

(Males Only).

| Location. | Approximate Date. | Cranial Index. (Mean ±1SD) | Reference. |
|---|---|---|---|
| Northern France. | 7000BC - 4900BC | 73.0 ±2.7 | Asmus (1973) |
| Northern France | 4950BC - 4400BC | 73.2 ±3.4 | Riquet (1973) |
| Northern France | 4400BC - 3400BC | 73.8 ±4.0 | Riquet (1973) |
| Northern France | 3400BC - 1750BC | 77.8 ±5.2 | Riquet (1973) |
| Denmark | 3400BC - 2600BC | 76.0 ±3.8 | Jorgensen (1973) |
| Denmark | 2600BC - 1800BC | 77.2 ±3.8 | Jorgensen (1973) |
| England | 4000BC - 3000BC | 70.1 ±3.2 | Present Study |
| England | 2500BC - 1600BC | 78.1 ±5.3 | Present Study |

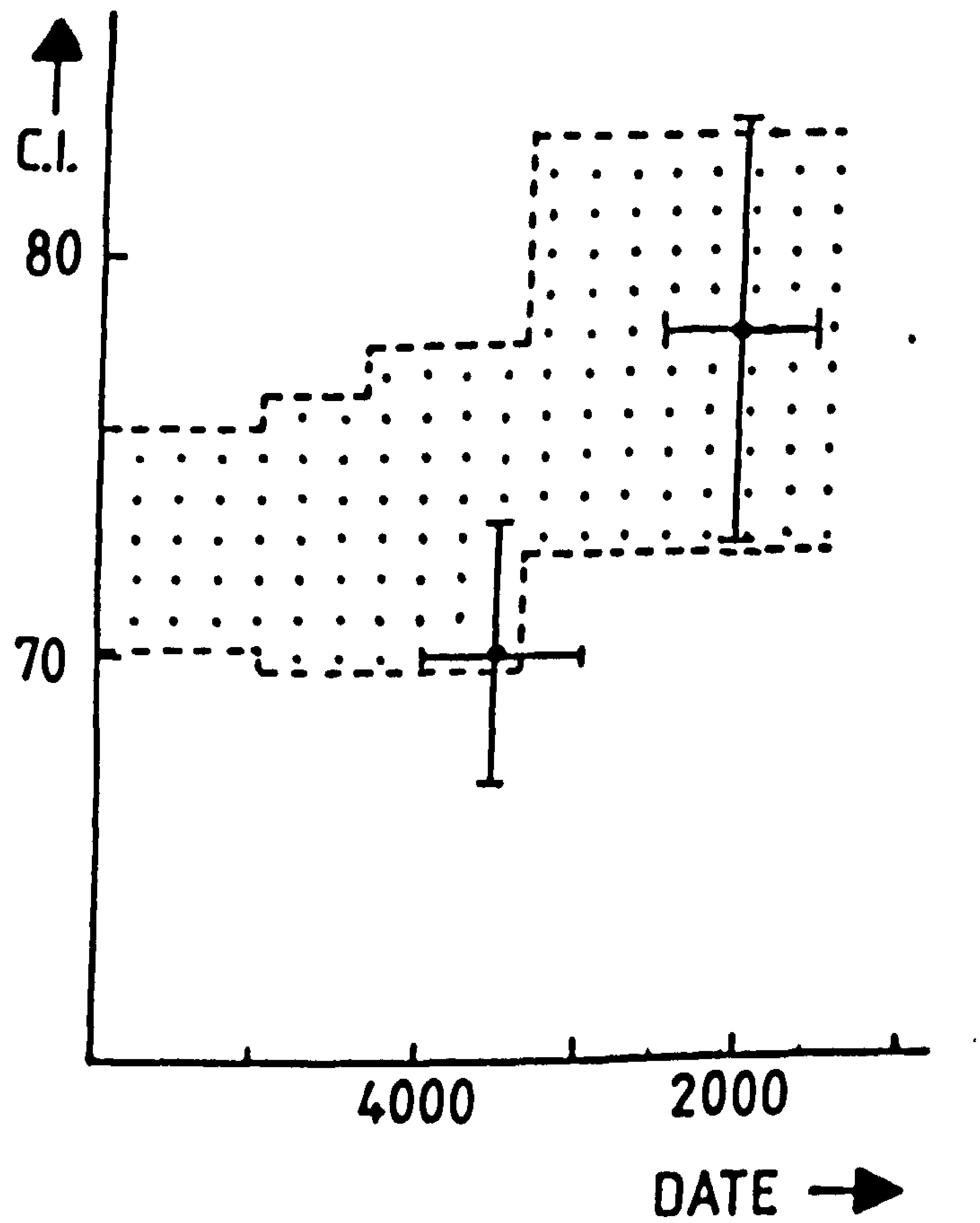



Figure 11.5.

Cranial Indices of some Prehistoric English and French Populations.

Mean ±1SD range of Cranial Indices of north French crania represented by dotted area. Superimposed are the mean ±1SD Cranial Indices of the English Neolithic and early Bronze Age series obtained during the present study. The horizontal bars provide an indication of the chronological spans of the respective English groups.

Table 11.2. British Cranial Data.

(Male Crania Only).

| Location | Approximate Date. | Cranial Index. (Mean ±1SD) | Reference. |
|---|---|---|---|
| England | 4000BC - 3000BC | 70.1 ±3.2 | Present Study |
| England | 2500BC - 1600BC | 78.1 ±5.3 | Present Study |
| Wetwang Slack. | 400BC - 50AD | 73.6 ±4.0 | Dawes (1980) |
| Maiden Castle. | 100BC - 50AD | 76.0 ±2.3 | Goodman & Morant(1940) |
| Danes Graves | 400BC - 50AD | 73.3 ±3.5 | Wright (1903) |
| Trentholme Drive | 150AD - 350AD | 76.5 ±8.4 | Dawes (1980) |
| Bidford on Avon | 500AD - 550AD | 73.6 ±2.7 | Brash et al (1935) |
| Burwell | 600AD - 700AD | 74.5 ±3.2 | Brash et al (1935) |

Table 11.2. (contd.) British Cranial Data.

(Male Crania Only).

| Location | Approximate Date. | Cranial Index. (Mean ±1SD) | Reference. |
|---|---|---|---|
| York Minster | ?500AD - 1100AD | 75.3 ±3.6 | Dawes (1980) |
| York Aldwark | 950AD - 1550AD | 79.4 ±4.3 | Dawes (1980) |
| York Clementhorpe | 1150AD - 1550AD | 80.2 ±3.6 | Dawes (1980) |
| Hythe | 1100AD - 1600AD | 82.6 ±3.7 | Dawes (1980) |
| Scarborough | 1200AD - 1500AD | 79.0 ±4.4 | Little (1943) |
| Carmelite Friary | 1300AD - 1600AD | 79.6 ±3.6 | Miles (1989) |
| Ensay | 1500AD - 1600AD | 77.1 ±3.3 | Miles (1989) |
| Farringdon Street | 1600AD - 1700AD | 75.4 ±3.5 | Hooke (1926) |
| Whitechapel | 1600AD - 1700AD | 74.3 ±3.3 | McDonell (1904) |
| Moorfields | 1600AD - 1700AD | 75.5 ±3.0 | McDonell (1906/7) |

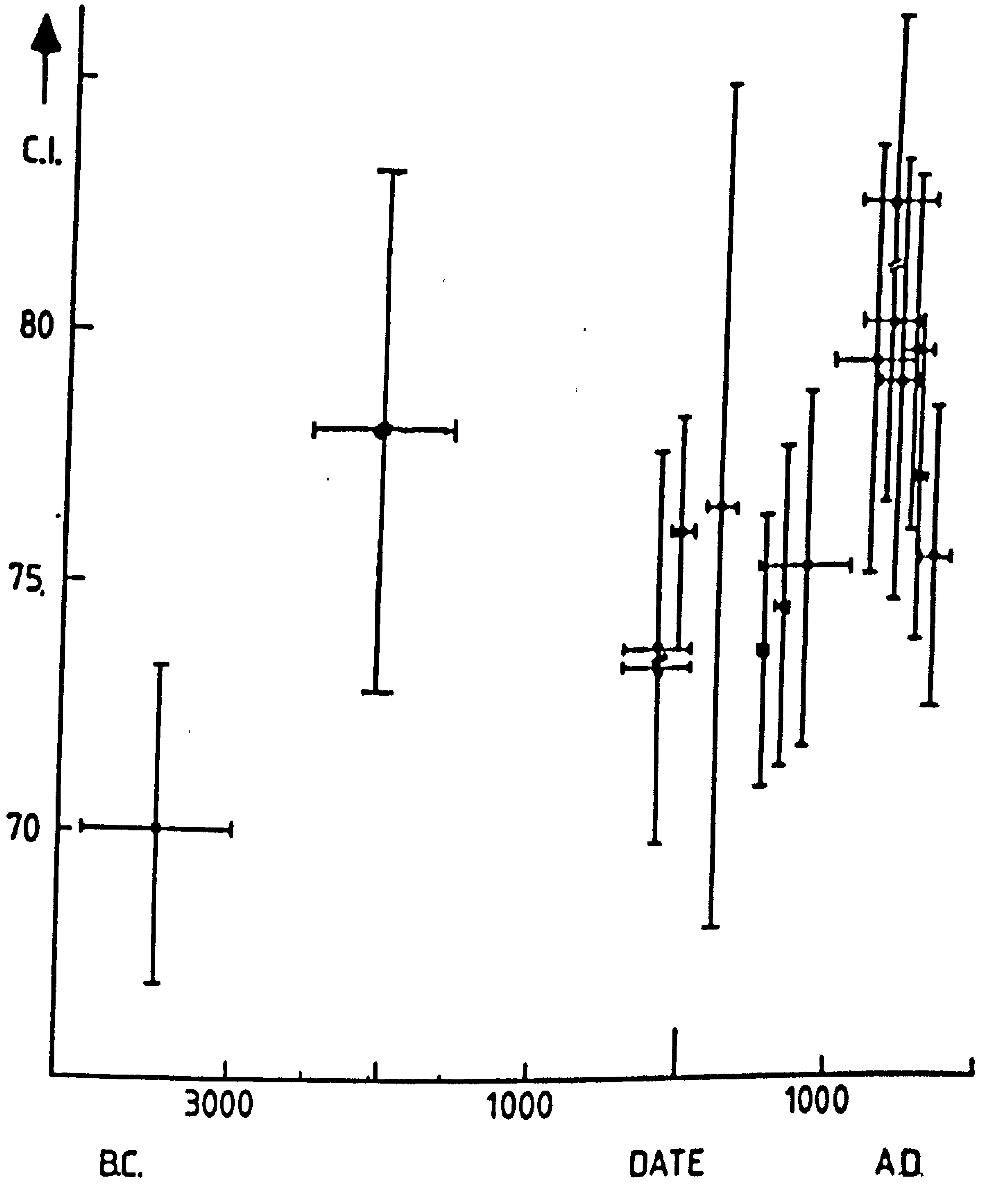
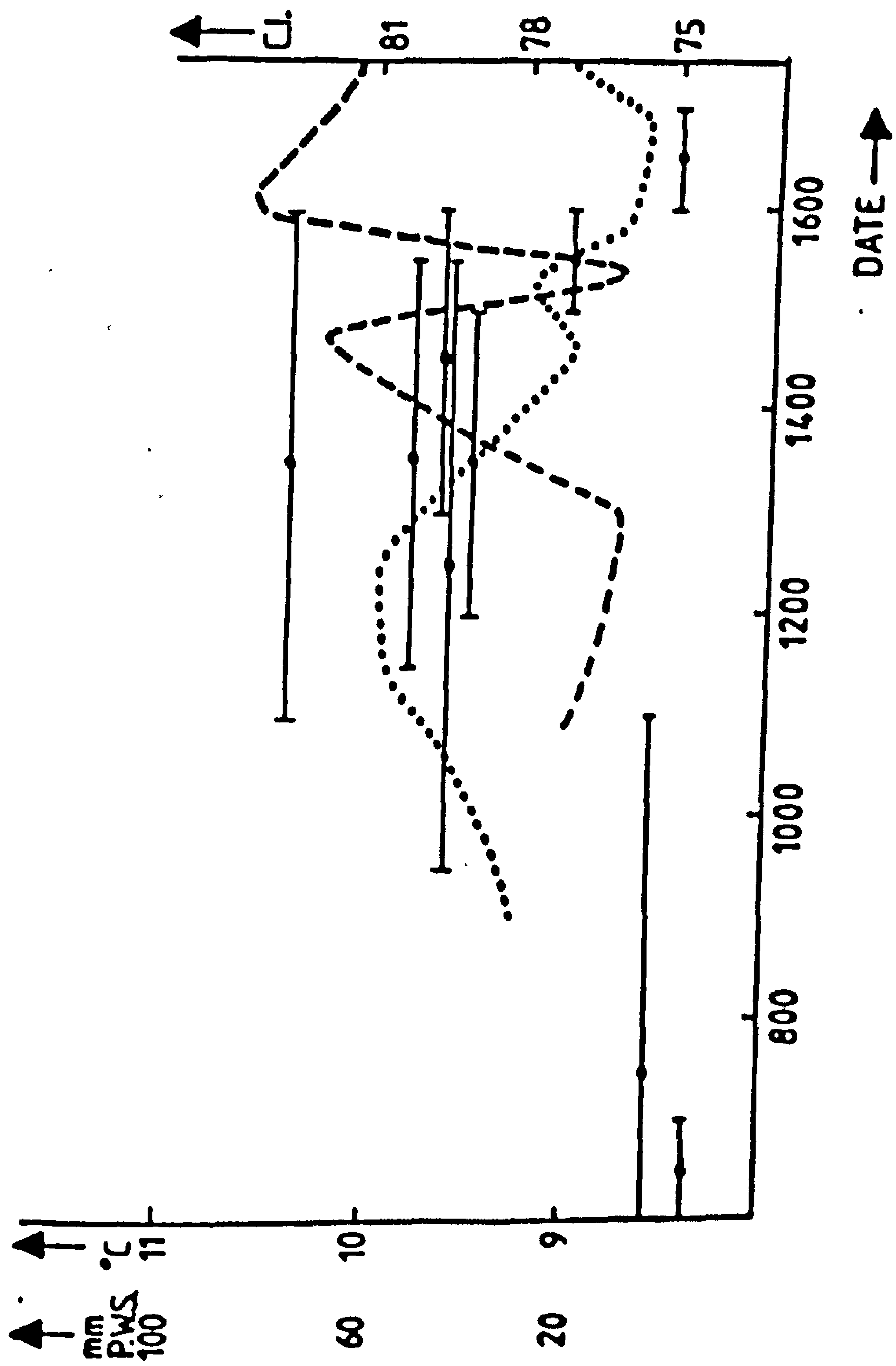



Figure 11.6.

Cranial Indices of Prehistoric and Historic British Populations.

Mean ±1SD range of Cranial Indices. Horizontal bars indicate approximate chronological span of the population.




<u>Figure 11.7.</u>

<u>Fluctuations in Climate and in Cranial Index.</u>

Broken line = potential water surplus in southern Scotland, measured at 50 year intervals. (Parry 1985: 43).

Dotted line = mean average temperature in central England, measured at 50 year intervals. (Lamb 1988: 53).

The first thing to notice is that there is a long term trend of climatic change apparent against a background of short term fluctuations (Lamb 1988: 27-39). The first century of the present millenium witnessed a gradual warming, to be followed by a climatic optimum between 1100AD and 1300AD. During this time average temperatures were 0.5°C higher than at present and the period was marked by the relatively frequent occurence of warm, dry summers and autumns. There was a subsequent deterioration of climate from this optimum until the nadir of the "little ice age" was reached between 1600AD and 1700AD. Average temperatures were 2°C cooler than at present and there was an increased incidence of wet, cool summers and autumns. Thereafter there was a recovery which lasted until the middle years of the present century. A graphical summary of this climatic oscillation is presented in Figure 11.7 with the Cranial Indices of chronologically relevant populations superimposed.

It must be remembered that cranial form at death will reflect the childhood environment, which suggests that the mean Cranial Indices in Figure 11.7 should, in reality, be shifted slightly to the left - by the space of a generation perhaps. Nevertheless, Cranial Index does seem to correlate positively with temperature and negatively with humidity. While the negative correlation with humidity is as expected, the positive correlation with temperature comes as some surprise. It will be recalled from Chapter 8 that several workers have shown Cranial Index to be negatively correlated with ambient temperature. However, in early 20th century Europe head shape tended to cline in an east-west direction rather than north-south (Figure 11.8). At this time dolichocephaly was associated with a maritime climate while brachycephaly was a feature of populations inhabiting more continental areas. If it is accepted that in temperate regions humidity is a more influential determinant of cranial morphology than is temperature then the historical picture clarifies. The brachycephaly of the British late medieval population was a response to the dryness, or continentality, of the climate.

If the brachycephalisation of the medieval inhabitants of Britain was a consequence of the mild dessication of their environment then the possibility that a similar circumstance may have caused the brachycephaly of the early Bronze Age must be considered. In the absence of written records, however, the prehistoric climate is less amenable to investigation than that of the past millenium. It is necessary to rely upon, often inconclusive, environmental data.

The Neolithic and Bronze Age crania examined in this study were all recovered from contexts encompassed chronologically by the period termed Sub-Boreal by Scandinavian palynologists. Lasting from 3800 calBC until 900 calBC, the Sub-Boreal has been classically described as a period of continental climate - drier, and with colder winters, than the preceding Atlantic period. The botanical evidence upon which this climatic succession was based has been criticised, however (Smith 1981), and in any case the evidence of the present millenium cautions against the acceptance of any schemes that posit millenia long periods of climatic uniformity. It seems preferable instead to consider the Atlantic and Sub-Boreal as a single period of post-glacial optimum climate, with temperatures perhaps 2°C higher than today, but subject to periodic oscillations (Smith 1981).

One such oscillation has been termed the "Piora". Pollen analyses and tree ring studies in central Europe have, together, provided evidence of a period of more unsettled weather dated to between 4240 calBC and 3800 calBC. The climate was colder and wetter, but also more variable (Bogucki 1988: 22). There is widespread formation

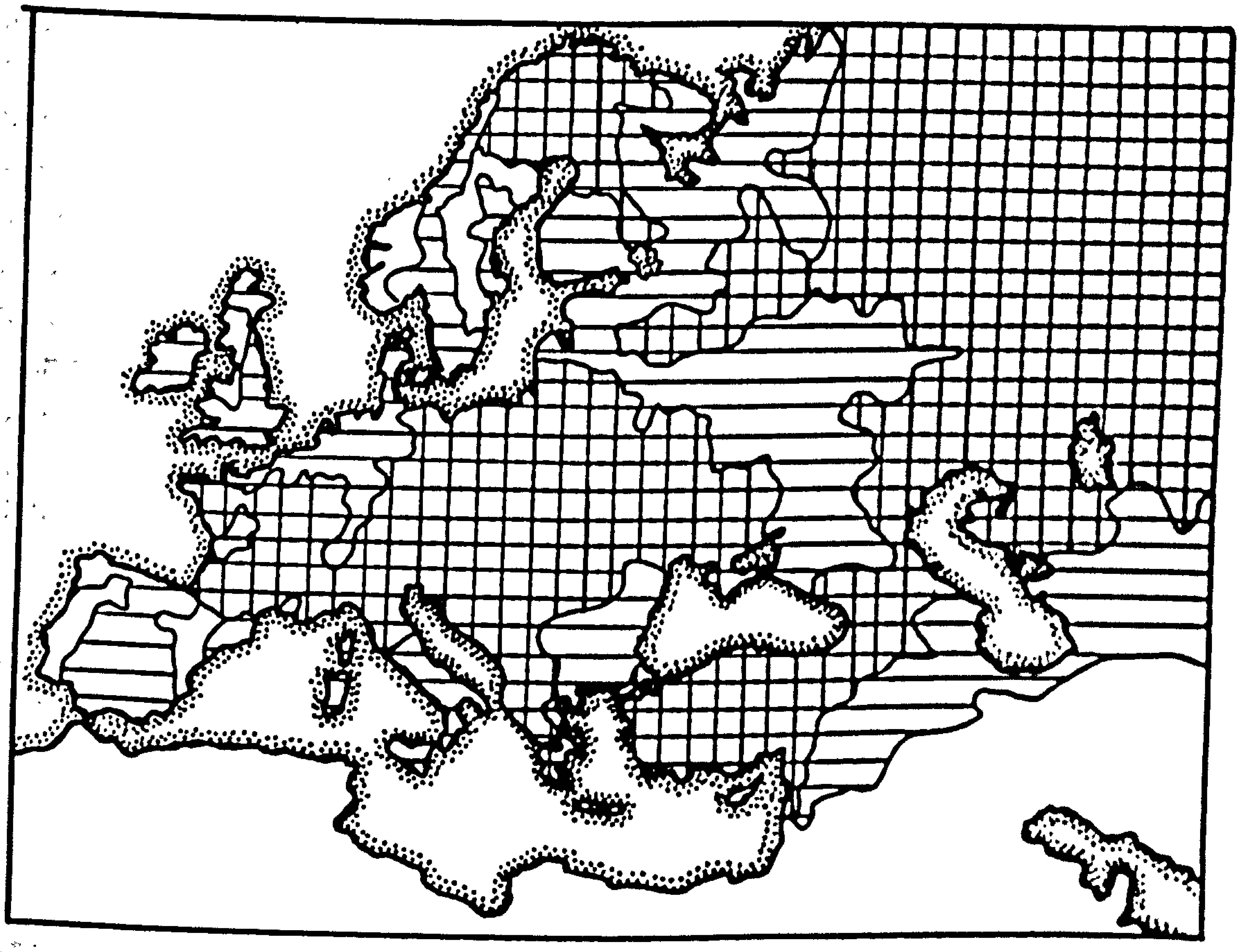


Figure 11.8.

Cranial Indices of European Populations, and their Neighbours, During the Early Twentieth Century.

Cross-hatched = brachycephalic (Cranial Index >81).
Horizontally-hatched = mesaticephalic
(Cranial Index 78-81).
Blank = dolichocephalic (Cranial Index <77).

(After Coon 1939: 258; Weidenreich 1945: 32).

of peat bog throughout Britain at this time, and trackways were built in the Somerset Levels. (Evans 1981: 12; Smith 1981: 141). Perhaps, therefore, the early Neolithic crania might have achieved their adult morphology in cool, damp conditions. On the other hand, there is evidence for drier conditions during the early Bronze Age (2480 calBC - 1450 calBC). Wind blown silt has been recovered from several contexts and there is formation of recurrence surfaces in peat bogs - no trackways were built on the Somerset Levels between 3100 calBC and 1750 calBC (Tinsley 1981: 211; Evans 1981: 17-19). Many marginal areas were also brought under cultivation during the early Bronze Age, only to be abandoned after 1450 calBC and not farmed again until the climatic amelioration of the Romano-British period and then again, significantly, during the medieval warm epoch (Burgess 1980: 118, 238).

There seem sufficient grounds to argue, therefore, that the gradual increase in Cranial Index which occurred throughout north-western Europe during the Neolithic and early Bronze Age could have been in response to climatic improvement. As the nasal breadths (NLB) of the Bronze Age series are greater than those of the Neolithic series, it seems possible that brachycephalisation was secondary to lateralisation of the nasal cavity - perhaps in order to make available a greater surface area of mucosa with which to humidify inspired air. It is less clear that poor climate would have been responsible for the dolichocephaly of the Neolithic Britons, however. This is extraordinary in comparison both to their continental contemporaries and to their insular successors.

## Cultural Environment.

The significantly greater lengths of the Neolithic parietal and occipital bones (as evidenced by the measurements PAK, PAC, OCC and OCK) suggest that the dolichocephalic morphology of the early Neolithic skull may have been necessary to accomodate posterior enlargement of the temporales muscles. If this was the case then, perhaps like the present day Inuit, the extreme length of the early Neolithic skull might have been a developmental response to certain features of the cultural environment. It is unlikely that these features would have been technological - the English crania are noticeably longer than their continental counterparts but there is no evidence to suggest that the sophistication of their respective household toolkits differed in a comparable fashion. If elements of the cultural environment were responsible for a posterior lengthening of the English Neolithic cranium, therefore, they must have been behavioural, and specific. The inhabitants of Neolithic England may have chosen to use their teeth for certain tasks - tasks for which other, continental, populations would have preferred to use tools.

The hypothesis that the cultural environment might affect cranial morphogenesis is derived, in part, from the analogy of the Inuit. The Inuit also suggest a test of the hypothesis. Cruwys (1989: 154) has shown that, in comparison to other population groups, the incisors of the Greenland Inuit show a relatively greater degree of tooth wear than do their molars. Thus, if the dolichocephalic form of the early Neolithic cranium was due, in part at least, to the habitual use of the anterior dentition as a "third hand" then their incisor:molar wear ratios should be correspondingly large, and significantly greater than those of Bronze Age crania. There was, unfortunately, insufficient time available to allow such a study within the confines of the present thesis. Thus, at present, the role of the cultural environment in cranial morphogenesis during the earlier Neolithic remains unknown, although an empirical route to the refutation of the hypothesis is available.

It remains to consider what influence, if any, artificial constraint may have exerted upon the morphogenesis of early Bronze Age crania. As already noted in the previous chapter, it is not at all certain that the measurements chosen in this study were suitable for demonstrating the effects of cradleboarding, or other forms of artificial constraint, on the human cranium. A similar conclusion was reached by Heathcote (1986: 95-102) using a much larger measurement suite than that of the present study, and who reported that the gross measurements of length and breadth (GOL and XCB) were those most likely to be affected, but not to any significant extent. Nevertheless, the increased NLB of the Bronze Age series, a measurement known to be unaffected by cradleboarding, suggests that their brachycephaly was largely independant of this type of constraint, although it might have been a contributory factor in some cases. For any future study of this phenomenon to be successful it would require the utilisation of novel measurements. This would be best accomplished by comparing a set of crania known to be deformed with a normal set, and devising a measurement suite which would provide optimum discrimination between the two.

## The Crania of Prehistoric Britain.

There are, then, two possible interpretations of the craniometric data:

- that the appearance of the brachycephalic skull in Britain announces the arrival of an immigrant population.
- that the different skull morphologies are caused by different cultural or climatic environments.

Neither can be excluded by study of early Neolithic and early Bronze Age crania alone. To choose between the two alternatives it is necessary to examine crania from the late Neolithic. Thus, if the immigrant population interpretation is to be accepted then it would imply that the crania of the later part of the Neolithic would resemble those of the earlier part. On the other hand, for the environmental interpretation to be valid, it would require the late Neolithic crania to be of intermediate morphology. Unfortunately, late Neolithic crania are notable largely on account of their rarity. Those crania that have been assigned a late Neolithic provenance are not precisely dated, it is not clear if they possess a uniform chronological spread or whether they should all be dated to an earlier or later part of the late Neolithic. Still, Cranial Indices were obtained from 11 male crania for comparison with those of the early Neolithic and Bronze Age cranial series.It can be seen in Figure 11.9 that the late Neolithic crania are, morphologically, more diverse those of the early Neolithic, and also tend more towards brachycephaly - but again the pattern is hardly conclusive. Of more interest are data from the tomb of Isbister, where 13 male crania were recovered and their Cranial Indices reported in the excavation publication (Hedges 1983). A series of C14 dates also provide a relatively secure time bracket for the use of the tomb, from 2950 calBC until 2450 calBC. These Isbister crania are indeed of intermediate morphology (Figure 11.9), an observation that would strongly support the second of the above alternatives - that the different skull morphologies arose out of different cultural or climatic contexts. It might be objected that as the Isbister tomb is situated in the Orkney Islands then the recovered crania are not strictly comparable to those of the English early Neolithic and Bronze Age series. Whilst this is true, it will be remembered from Chapter 6 that the literature describing Scottish crania has consistently reported a morphological dichotomy which is parallel to that of England. There seems no reason to doubt the significance of the Isbister crania.

Table 11.3. British Cranial Data.

(Male Crania Only).

| Location | Approximate Date. | Cranial Index. (Mean ±1SD) | Reference. |
|---|---|---|---|
| England | 4000BC - 3000BC | 70.1 ±3.2 | Present Study. |
| Isbister | 2950BC - 2450BC | 73.4 ±3.3 | Hedges (1983). |
| England | 3000BC - 2200BC | 71.5 ±4.8 | Present Study. |
| England | 2500BC - 1600BC | 78.1 ±5.3 | Present Study. |

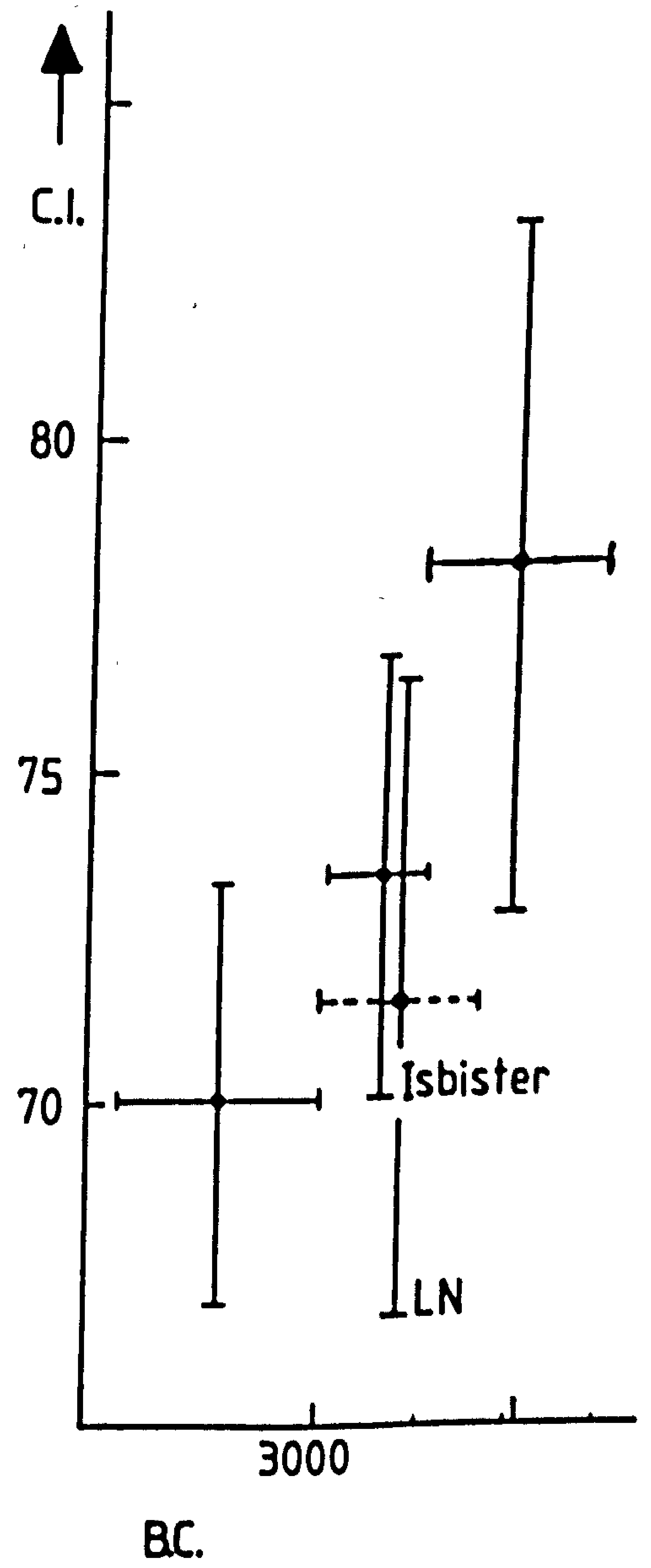



Figure 11.9.

Cranial Indices of British Prehistoric Populations, Including Isbister Data.

If it may be accepted that changing environments induced correlative anatomical changes in the human crania of prehistoric Britain, then what would be a likely scenario? The brachycephaly of the early Bronze Age seems normal in the context of north-western Europe, and can be explained as a response to the prevailing continental climate. The dolichocephaly of the early Neolithic may have been due, in part, to a wetter climate; but it seems more likely that culturally-specific behaviour also contributed to the extreme dolichocephaly. Climatic amelioration and altering patterns of behaviour then combined to produce the trend to Bronze Age brachycephaly. This scenario remains speculative, of course, but it presents a coherent hypothesis of morphological change that may stand in opposition to the genetic/immigration hypothesis. Future research projects may help to decide between them, some possible avenues of approach have already been suggested in this chapter.

## Conclusion.

On balance, it seems that there is little need to look for a "Beaker Folk" when attempting to explain diachronic change in cranial morphology. The biological literature suggests that morphological change would occur in response to parallel changes in the extra-cranial environment and independantly of any genetically-driven microevolutionary process. The results of this cranial study and consideration of comparative material do not contradict this suggestion. However, this should not be taken as confirmation of the non-existence of the "Beaker Folk". Rather, it serves to emphasise that the brachycephalisation of prehistoric Britons was a biological phenomenon, and one which cannot be utilised for the investigation of an archaeological entity, such as the Beaker culture. Biology cannot provide easy answers to complex archaeological questions.

Several methodological points need to be made. The measurements taken in this study were standard, internationally recognised and have been in use for over 100 years. As such, they were designed to answer 19th century questions and it is not at all clear that they remain universally optimal. A failing of the measurement suite has already been touched upon in the discussion of artificial constraint, but more could have been said during the consideration of the cultural environment. The length of the temporal fossa, for instance, may have provided a useful indicator of temporalis development. Measurement of the superior temporal line, if patent, and which marks the upper margin of the temporalis muscle, may also have been useful in this respect. Multivariate techniques of data analysis did not prove to be of great benefit to this study. Most conclusions were arrived at after comparison of individual measurements or cranial indices. It is possible that this failing of the multivariate analyses was due, in part, to the non-specificity of the measurement suite.

The comparative data which was considered towards the end of this cranial study suggested that cranial morphology and climate might fluctuate in tandem. This seems to be a novel observation. Although it is well known that cranial form correlates with climate the correlation is usually assumed to have deep evolutionary roots; but the medieval oscillation of Cranial Index would seem to contradict this and point instead to a cranial reaction which is developmental in origin. There are further ramifications. It exposes a fundamental weakness of climatic studies. These generally assume that head shape has been stable over the last millenium - thus many alleged "recent" crania studied are in fact of medieval date. Inclusion of those medieval crania acts to obscure more subtle patternings of morphology within climatic zones. Europe appears to be more uniformly brachycephalic than is actually the case.

Overall, the conclusions that can be drawn from this cranial study are disappointing. This is not surprising, perhaps, given the lack of any real understanding of cranial morphogenesis. This has been compounded by the relative paucity of reliable data available from more recent excavations. It is unfortunate that the study of cranial morphology has fallen into such disrepute that many human bone reports do not now include even the most basic measurements of cranial length and breadth. Nor yet do the determinants of cranial form warrant more than a passing mention in most textbooks. This reluctance to measure, and to discuss, is no doubt a product of the legitimate desire of bone specialists to distance themselves from the distorted racism of past decades; but it serves only to impede the formulation of anything other than simplistic explanations based only on genetics - on race. In the absence of new hypotheses, firmly grounded on fresh data, then the old ones persist. This cranial study will have been worthwhile if it has persuaded some, at least, that such a study is not taboo, but rather that it is a necessary endeavour if the myths of yesteryear are to be finally dispelled.

## Chapter Twelve.

## CONCLUDING THOUGHTS.

This thesis reviewed the changes in interpretation of the Neolithic - Bronze Age transition that have taken place over the last twenty years.

The first part of the thesis critically examined the case put forward for a diffusionist explanation of Beaker culture spread; and concluded that its theoretical basis - that Beaker assemblages had acted as either a symbol or as an agent of social change - was ungrounded. Furthermore, a structured model of long-distance migration seemed better suited to address the complex archaeology of the period. It became clear that the refutation of the "migrating Beaker Folk" hypothesis during the 1970s had been facilitated by the use of outdated Childean definitions of culture, people and migration; definitions which Childe himself had discarded before the end of his career. No effort had been made to construct alternative models of migration from out of the more detailed material available within the literature of anthropology, geography and demography.

The second part of the thesis looked once more at the well-known dichotomous morphologies of British prehistoric crania - the Neolithic "long-heads" and Bronze Age "round-heads". Mechanisms of morphological change other than the usual, genetically derived, models of population mixing and/or repacement were were sought for. A large body of comparative data was assembled which suggested that changes in the cultural or natural environments would induce correlative changes in cranial morphology, and a possible scenario was proposed. It was worrying that proponents of

Beaker diffusion had never properly addressed the issue of cranial morphology, particularly as it constituted a major obstacle to the acceptance of their hypothesis.

Despite appearances to the contrary, the changing interpretations of the Beaker culture did not arise out of any logical process of data analysis, hypothesis testing or rational argument. Instead, they seem to have occurred as secondary responses to changes in the dominant mode of archaeological explanation, in this case from culture-historical to evolutionist/processual. It is proposed now, during the course of this conclusion, to examine why this change in theoretical orientation came about and to explore some of its consequences. Attention focusses upon British archaeology as, all too often, developments in Britain and America are thought to be closely related, and share common causes. This need not necessarily be the case, and might serve to obscure the individuality of the different traditions.

## Paradigms in Prehistory.

It was described in Chapter Two how it is possible to discern in the various works of Childe a gradual elaboration of theory; from his early, optimistic, definitions of culture in the 1920s through to his more cautious, indeterminate statements of the 1950s, and to his increasing concern with processes of long term change, both social and technological. It was claimed that his ultimate theoretical stance was not so different from that of Clarke (1968) or Renfrew (1977). However, this view of a gradual and continuous development of archaeological theory is not generally accepted, or realised. It was suggested in Chapter Two that the attack on the dual concept of Beaker culture and "Beaker Folk" had been facilitated by use of Childe's early, simple, definitions of culture and migration. This ommission seems to be a feature of the

"New", or processual, archaeology generally. Thus, in two recent textbooks, Prehistoric Europe (Champion et al 1984) and Neolithic Europe (Whittle 1985), the only general works by Childe listed in their bibliographies are his earliest: The Dawn of European Civilisation (3rd ed. 1939) and The Danube in Prehistory (1929). His later works, books such as Social Evolution (1963) and Piecing Together the Past (1956), are passed over in silence. Whilst not deliberate, the effect of this omission is to emphasise the theoretical originality of the "New Archaeology", and to create a vision of prehistoriography which is revolutionary, as opposed to evolutionary.

Revolution is a word much used in the writings of archaeologists. It was used by Childe between the wars in a subversive fashion - with its connotations of Bolshevism it was unsettling to the academic establishment. More recently, however, the word revolution has been used to describe apparent changes in the aims and epistemology of archaeology theory, following closely the revolutionary model developed by Kuhn (1970) to describe theory change in the natural sciences.

Kuhn suggested that all scientific research proceeds within the confines of a series of disciplinary frameworks - constructed from agreed sets of methodologies and theoretical assumptions. He chose to call these disciplinary frameworks "paradigms" and argued that scientists will never make a concerted effort to refute the basic tenets of their supporting paradigm. He thus disagreed with Popper's "conjectures and refutations" model of scientific progress. Nevertheless, the history of science is littered with abandoned paradigms, and Kuhn took pains to explain why this should be.

There will always be anomalous observations, observations inexplicable within the orthodox paradigm.

Their number will tend to increase through time, engendering disatisfaction with the paradigm. Ultimately a new, different, paradigm is articulated, one that is able to accomodate all known observational data, including anomalies. The new paradigm is not a logical outgrowth of the first, however, but presents instead a new way of representing and investigating reality. It has a different epistemology. It is a change in scientific viewpoint that Kuhn likened to a gestalt switch. A period of "extra-ordinary" science ensues, during which time the new paradigm gathers adherents while the old one falls into disrepute and its supporters, like old soldiers, just fade away. Kuhn termed this process a paradigm shift, the classic example is held to have occurred in physics when the Einsteinian view of a relative universe replaced the absolutism of the Newtonian one.

Kuhn provided a model of scientific progress that was discontinuous. Periods of consolodating "normal" science are punctuated by intervals of rapid, revolutionary, advance - by periods of "extra-ordinary" science. This model is at variance with the received wisdom of gradual, evolutionary, growth, but has proved attractive to recent generations of theoretical archaeologists, particularly those of the "New Archaeology" that emerged during the 1960s and 1970s. However, although providing an attractive analogue for the development of archaeological theory, it rather falls down when there is no general agreement about the timing of paradigm shifts. Often, and predictably, the scholar proposing a paradigm shift is holding forward his or her own work as being exemplary of the new paradigm. One candidate for the appelation "new paradigm" was the New Archaeology, as its name suggests. It was discussed by one of its leading British protagonists, writing in Kuhnian inspired prose, as follows:

> "Several commentators have spoken recently of a "revolution" in prehistory, of the same fundamental

nature as a revolution in scientific thinking.

It has been suggested, indeed, that the changes now at work in prehistory herald the shift to a "new paradigm", an entire new framework of thought, made necessary by the collapse of the "first paradigm", the existing framework in which prehistorians have grown accustomed to work."

(Renfrew 1973: 15).

But to a younger, uninvolved, generation the revolutionary significance of the New Archaeology begins to fade away, it is perceived to be a constituent of the orthodox mainstream. New, "revolutionary" developments clamour for attention:

"If one wishes to talk about paradigms in archaeology, where the term "paradigm shift" means a fundamental change in the way in which archaeologists actually see the world of material culture, the decisive break occurs not in 1962 with the substitution of one form of empiricism with another (Binford 1962), but in 1982 with the appearance of Symbolic and Structural Archaeology."

(Tilley 1989: 185).

It is too soon to judge the revolutionary claims of the post-Processualists but, with hindsight, it now seems possible to judge the extent to which the New Archaeology really was new - and the verdict seems to be, in theoretical terms at least: not very (Trigger 1989: 289-328; Courbin 1982). New Archaeologists undoubtedly benefitted from the development and application of new scientific techniques, C14 dating in particular; they were also to the fore in producing large bodies of novel data after the development of new methodologies, notably surface survey and the systematic recovery of floral and faunal remains. Theoretically, however, much was derived from social anthropology - both the social evolutionism of the 19th century and the structural-functionalism of the early 20th. Palaeoeconomic studies were grounded on the work of Clark (1952).

The example of the New Archaeology seems not to support Kuhn's model of revolutionary progress, therefore. It is possible to trace an evolutionary scheme of theory development with any "newness" or "revolution" being derived from technical, and not theoretical, advances. Since the second world war, at least, processual/evolutionist and culture-historical prehistories had co-existed, were even articulated, notably in the various writings of Childe, but also by others (Daniel & Renfrew 1988: 92). The co-existence of different archaeological approaches within the archaeological mainstream seems to offer a better description of archaeology than a revolutionary succession of paradigms. Kuhn himself doubted that his model was applicable to the social sciences or humanities. What seemed to distinguish science, for Kuhn, was the absence of multiple paradigms, a situation common in the arts (Kuhn 1970: 209). Nevertheless, Kuhn's model seems to have left a deep impression upon those who seek to theorise, and see fit to categorise themselves with labels of chronological exclusion - whether it be "new" or "post". Clarke, however, warned that to restrict archaeological research to a single paradigm implies a:

> ".....deliberate relinquishment of certain freedoms and an inevitable narrowing of intellectual focus."
> (Clarke 1972: 9).

It is a fundamental of the Kuhnian model that an outdated explanatory paradigm is no longer of any value for either the aquisition or the interpretation of data - it can no more ask the right questions than it can supply the right answers. The concept of "paradigm shift" lends itself to misuse as an instrument of academic closure. Claims of new paradigms carry with them the unstated proposal that all previous work, in the form of of the replaced paradigm, is no longer relevant. It discourages the study of large sections of the pre-existing archaeological literature, the outcome being under-informed and often repetitive explanations. Strident claims of new paradigms should therefore be viewed with suspicion, and resisted.

Explanatory Modes.

In a philosophical sense most archaeologists are realists. They believe the the world is a physical entity whose existence is independent of any knowledge thereof, and that theories which relate to its existence may possess a greater or lesser degree of correspondence to material reality. This realist orientation is virtually unavoidable given the nature of the subject matter with which the archaeologist works. Nevertheless, unsurprisingly perhaps, there are dissenters:

> "....we abandoned any attempt to create a privileged or foundational discourse which would suggest that it is "in the true" by virtue of internal logical coherency or by means of reference to, or correspondence with, realities standing outside discourse...."
>
> (Shanks & Tilley 1989: 7).

Ultimately, perhaps inevitably in an archaeological context, such an idealist stance is untenable - the realities standing outside of discourse await confrontation:

> "The data set used to investigate some aspects of the theoretical perspective put forward above consists of 70 completely restored or restorable vessels attributable to the southern Swedish middle neolithic funnel neck beaker (TRB) tradition, dateable to between circa 2600bc and 2280-2140bc..."
>
> (Shanks & Tilley 1987: 155).

There is an objective reality then, a material past, and it invites investigation. It is not conducive to simple description, however; it is complex and may be approached by many descriptions, or explanations, which are not necessarily exclusive (Piggott 1965: 6, Clarke 1968: 643). Throughout this thesis reference has been made to two alternative approaches to the material reality of the archaeological record, two different "modes" of archaeological explanation: culture-historical and processual/evolutionist.

The choice of the word mode was deliberate, it was to emphasise that an "explanatory mode" was not to be equated with a Kuhnian paradigm, and also that it represented a distinct way, or fashion, of approaching the past. Thus the processual/evolutionist mode is used to explain long term sequences of change that present in the archaeological record by reference to an underlying mechanism, or regularity, adumbrated as a general theory. The culture-historical mode, on the other hand, is used to explain short term, often unique, patterns of change. The processual/evolutionist mode is more suited to the study of prehistory while that of culture-history is the preserve of the historical archaeologist. These two modes of explanation are structurally dissimilar. The processual/evolutionist subsumes a number of alternative theories for explaining change, foremost amongst which are Marxism, Systems Theory and Neo-Darwinism. These theories are close parallels to Kuhn's paradigms in that they contain their own theoretical assumptions and dictate the use of different categories of data. Clarke referred to them as "supermodels" (1972: 5) while Trigger termed them "high level theories" (1989: 22). (Trigger was mistaken when he likened his high-level theories with Clarke's controlling models. These were more fully termed controlling mind models by Clarke and they referred to the, not fully perceived, social environment of the archaeologist which helped to form his or her world view. As such, the controlling models controlled the archaeologist, not subsidiary set of models or theories).

The two modes of explanation are dissimilar, therefore, and because they are structurally dissimilar it is not possible to derive one from another. Thus a diachronic stack of culture-historical explanations will not form a processual explanation in the absence of any articulating theory. Their dissimilarity does not imply incompatibility, however. Each mode may be used to "frame" a certain aspect of reality, but neither one enjoys priority. Different explanatory aims require the use of different explanatory modes, although it is not at all clear that this point has been generally realised.

Before a theory can be considered to be new, or revolutionary, it must displace an old, discreditted theory. This is why Renfrew spoke of the collapse of the "first paradigm". It is also why Champion et al looked forward to the:

> "....development of an acceptable alternative framework for European prehistory..."

to replace the inadequate:

> ".....traditional normative model."
> (Champion et al 1984: 156).

Thus, before any revolutionary, processual, explanations could be deployed by the New Archaeologists it was first felt necessary to thoroughly discredit previous explanations, and show them to be devoid of any explanatory potential. This was achieved by ignoring anything that was processual or evolutionist in the writings of "pre-processual" archaeologists and by characterising the, admittedly predominant, culture-historical scenarios as sterile. Ultimately, this is why the concepts of Beaker culture and "Beaker Folk" were attacked, not because of any irreconcilable asymmetry of theory and data, but because there was no room for them in the new scheme of things. Yet, as the preceding discussion of explanatory modes made clear, they are not mutually exclusive alternatives, they are complementary, and describe different aspects of reality. The utilisation of one does not require the prior refutation of the other. Thus, the denial of archaeological cultures or ethnic groupings is not a prior requisite of a study of social ranking in western Europe. As a procedure it is analogous to arguing that lions and tigers do not exist before proceeding with a study of the evolution of mammalian carnivores. The dangers inherent to such an approach were emphasised towards the end of Chapter Two. Although the culture-historical mode might seem unsuitable, or innappropriate, for the study of prehistory, the entities it defines really exist, and lie in wait, ready at all times to mislead the unwary processualist. The inability, or at least unwillingless, to realise this has been a major failing of the British New Archaeology.

## The Subjective Archaeologist.

It seems that the interpretations of archaeologists may often be, unwittingly and unwillingly, influenced by realities other than those contained within the archaeological record. This is not a novel observation. The controlling models of Clarke have already been alluded to, Piggott was more specific:

> "....we interpret the evidence in terms of our own intellectual make-up, conditioned as it is by the period and culture within which we were brought up, our social and religious background, our current assumptions and presuppositions, and our age and status."
>
> (Piggott 1965: 5).

It was the laudable aim of many new archaeologists to circumnavigate these shoals of subjectivity, although some would claim that they foundered in the attempt. This thesis suggested as much. The differing morphologies of prehistoric crania were a well known "fact", but in the shadow of the second world war it was considered to be an unsavoury one, deemed to be unworthy of investigation. Renfrew's characterisation of craniology as phrenology was symptomatic, prehistorians generally were content to overlook or to summarily dismiss the evidence of the crania whilst constructing theories based upon more up to date, more fashionable, bodies of data. Similarly, the availability of improved models of migration and ethnicity seems not to have been recognised, or even desired, by those wishing to be part of a "processual revolution". There certainly does not appear to have been any attempt to seek them out.

Trigger has argued that the social concerns and aspirations of archaeologists will be those of their larger peer group - the middle classes (1989: 14). He suggested that, in America at least, the revival of interest in cultural evolution during the 1960s may have been borne out of the desire of archaeologists qua middle classes to present their privileged position as the natural outcome of an evolutionary process that was beyond their control (1989: 289). On the other hand it has been argued that the 1960s and 1970s were a time of withdrawal from empire, of relinquishment of imperial ambitions, and alternatives to nationalist, culture-historical explanations were sought for (Ammerman 1989). But why New Archaeologists, or their successors, should desire an "archaeology of discontinuity" is not altogether clear, unless motives of personal advancement are suspected. However, it seems probable that the adoption of a revolutionary polemic by the New Archaeologists of the 1960s was a response to the political environment of their academic adolescence. In western Europe and north America the children of the middle classes had embarked upon a crusade to establish a new world order, to meet the challenge archaeology needed to be both ambitious and iconoclastic - the times demanded nothing less.

It seems more honest then to admit to subjectivity, and perhaps in so doing to diminish its effects. The self-reflexive subjectivity of Piggott seems, in the end, to present a more certain route to objectivity than do many attempts at strict theoretical legislation. Hypotheses and interpretations may multiply as a result, and entail a continuing process of evaluation. Interpretations must be open to constant scrutiny as facts and theories shift around within their social formers. This is no bad thing, a fuller understanding of the past can only follow. But it seems desirable that any process of critical evaluation should proceed by means of a logical and structured discourse, polemical exchanges from theoretical bunkers serve only to retard progress and ultimately vitiate the discipline.

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## Appendix One.

## BONE GROWTH AND REMODELLING.

Human skeletal structures are composed of two major tissue types - bone and cartilage - which differ markedly in their structure and function. Cartilage is an avascular, pliable, pressure tolerant tissue which provides flexible support in areas of direct compression. Cartilage may also partake in bone formation. Bone provides rigid support. It is vascular and forms in areas of high tensile stress, it is protected by a surrounding membrane, the periosteum, which ensures a supply of blood to the bone, and also partakes in bone growth. Mature bone is a structurally differentiated tissue which forms around a marrow cavity. The outside of a bone is surrounded by the periosteal membrane; a less well characterised membrane - the endosteal - separates the inside of a bone from the marrow cavity. Macroscopically bone can be described as either spongy (cancellous or trabecular) or compact. Spongy bone is always formed by the the endosteum, it never forms on the outside of a bone and is always enclosed within a cortex of compact bone. Flat bones consist of two layers of bone, known as tables, sandwiching an inner compartment, called the diploe,, which contains marrow and spongy bone. Bone can only grow appositionally, by marginal expansion, following either intramembraneous or endochondral ossification. It cannot uniformly expand.

Endochondral ossification occurs as chondrocytes within a cartilage anlage, or model, undergo a hypertrophy which is associated with the mineralisation of the cartilage matrix. The surrounding membrane adopts the functions of the periosteum and initiates vascularisation of the mineralised cartilage, whereupon undifferentiated connective tissue cells pass into the matrix and develop into bone forming osteoblasts. The osteoblasts form true bone while large polynuclear osteoclasts are active removing mineralised cartilage. Endochondral ossification is particularly associated with the human growth phase. In the skull, after partial ossification, growth may continue to occur away from cartilageneous synchondroses. Such growth occurs as cartilage cells proliferate with subsequent mineralisation and bone deposition, bone itself does not physically expand.

During intramembraneous ossification undifferentiated connective tissue cells on the inner surface of the periosteum develop into osteoblasts which organise into sheets and lay down an intercellular matrix (osteoid), which consists primarily of collagen, on the surface of a pre-existing bone. This osteoid matrix is subsequently mineralised by hydroxy-apatite crystals to form new bone.

During growth a bone maintains its required shape and proportions by a process of remodelling (Enlow 1990). This is an intramembraneous process and entails the laying down of new bone on one surface being balanced by resorption on the opposite surface. The surfaces of growing bones are thus covered by a series of "depository" or "resorptive" growth fields. If a given periosteal surface surface area of a bone has a resorptive field then it will be balanced by an endosteal depository field, and vice versa. Rates of resorption and deposition are not balanced, however; during growth the rate of bone deposition exceeds that of resorption, thus allowing for both regional and overall enlargements of individual bones. Growth remodelling also allows bones to change location during growth, a process termed drift, or transformation. Similarly, structurally important features of a bone can maintain their position, or move, as required. Despite constant remodelling, as a bone grows, it retains a basically recognisable shape.

Intramembraneous growth and/or remodelling occurs in response to forces acting upon the bone or its surrounding membrane. These forces may be passive in origin, arising out of surrounding tissue growth, or else result directly from the action of attached muscle. Two mechanisms of remodelling induction are currently known, one initiated within the periosteum and the other in the bone matrix itself. The action of mechanisms is ultimately expressed at the cellular level by modulation of levels of cytoplasmic calcium, which acts as a second messenger by either activating or suppressing the enzyme systems responsible for cell function.

Periosteal mediated remodelling occurs when the periosteum itself is stressed and the amount of blood arriving at the bone is thereby altered. Compression of the periosteal membrane occludes the vasculature and, therefore, reduces the blood flow into subjacent areas of bone tissue. This relative ischaemia inhibits osteoblast function, while at the same time encouraging osteoclasts to remove the the affected bone and relieve the pressure. Conversely, in conditions of tension, blood vessels may be dilated, improving the blood supply and stimulating osteoblast activity and the deposition of new bone.

The second activating mechanism of remodelling is brought into play when the mineralised matrix of the bone itself is stressed. This occurs as mechanical loadings of the bone, caused by either contradictory growth vectors of adjacent tissues or else by muscle action, act to distort its normal shape. These distortions of the bone take the form of small, compressed, concave areas with corresponding tension stressed convexities. Responsive changes in the bioelectric charge of the distorted areas stimulate osteoblastic deposition in concavities and osteoclastic resorption in convexities. This bioelectric phenomenon is known as the piezo effect.

The mode of interaction between these two regulatory mechanisms of remodelling activity remains poorly characterised, particularly in the case of the muscle-bone interface. To some extent this is because muscle attachments to bone vary in type. Muscles may either attach directly to the calcified matrix of the bone by means of tendons or aponeuroses (sheets), or else terminate in the periosteum. it is not clear how these two types of muscle attachment influence remodelling activity although, intuitively, it would seem likely that periosteal attachments would promote a diffuse, membrane mediated, response while tendons might cause more localised remodelling by virtue of the piezo effect.

## Appendix Two.

## THE CHRONOLOGICAL AND CULTURAL RELATIONSHIPS OF BEAKER AND FOOD VESSEL POTTERY.

The ceramic repertoire of early Bronze Age Britain is dominated by three ceramic types: Beakers, Food Vessels and Collared Urns. Traditionally, they were considered to constitute a diachronic sequence but more recently scholars have preferred social explanations of this ceramic trichotomy (Simpson 1968: 201-202, Burgess 1974: 176-178, Bradley 1984: 71-73). The different types of pottery are still considered to possess some degree of chronological order, with Beakers appearing first and Collared Urns persisting the longest, but it is thought that there was a long temporal overlap during which all types were in contemporary usage. Social considerations of status, fashion or whatever would have determined their selection for inclusion at burial. If this interpretation is correct, then it has ramifications for the craniometric study presented herein. The crania recovered with either Food Vessels or Beakers would belong to separate sectors of a contemporary population and any differences in cranial morphology might be the result of selective or exclusive breeding practices. Alternatively, if Beakers and Food Vessels can be used as chronological markers then any differences in cranial morphology would have to be interpreted within a longer term context of morphological change. It is argued below that the evidence for temporal overlap is rarely discussed and that a critical examination shows it to be quite tenuous, it is more probable that the use of Food Vessels did succeed that of Beakers and that it is correct to conceive of them as constitutive of a diachronic sequence. The evidence to be considered is of three types: stratigraphy, associations and C14 dates.

There is one case reported in the literature of a Food Vessel enjoying stratigraphical precedence over a Beaker. This was at Broad Down, Devon, where a cairn had apparently been built over a Food Vessel accompanied cremation, but with a later Beaker insertion (Fox 1948). However, this cairn was excavated by a certain Reverend R. Kirwan in the middle of the 19th century and whose technique consisted of driving a trench through the centre of a mound until an assumed primary burial was discovered. Furthermore, it is reported that he was often not present on site when discoveries were made by his workmen (Fox 1948: 3). In the absence of any corroborating comparanda this excavation cannot be held to have produced any reliable archaeological information.

It is frequently observed that Food Vessel burials are to be found in the upper parts of shaft graves that contain primary Beaker inhumations, and also fragmented Beaker pottery throughout the fill. This, it is suggested, is indicative of a close chronological relationship (Simpson 1968: 201, Burgess 1980: 29); but it does not necessarily follow, it seems more likely that existing graves were dug out and reused. The fills of these graves are also found to contain broken and incomplete skeletons, probably the remains of earlier interments. There are, however, several instances reported of Beakers and Food Vessels being recovered from contemporary contexts. These include Fargo Plantation (Ashbee 1960: 138), Hawkhill (Simpson 1968: 201) and Edington Mill (Simpson 1968: 201). At Fargo Plantation, a flat grave was found to contain a single Beaker inhumation burial in association with three cremations, one of which had probably been accompanied by a Food Vessel; the site had been badly disturbed by rabbits, however, and the Food Vessel was fragmented and scattered, with only it's base remaining close to the cremation (Stone 1938).

The excavator believed that the inhumation burial, the Food Vessel cremation and one of the remaining cremations were contemporary as they were spaced apart on the bottom of the grave and covered by a compact layer of chalk. However, the skeleton was incomplete, and it was not centrally placed but was instead located in a corner of the grave. It seems likely that the Beaker inhumation may have been the original occupant of the grave, but had been subsequently exhumed and partially dismembered before being replaced in a position secondary to the now primary cremations. The Food Vessel at Edington Mill was recovered from a cist which was partially filled with soil, together with a few sherds of a Beaker (Craw 1913), the relationship of these sherds to the Food Vessel is questionable. The Food Vessel and the Beaker from Hawkhill came from seperate cists (Tate 1851). It is significant that Clarke lists only one instance of a Beaker/Food Vessel association, at Brougham, but regards it as dubious (1970: 451).

There is, thus, little evidence to be recovered from a study of barrow stratigraphies that would point, unequivocally, to contemporary usage of both Beaker and Food Vessel pottery. Arguments derived from the evidence of shared associations are stronger perhaps, but still far from conclusive. It is true that Beaker and Food Vessel burials share some artefactual associations, but these are generally types with a broad chronological spread, v-bored conical buttons or double pointed awls, for example. Of the 4 bronze daggers associated with Food Vessels, two (Gerloff #260, Amble; Gerloff #288, Argyll) belong to Gerloffs rather heterogeneous "Flat Rivetted Knife Dagger" classification, examples of which have been found in Beaker, Wessex I and Wessex II contexts. The dagger found with a Food Vessel cremation in a cist at Merthyr Mawr (Gerloff #48) is the archetype for another Gerloff classification which includes a dagger found with a Clarke S2 Beaker at Aldro 116. Gerloff suggested that members of her "Type Merthyr Mawr" category were closely related to those of her "Type Butterwick", examples of which have been found with Clarke S3 and S4 Beakers. The final dagger accompanied Food Vessel burial was the encisted cremation at Llandfyfnan. This dagger was included by Gerloff (#107) in her "Group Aylesford", also related to "Type Butterwick" although often with a pointille decorated blade reminiscent of Wessex II "Camerton-Snowshill" daggers.

There are a number of artefacts found in Food Vessel graves but not in those with Beakers. Single pointed awls with a flattened tang fall into this category as do bone, ring headed, pins. The classic Food Vessel association is, of course, the plano-convex flint knife which is never found with Beaker burials. Also distinctive of Food Vessel burials are the spacer-plate necklaces of jet, related to Wessex amber examples, and single-stranded jet bead necklaces. Although jet and amber beads are found in Beaker contexts, large quantities of perforated beads are not. Possible exceptions are at Dalgety (Watkins 1982), where a necklace of 210 shale disc beads and pieces of two broken jet pendants were discovered in a cist together with an inhumation and a Clarke S4 Beaker. This was similar to an assemblage of 188 jet disc beads with a triangular toggle discovered in association with a sub-Beaker Food Vessel (Clarke 1970 #1803).

Thus, although there are artefactual associations which are shared by both Food Vessel and Beaker burials, it is by Food Vessels and late Beakers, usually Clarkes S3 and S4. They do not share an integrated artefact "package". It would be expected for this to be the case in the chronological development of any society that did not experience a disjunctive culture change. Material culture assemblages are composed of a number of artefact types that may change or be substituted either independantly, or else sometimes as a group, depending upon their functional or social inter-relationships. Simply because the pottery used by a society changes in type it does not automatically follow that there will be associated changes in other areas of the material culture assemblages.

It remains to consider the C14 evidence for a Beaker/Food Vessel overlap. On the face of it, the C14 dates currently available from Food Vessel and Beaker associated contexts appear to show a large degree of temporal overlap, but it is not altogether clear how credible this overlap is (Table A2.1, Figure A2.1). The Beaker culture is quite well dated, surviving for a period of approximately 800 years, from 2600 calBC to 1800 calBC. This chronological "bracket" was obtained after analysis of 35 samples of human bone and is probably the best estimate that present technology can offer (Kinnes et al 1991). The quality of Food Vessel related C14 dates compares unfavourably, however. The majority are from contexts antedating the Food Vessel, they are usually obtained from charcoal and, in effect, represent a series of terminus post quems. There are fewer of the more reliable bone-derived dates available, but those that are suggest a period of usage that extended over at least 500 years, from about 2050 calBC to 1600 calBC. This implies that Food Vessels and Beakers may have been in contemporary usage for a couple of centuries but there is a problem with this interpretation. It is questionable as to whether the precision currently available to C14 dating methodologies is sufficiently tight to permit sharp demarcation of chronologically successive cultural groups. Dates with a standard deviation of 60 C14 years provide 95% confidence limits that span 240 C14 years, the true timespan is even greater after calibration. Thus an apparent overlap of 200 years would in fact be expected, even if the cultural groups in question were chronologically distinct.

From the evidence adduced it might indeed be possible to argue for Food Vessel/Beaker contemporaneity, but the case is weak, a chronological succession of types provides a more parsimonious explanation and it is the one accepted here.

Table A2.1. Food Vessel associated C14 dates.

| | | | |
|---|---|---|---|
| **Primary associations:** | | | |
| Dunfermline, Kinross. | Bone | SRR 292 | 3581±40 BP |
| Trelystan I, Powys. | Charcoal | CAR 280 | 3645±70 BP |
| | Charcoal | CAR 281 | 3695±70 BP |
| Trelystan II, Powys. | Charcoal | CAR 283 | 3550±60 BP |
| Strathallen B, Perth. | Bone | GU 1381 | 3490±65 BP |
| Ardnave, Islay. | Charcoal | GU 1371 | 3610±85 BP |
| | Charcoal | GU 1439 | 3680±65 BP |
| | Bone | GU 1274 | 3325±80 BP |
| | Charcoal | GU 1440 | 3687±60 BP |
| | Charcoal | GU 1442 | 3655±60 BP |
| Kneep, Lewis. | Charcoal | GU 1174 | 3410±55 BP |
| Garton Slack 7, East Riding. | Charcoal | HAR 1236 | 3550±70 BP |
| Harland Edge, Derby. | Charcoal | BM 178 | 3440±90 BP |
| Radley, Oxford. | Bone | OxA 1884 | 3670±80 BP |
| **Secondary associations:** | | | |
| Trelystan II, Powys. | Charcoal layer cut by FV pit. | CAR 390 | 3550±65 BP |
| Kentraw, Islay. | Bone from inhumation underlying FV inhumation. | GU 2189 | 3510±50 BP |
| Heslerton 1L, Yorkshire. | Charcoal underlying FV barrow. | HAR 6690 | 3840±40 BP |

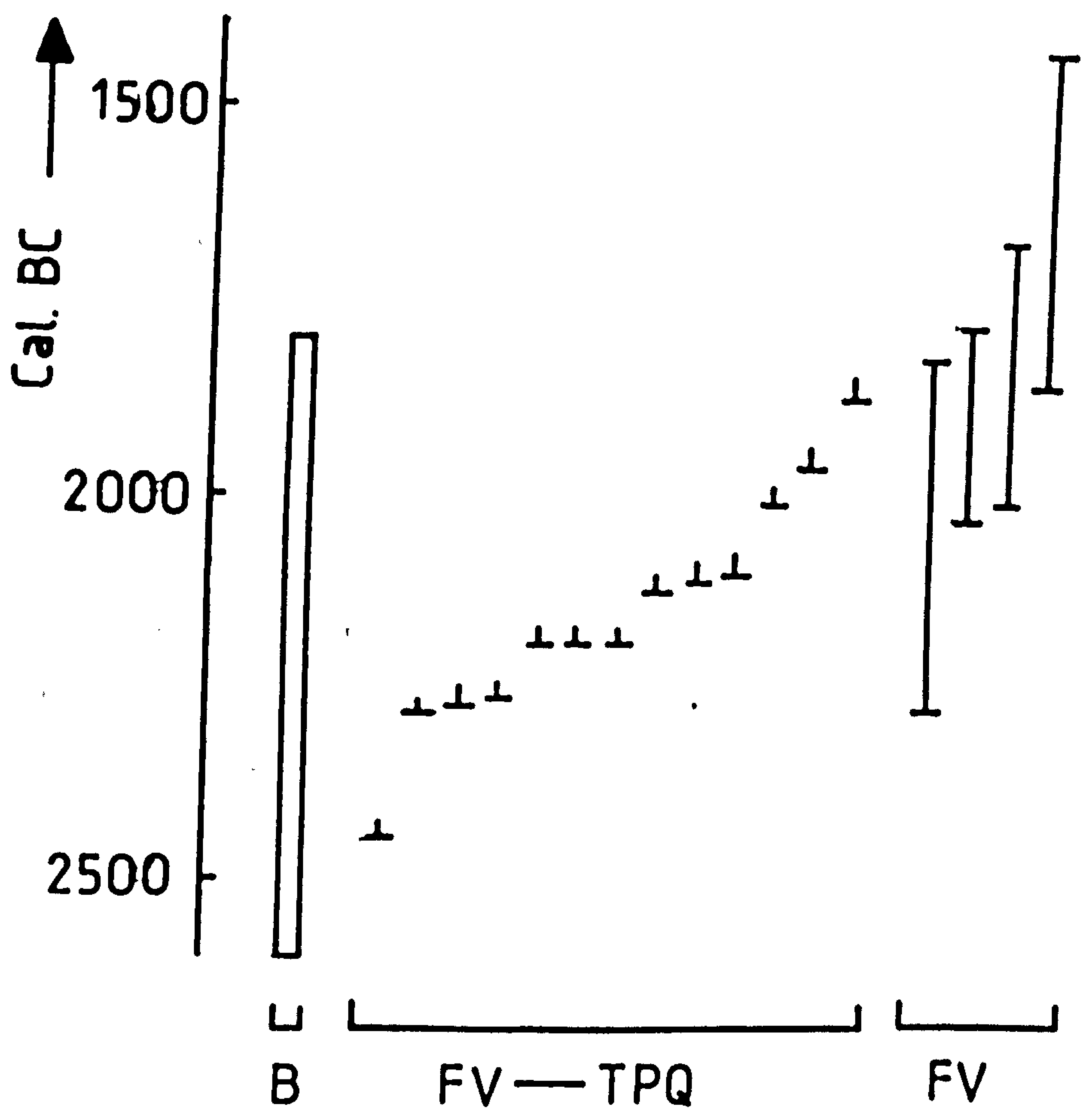


Figure A2.1.

Calibrated Beaker and Food Vessel C14 Dates.

B = range of Beaker dates.
FV-TPQ = individual Food Vessel T.P.Q.s.
FV = individual Food Vessel dates.

(For T.P.Q.s only the lower end of the calibrated date range is shown).

## Appendix Three.

## CATALOGUE OF PREHISTORIC ENGLISH CRANIA.

Each entry in this catalogue contains two sets of references. The initial reference set provides, where possible, the primary source of information for the archaeological context from which the cranium was recovered, followed by corpora references for associated artefacts. Crania of doubtful or uncertain provenance have not been included. The second set of references are to anatomical listings or studies. Where the cranium has been personally inspected the location and museum number are listed at the end of the entry. If published data were utilised instead of personal measurement the name of the anthropologist is provided within the second reference set. Each entry is followed by the chronological group to which it was assigned for purposes of the study.

### Group Abbreviations.

EN - Early Neolithic
LN - Late Neolithic
ON - Other Neolithic
BB - Bell Beaker
WG - Weapon Group
FV - Food Vessel
BA - Early Bronze Age
NG - Not grouped

### Reference Abbreviations.

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Wright. - Skulls from Round Barrows of East Yorkshire. Journal of Anatomy and Physiology 38: 119-132, 39: 417-449.

## CATALOGUE OF PREHISTORIC ENGLISH CRANIA.

### BERKSHIRE.

001. RADLEY 3. Contracted male inhumation in grave under round barrow with bronze dagger. Oxoniensia 17 (1952) p24; Gerloff 63, Type Milston. Oxoniensia 13 (1948) p15. Cambridge Eu 1.4.5.
Group: WG.

### CAMBRIDGESHIRE.

002. BARNACK, GRAVE 28. Primary burial. Contracted male inhumation in grave under round barrow with W/MR Beaker, small tanged copper dagger, bone pendant and wristguard. Antiquaries Journal 57 (1977) p208. Wells, ibid, p219.
Group: BB.

### DERBYSHIRE.

003. ARBOR LOW. Contracted female inhumation in cist under round barrow with jet necklace. TYD p24, ln33. Bateman P103; CB p135. Sheffield J93.942.
Group: FV.

004. BAILEY HILL. Contracted female inhumation in grave under round barrow with Food Vessel and boars tusk. TYD p169, ln28. Bateman P168. Sheffield J93.946.
Group: FV.

005. BALLIDON MOOR. Contracted male inhumation in cist under round barrow with flint ?arrowhead. TYD p58, ln34. Bateman P159; CB pl1. Sheffield J93.929.
Group: BA.

006. BEE LOW. Contracted female inhumation in grave under round barrow with Beaker and serrated flint blade. TYD p72, ln19; Clarke 153, S2. Bateman P177. Sheffield J93.935.
Group: BB.

007. BEE LOW. Disarticulated male skeleton in cist under round barrow, no associations. TYD p73, ln2. Bateman P178. Sheffield J93.944.
Group: BA.

008. BLAKE LOW. Contracted female inhumation in grave under round barrow with Beaker. TYD p41, ln7; Clarke 135, N2. Bateman P112. Sheffield J93.941.
Group: BB.

009. FIVE WELLS HILL, NEAR TADDINGTON. Multiple inhumation in round chambered cairn. Vestiges p91. Bateman P89. Sheffield J93.937.
Group: ON.

010. GOTAM, NEAR PARWICH. Contracted male inhumation in cist under round barrow with flint spearhead and bronze awl.Vestiges p105, ln5. Bateman P100. Sheffield J93.918.
Group: BA.

011. GREEN LOW. Contracted male inhumation in cist under round barrow with Beaker, 3 flint barb and tanged arrowheads, flint dagger, 3 bone spatulae and bone awl. Vestiges p59, ln10; Clarke 115, S1; Green 131. Bateman P53; CB pl41. Sheffield J93.909.
Group: BB.

012. LIFF'S LOW. Contracted male inhumation in cist under barrow with Seamer-type flint axe, antler hammerhead, flint arrowheads and round-bottomed ceramic vessel of uncertain type. Vestiges p42, ln13. Bateman P22. Sheffield J93.931.
Group: LN.

013. MONSAL DALE. Disembodied female skull in grave under round barrow close to Beaker. TYD p76, ln1; Clarke 143, S2. Bateman P181. Sheffield J93.943.
Group: BB.

014. MONSAL DALE. Contracted male inhumation in cist under round barrow with flint arrowhead. TYD p75, ln34. Bateman P183, CB pl60. Sheffield J93.911.
Group: BA.

015. MONSAL DALE. Contracted male inhumation in grave under round barrow with "clay vase" and flint spearhead. TYD p78, ln12. Bateman P187. Sheffield J93.912.
Group: BA.

016. MONSAL DALE. Contracted male inhumation in grave under round barrow, no associations. TYD p79, ln8. Bateman P190. Sheffield J93.908.
Group: BA.

017. PARCELLY HAY. Sitting female inhumation in cist under cairn, no associations. TYD p22,ln28. Bateman P102. CB pl2. Sheffield J93.945.
Group: BA.

018. SHUTTLESTONE, NEAR PARWICH. Contracted female inhumation in cist under round barrow with bronze axe, bronze dagger, jet bead and flint disc. TYD p34,ln25; Gerloff 54, Type Merthyr Mawr. Bateman P108. Sheffield J93.948.
Group: WG.

019. SMERRILL MOOR. Contracted female inhumation in cist under round barrow with flint knife, adjacent to cist containing multiple disarticulated inhumation deposit. TYD p102, ln16. Bateman P231. Sheffield J93.923.
Group: UG.

020. SMERRILL MOOR. Contracted male inhumation in round barrow mound, no associations. TYD p104, ln5. Bateman P234. Sheffield J93.940.
Group: BA.

021. STAKOR HILL. Contracted female inhumation in grave under round barrow with Beaker. TYD p80, ln23; Clarke 122, FP. Bateman P192. Sheffield J93.922.
Group: BB.

022. WAGGON LOW. Contracted male inhumation in grave under round barrow, no associations. TYD p86, ln10. Bateman P207. Sheffield J93.932.
Group: BA.

DORSET.

023. DORCHESTER. Museum documentation records that this skeleton was found with a Beaker in its hands close to the Hospital gates, Dorchester. It is possibly Dorchester G5, recovered when lowering the floor of the Masonic Hall, with a Beaker in the arm of the skeleton. London SK26.
Group: BB.

024. FRAMPTON G5. (LONG ASH LANE). Contracted female inhumation in grave under bowl barrow with single pointed bronze awl. Dorset Proceedings 80 (1959) p120. Cambridge Eu 1.4.23.
Group: BA.

025. HANDLEY G1. (WOR BARROW). Multiple inhumation deposit in long barrow, male skull. CC IV p66, skeleton 3. Salisbury.
Group: EN.

026. HANDLEY G1. (WOR BARROW). Multiple inhumation deposit in long barrow, male skull. CC IV p66, skeleton 4. Salisbury.
Group: EN.

027. HANDLEY G1. (WOR BARROW). Multiple inhumation deposit in long barrow, male skull. CC IV p66, skeleton 5. Salisbury.
Group: EN.

028. HANDLEY G1. (WOR BARROW). Contracted male inhumation in ditch deposits of long barrow with leaf shaped flint arrowhead in ribs. CC IV p63, skeleton 8; Green 201. Salisbury.
Group: EN.

029. HANDLEY G1. (WOR BARROW). Contracted male inhumation in grave in long barrow mound with Beaker. CC IV p114; Clarke 191, FN. Salisbury.
Group: BB.

030. HANDLEY, RUSHMORE BARROW 20. Contracted male inhumation in grave under round barrow with Beaker. CCII p5. Salisbury.
Group: BB.

031. TARRANT LAUNCESTON G5. (CRICHEL DOWN 14). Contracted male inhumation in grave under bowl barrow with Beaker and flint flake. Archaeologia 90 (1944) p75; Clarke 201, W/MR. Proceedings of the Prehistoric Society (1940) p131. Cambridge Eu 1.4.57.
Group: BB.

GLOUCESTERSHIRE.

032. FROCESTER G1. (NYMPSFIELD). Multiple inhumation deposit in chambered tomb, male skull. JT p55. Cambridge. Eu 1.5.65.
Group: EN.

033. RODMARTON G1. Multiple inhumation deposit in chambered tomb, female skull. JT p55. CB p159, Schuster 39. London SK1823.
Group: EN.

034. RODMARTON G1. Multiple inhumation deposit in chambered tomb, male skull. JT p55. Cambridge Eu 1.5.68.
Group: EN.

035. SUDELEY G1. (BELAS KNAP). Multiple inhumation deposit in chambered tomb, male skull. Proceedings of the Society of Antiquaries, 3 (1866) p277, burial CIII. Cambridge. Eu 1.5.5.
Group: EN.

036. SUDELEY G1. (BELAS KNAP). Multiple inhumation deposit in chambered tomb, male skull. Proceedings of the Society of Antiquaries, 3 (1866) p277, burial CV. Cambridge. Eu 1.5.6.
Group: EN.

037. SUDELEY G1. (BELAS KNAP). Multiple inhumation deposit in chambered tomb, female skull. Proceedings of the Society of Antiquaries, 3 (1866) p277, burial CVI. Cambridge. Eu 1.5.7.
Group: EN.

038. SUDELEY G1. (BELAS KNAP). Multiple inhumation deposit in chambered tomb, female skull. Proceedings of the Society of Antiquaries, 3 (1866) p277, burial DII. Cambridge Eu 1.5.3.
Group: EN.

039. SUDELEY G1. (BELAS KNAP). Multiple inhumation deposit in chambered tomb, male skull. Proceedings of the Society of Antiquaries, 3 (1866) p277, burial DIV. Cambridge Eu 1.5.10.
Group: EN.

040. SWELL G5. (UPPER SWELL 232). Multiple inhumation deposit in chambered tomb, female skull. GRBB p528, ln13. London SK1856.
Group: EN.

041. SWELL G5. (UPPER SWELL 232). Contracted female inhumation in multiple inhumation deposit in chambered tomb. GRBB p529, ln5.
London SK1857.
Group: EN.

**KENT.**

042. COLDRUM. Multiple inhumation deposit in chambered tomb, male skull. Journal of the Royal Anthropological Institute, 43 (1913) p78. Cambridge Eu 1.5.118.
Group: EN.

**LINCOLNSHIRE.**

043. GIANTS HILLS I. Multiple inhumation deposit in long barrow, female skull. Archaeologia, 85 (1936) p53. Cave, ibid, p90.
Group: EN.

044. TALLINGTON. Contracted male inhumation under round barrow, no associations. Proceedings of the Prehistoric Society, (1976) p226, grave 2, secondary burial. Cambridge Eu 1.4.90.
Group: BA.

NORTHAMPTONSHIRE.

045. ALDWINCLE. Disarticulated male inhumation in coffin under round barrow with Beaker, probably Clarke Type S3. Northamptonshire Archaeology, 11 (1976) p30. Cambridge.
Group: BB.

OXFORDSHIRE.

046. ASCOTT-UNDER-WYCHWOOD. Multiple inhumation deposit in chambered tomb, female skull. Man, 12 (1977) p22-32. London.
Group: EN.

047. ASCOTT-UNDER-WYCHWOOD. Multiple inhumation deposit in chambered tomb, male skull. Man, 12 (1977) p22-32. London.
Group: EN.

048. CASSINGTON. Contracted female inhumation in flat grave, no associations. Antiquaries Journal, 14 (1934) p271, grave 2. London SK2028.
Group: BA.

049. CASSINGTON. Contracted male inhumation in flat grave with Beaker. Antiquaries Journal, 14 (1934) p272, grave 6; Clarke 720F, ?S4. London SK2031.
Group: WG.

050. CASSINGTON. Contracted male inhumation in grave under round barrow with flint flake. Oxoniensia, 11/12 (1946/7) p11. Cambridge Eu. 1.4.1.
Group: BA.

051. EYNSHAM. Contracted male inhumation in flat grave with Beaker. Oxoniensia, 3 (1938) p21, burial 4; Clarke 743, S4. London SK2044.
Group: WG.

052. EYNSHAM. Contracted male inhumation in single grave with Beaker. Oxoniensia, 3 (1938) p22, burial 14; Clarke 745, S4. London SK2049.
Group: WG.

053. EYNSHAM. Contracted male inhumation in flat grave with Beaker and bronze dagger. Oxoniensia, 3 (1938) p22, burial 15; Clarke 746, FP; Gerloff 41, Type Butterwick. London SK2050.
Group: WG.

STAFFORDSHIRE.

054. CASTERN. Contracted male inhumation in cist under round barrow with Beaker. Vestiges p87, ln 21; Clarke 835, S2. Bateman P84. Sheffield J93.915.
Group: BB.

055. LONG LOW. Multiple inhumation deposit in cist in long cairn with two flint leaf arrowheads and a flint knife, male skull. TYD p146, ln21; Green 130. CB p133; Bateman P145. Sheffield J93.930.
Group: EN.

056. WETTON HILL. Contracted male inhumation in cist under round barrow with Food Vessel. TYD p139, ln23. CB p112. Bateman P142. Sheffield J93.939.
Group: FV.

WILTSHIRE.

057. AMESBURY G51. Contracted male inhumation in round barrow mound with Beaker, bronze awl, antler slip, flint scraper and wooden objects. Wiltshire Archaeological Magazine, 70/71 (1978) p14, burial A; Clarke 1037 S2(E). Cambridge Eu 1.4.100.
Group: BB.

058. AMESBURY G51. Contracted male inhumation in ditch under round mound with Beaker. Wiltshire Archaeological Magazine, 70/71 (1978) p16, burial B; Clarke 1036 W/MR. Cambridge EU 1.4.101.
Group: BB.

059. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in chambered tomb, male skull. JT III p55, burial 1. Cambridge Eu 1.5.61.
Group: EN.

060. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in chambered tomb, male skull. JT III p55, burial 2. Cambridge Eu 1.5.62.
Group: EN.

061. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in chambered tomb, male skull. JT III p55, burial 13. Cambridge Eu 1.5.63.
Group: EN.

062. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in chambered tomb,male skull. JT III p55, burial 4. CB p150. Cambridge Eu 1.5.64.
Group: EN.

063. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in north-east chamber of chambered tomb, female skull. Piggott (1962) p25 burial 1. Cambridge Eu 1.5.142.
Group: EN.

064. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in south-west chamber of chambered tomb, female skull. Piggott (1962) p26 skull 1. Cambridge Eu 1.5.147.
Group: EN.

065. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in south-west chamber of chambered tomb, female skull. Piggott (1962) p26 skull 3. Cambridge Eu 1.5.149.
Group: EN.

066. AVEBURY G22. (WEST KENNET). Multiple inhumation deposit in north-west chamber of chambered tomb, male skull. Piggott (1962) p26, skull 1. Cambridge Eu 1.5.150.
Group: EN.

067. BISHOPS CANNINGS G34. Contracted male inhumation in grave under round barrow, no associations. Wiltshire Archaeological Magazine, 6 (1860) p318. CB p132. Cambridge Eu 1.4.32.
Group: BA.

068. BRATTON G8A. Contracted male inhumation in cist under round barrow, no associations. Grinsell (1957) p161. Cambridge Eu 1.4.38.
Group: BA.

069. CALNE/CHERHILL G5. (OLDBURY HILL). One of three skeletons in large shallow grave in long barrow, female. ? primary or secondary. Wiltshire Archaeological Magazine, 13 (1872) p104. JT II p473. Cambridge Eu 1.5.77.
Group: NG.

070. CALNE/CHERHILL G5. (OLDBURY HILL). One of three skeletons in large shallow grave surrounded by blocks of sarsen stone, female. Wiltshire Archaeological Magazine, 13 (1872) p104. JT II p473. Devizes C8.
Group: NG.

071. CHIPPENHAM G1. (LANHILL). Multiple inhumation deposit in chambered tomb, male skull. Proceedings of the Prehistoric Society, 4 (1938) p125, burial 1. Cambridge Eu 1.5.104.
Group: EN.

072. CHIPPENHAM G1. (LANHILL). Multiple inhumation deposit in chambered tomb, female skull. Proceedings of the Prehistoric Society 4 (1938) p125, burial 2. Cambridge Eu 1.5.105.
Group: EN.

073. CHIPPENHAM G1. (LANHILL). Multiple inhumation deposit in chambered tomb, female skull. Proceedings of the Prehistoric Society, 4 (1938) p125, burial 5. Cambridge Eu 1.5.107.
Group: EN.

074. FIGHELDEAN G31. Single male inhumation under long barrow. JT III p55. Cambridge Eu 1.5.86.
Group: EN.

075. FUSSELLS LODGE. Multiple inhumation deposit in long barrow, probably female skull. Archaeologia, 100 (1957) 1-80. London SK3312.

076. HEYTESBURY G1. (BOWLS BARROW). Multiple inhumation deposit in long barrow, male skull. JT II p473. Cambridge Eu 1.5.79.
Group: EN.

077. HEYTESBURY G1. (BOWLS BARROW). Multiple inhumation deposit in long barrow, male skull. JT II p473. Cambridge Eu 1.5.80.
Group: EN.

078. NETTLETON G1. (LUGBURY). Multiple inhumation deposit in chambered tomb, male skull. Grinsell 1957 p142. Cambridge Eu 1.5.52.
Group: EN.

079. NETTLETON G1. (LUGBURY). Multiple inhumation deposit in chambered tomb, male skull. Grinsell 1957 p142. Cambridge Eu 1.5.53.
Group: EN.

080. NETTLETON G1. (LUGBURY). Multiple inhumation deposit in chambered tomb, female skull. Grinsell 1957 p142. Cambridge Eu 1.5.59.
Group: EN.

081. NORTON BAVANT G13. Multiple inhumation deposit in long barrow, female skull. JT III p55. Cambridge Eu 1.5.98.
Group: EN.

082. NORTON BAVANT G13. Multiple inhumation deposit in long barrow, female skull. JT III p55. Cambridge Eu 1.5.99.
Group: EN.

083. NORTON BAVANT G13. Multiple inhumation deposit in long barrow, male skull. JT III p55. Cambridge Eu 1.5.92.
Group: EN.

084. NORTON BAVANT G13. Multiple inhumation deposit in long barrow, male skull. JT III p55. Cambridge Eu 1.5.93.
Group: EN.

085. ROUNDWAY G8. Contracted male inhumation in grave under round barrow with Beaker, flint barbed and tanged arrowhead, tanged copper dagger, bracer and bronze pin. Wiltshire Archaeological Magazine, 3 (1857) p186; Clarke 1135, W/MR; Gerloff 1; Green 206. CB pl42. Devizes C14.
Group: BB.

086. SHREWTON G5K. Contracted male inhumation in grave under bowl barrow with small tanged copper dagger and Beaker. Proceedings of the Prehistoric Society, 50 (1984) p275; Clarke 1140, N2; Gerloff 12. Wells, ibid, microfiche.
Group: BB.

087. SHREWTON G24. Contracted male inhumation in grave under bowl barrow with late Southern beaker. Proceedings of the Prehistoric Society, 50 (1984) p285. Salisbury. Wells, ibid, microfiche.
Group: WG.

088. STONEHENGE DITCH. Inhumation in secondary ditch fill of henge monument with 2 hole slate bracer and 3 flint barbed and tanged arrowheads. Wiltshire Archaeological Magazine, 78 (1984) p13; Green 226/I. Salisbury.
Group: BB.

089. UPAVON. Male inhumation with Beaker. Wiltshire Archaeological Magazine, 40 (1919) p6; Clarke 1150, W/MR. Devizes.
Group: BB.

090. WEST OVERTON G1. Contracted male inhumation in grave under round barrow with bronze knife dagger and either a crutch headed pin or a bronze awl. (Uncertain associations, see entry in Guide Catalogue of Neolithic and Bronze Age Collections in Devizes Museum (1964) p52); Gerloff 271. CB pl11. Cambridge Eu 1.4.28.
Group: BA.

091. WEST OVERTON G6b. Contracted male inhumation in grave under round barrow with Beaker, antler spatula, bronze awl, flint knife, flint flake and two slate objects. Proceedings of the Prehistoric Society, 32 (1966) p127; Clarke 1131, S2. London.
Group: BB.

092. WINTERBOURNE MONKTON G2B. (CIST 300yds FROM MILL BARROW). Multiple inhumation deposit in large cist under a sarsen, male skull. Wiltshire Archaeological Magazine, 1 (1853) p303. Devizes.
Group: NG.

093. WINTERBOURNE STOKE G1. Contracted male inhumation at base of long barrow with flint bludgeon, probably primary. JT I p141, burial A. Cambridge Eu 1.4.44.
Group: EN.

094. WINTERBOURNE STOKE G1. Contracted male inhumation in long barrow mound with ?urn and flint knife, probably secondary. JT I p141, burial B. Cambridge Eu 1.4.43.
Group: BA.

095. WINTERBOURNE STOKE G43. Contracted female inhumation in grave under round barrow, probably with Beaker. Wiltshire Archaeological Magazine, 67 (1972) p51. Dawes, ibid, p57.
Group: BB.

096. WOODHENGE. Male inhumation holding axehammer with Beaker near skull. Woodhenge (1929). London SK49.
Group: WG.

097. WOODHENGE. Male inhumation in grave with oxbones. Woodhenge (1929). London SK50.
Group: BA.

YORKSHIRE.

098. ACKLAM WOLD 124. Contracted male inhumation in grave under round barrow with flint dagger, flint knife, v -bored amber button, pyrites, bone pin, jet ring and Beaker. 40yrs p91, burial 4; Clarke 1210, S1. Wright 46. Hull 46.
Group: BB.

099. ALDRO 52. Contracted female inhumation in grave under round barrow, no associations. 40yrs p62, burial 1. Hull 78.
Group: BA.

100. ALDRO 54. Contracted male inhumation in grave under round barrow, no associations. 40yrs p64, burial 3. Wright 29. Hull 29.
Group: BA.

101. ALDRO 113. Contracted female inhumation in grave under round barrow with 6 bone hairpins and 3 worked flints. 40yrs p76, centre burial. Wright 50. Hull 50.
Group: BA.

102. BARROW NOOK 296. Contracted male inhumation in grave under round barrow, no associations. Yorkshire Archaeological Journal, 20 (1909) p491. Hull 108.
Group: BA.

103. CALLIS WOLD 23. Contracted male inhumation in grave under round barrow with Food Vessel and perforated stone battle-axe. 40yrs p154; Roe 250, IIIa. Wright 35. Hull 35.
Group: FV.

104. CALLIS WOLD 275. Contracted male inhumation on old ground surface under round barrow. 40yrs p161, burial 3. Wright 44. Hull 44.
Group: ON.

105. CALLIS WOLD 275. Contracted male inhumation on pavement under round barrow. 40 yrs p162, burial 9. Hull 92.
Group: ON.

106. COWLAM WOLD 56. Contracted female inhumation in grave under round barrow with Food Vessel. Watts and Rahtz 1984. Dawes, ibid.
Group: FV.

107. COWLAM WOLD 57. Contracted male inhumation on old ground surface under round barrow with antler macehead. GRBB p217, ln10, burial 4. Schuster 149. London SK1942.
Group: LN.

108. COWLAM WOLD 57. Contracted female inhumation on old ground surface under round barrow with flint leaf arrowhead. GRBB p218, ln27, burial 6; Green 91. Schuster 150. London SK1943.
Group: ON.

109. COWLAM WOLD 57. Multiple disarticulated inhumation deposit under round barrow, female skull associated with bone pin. GRBB p219, ln3, burial 7. Schuster 151. London SK1944.
Group: ON.

110. DINNINGTON. Multiple inhumation deposit in long barrow, male skull.JT p132. Cambridge Eu 1.5.76.
Group: EN.

111. DINNINGTON. Multiple inhumation deposit in long barrow, male skull. JT p132. London SK1807.
Group: EN.

112. DINNINGTON. Multiple inhumation deposit in long barrow, male skull. JT p132. Schuster 21. London SK1813.
Group: EN.

113. DINNINGTON. Multiple inhumation deposit in long barrow, male skull. JT p132. Schuster 22. London SK1814.
Group: EN.

114. DINNINGTON. Multiple inhumation deposit in long barrow, male skull. JT p132. Schuster 25. London SK1816.
Group: EN.

115. DINNINGTON. Multiple inhumation deposit in long barrow, male skull. JT p132. Schuster 29. London SK1820.
Group: EN.

116. DINNINGTON. Multiple inhumation deposit in long barrow, female skull. JT p132. London SK1809.
Group: EN.

117. DINNINGTON. Multiple inhumation deposit in long barrow, female skull. JT p132. Schuster 24. London SK1815.
Group: EN.

118. DINNINGTON. Multiple inhumation deposit in long barrow, female skull. JT p132, p478. Schuster 26. London SK1817.
Group: EN.

119. DINNINGTON. Multiple inhumation deposit in long barrow, female skull. JT p132, p478. Schuster 27. London SK1818.
Group: EN.

120. DINNINGTON. Multiple inhumation deposit in long barrow, female skull. JT p132. Schuster 28. London SK1819.
Group: EN.

121. DINNINGTON. Multiple inhumation deposit in long barrow, female skull. JT p132. Schuster 30. London SK1821.
Group: EN.

122. DUGGLEBY HOWE 273. Contracted male inhumation in grave under round barrow with long bone pin, several transverse arrowheads and worked flints. 40yrs p27, burial C. Garson, ibid, C.
Group: LN.

123. DUGGLEBY HOWE 273. Contracted male inhumation on old ground surface under round barrow with polished flint knife. 40yrs p28, burial D. Garson, ibid, D. Hull 70.
Group: LN.

124. DUGGLEBY HOWE 273. Contracted male inhumation in grave under round barrow with antler macehead, flint axe and leaf-shaped flint arrowhead. 40yrs p28, burial G; Green 85. Garson, ibid, G. Hull 72.
Group: LN.

125. DUGGLEBY HOWE 273. Contracted male inhumation in grave under a round barrow, no associations. 40yrs p28, burial I. Garson, ibid, I.
Group: LN.

126. DUGGLEBY HOWE 273. Disembodied skull in grave under round barrow. 40yrs p29, burial J. Garson, ibid, J. Hull 71.
Group: LN.

127. DUGGLEBY HOWE 273. Contracted male inhumation in grave under round barrow with towthorpe bowl, 9 flint flakes and a core. 40 yrs p29, burial K. Garson, ibid, K. Hull 74.
Group: LN.

128. DUGGLEBY HOWE 273. Contracted male inhumation in grave under round barrow, no associations. 40yrs p29, burial L. Garson, ibid, L. Hull 75.
Group: LN.

129. EBBERSTON 221. Multiple inhumation/cremation deposit in long barrow, male skull. GRBB p486. Schuster 7. London SK1798.
Group: EN.

130. EBBERSTON 221. Multiple inhumation/cremation deposit in long barrow, male skull. GRBB p486. Schuster 4. London SK1795.
Group: EN.

131. FIMBER C33. Contracted female inhumation in grave under oval barrow with food vessel and 3 flint flakes. 40yrs p191, burial 2. Wright 45. Hull 45.
Group: FV.

132. FOLKTON (ELF HOWE). Contracted male inhumation in grave under round barrow with collared vessel. GRBB p272, ln1; Longworth 1141. Schuster 173. London SK1966.
Group: FV.

133. FOLKTON 70. Contracted female inhumation on old ground surface under round barrow with collared vessel. GRBB p273, ln14; Longworth 1137. Schuster 177. London SK1969.
Group: FV.

134. FOLKTON 70. Contracted male inhumation in grave under round barrow with boars tusk pin and flint blade. GRBB p274 ln12. Schuster 178. London SK1970.
Group: BA.

135. FOLKTON 71. Contracted female inhumation in grave under round barrow with Food Vessel, bronze awl, flint scraper and three bone beads. GRBB p275, ln8 from bottom. Rolleston p575; Schuster 180. London SK1972.
Group: FV.

136. GANTON 21. Contracted male inhumation in grave under round barrow with Food Vessel. GRBB p163, ln25. Schuster 111. London SK1905.
Group: FV.

137. GANTON 22. Contracted male inhumation in penannular ditch under round barrow, no associations. GRBB p166, ln7 from bottom. Schuster 114. London SK1908.
Group: BA.

138. GANTON 22. Contracted female inhumation on old ground surface under round barrow, no associations. GRBB p166, ln2 from bottom. Schuster 115. London SK1909.
Group: BA.

139. GANTON 27. Contracted female inhumation in round barrow mound with v-bored conical jet button. GRBB p174, ln32. Schuster 117. London SK1911.
Group: BA.

140. GANTON 28. Contracted male inhumation in hollow under round barrow with ?plain vase. GRBB p176, ln7. Schuster 118. London SK1912.
Group: BA.

141. GARROWBY WOLD 32. Contracted male inhumation in grave under round barrow with bronze dagger. 40yrs p146, burial 4; Gerloff 43, Type Butterwick. Hull 86.
Group: WG.

142. GARROWBY WOLD 104. Contracted male inhumation in grave under round barrow with curved knife of black flint. 40yrs p134, burial 1. Wright 36. Hull 36.
Group: BA.

143. GARROWBY WOLD 104. Contracted male inhumation in grave under round barrow with Beaker and piece of flint. 40yrs p135, burial2; Clarke 1293, S2. Wright 37. Hull 37.
Group: BB.

144. GARROWBY WOLD 120. Contracted male inhumation in grave under round barrow, no associations. 40yrs p146, burial 1. Hull 87.
Group: BA.

145. GARROWBY WOLD 120. Contracted male inhumation in mound of round barrow with Food Vessel. 40yrs p147, burial 4. Hull 88a.
Group: FV.

146. GARTON SLACK, BREWSTER 29. Contracted male inhumation in flat grave, possibly ploughed out barrow, with N2 Beaker and flint flake. Brewster 1980 p573, BA burial 4. Hull.
Group: BB.

147. GARTON SLACK 37. Contracted female inhumation on old ground surface under round barrow with bone pin. 40yrs p209, burial 3; Brewster 1980 p92. Wright 6. Hull 6.
Group: BA.

148. GARTON SLACK 37. Contracted male inhumation in grave under round barrow with Beaker, flint dagger, perforated stone battle-axe and v-bored jet button. 40yrs p209, burial 6; Brewster 1980 p92; Clarke 1296, S1; Roe 261, Ia. Wright 1. Hull 1.
Group: BB.

149. GARTON SLACK 37. Contracted female inhumation crouched on old ground surface under round barrow, no associations. 40yrs p210, burial 8. Brewster 1980 p92. Wright 2. Hull 2.
Group: NG.

150. GARTON SLACK 37. Contracted female inhumation on old ground surface under round barrow, no associations. 40yrs p210, burial 9. Brewster 1980 p92. Wright 4. Hull 4.
Group: NG.

151. GARTON SLACK 37. Contracted male inhumation on old ground surface under round barrow with gritstone pounder, lower jaw of ox or deer and flint flake. 40yrs p210, burial 12. Brewster 1980 p92. Wright 7. Hull 7.
Group: NG.

152. GARTON SLACK 37. Contracted female inhumation on old ground surface under round barrow, no associations. 40 yrs p210, burial 10. Brewster 1980 p92. Wright 5. Hull 5.
Group: NG.

153. GARTON SLACK 37. Contracted female inhumation on old ground surface under round barrow, no associations. 40yrs p210, burial 11. Brewster 1980 p92. Wright 3. Hull 3.
Group: NG.

154. GARTON SLACK 37. Contracted male inhumation in grave under round barrow, no associations. 40yrs p211, burial 15. Brewster 1981 p92. Wright 8. Hull 8.
Group: BA.

155. GARTON SLACK 40. Contracted male inhumation in grave under round barrow with Food Vvessel, flint knife, two yellow quartz pebbles and a clay button. 40yrs p229, burial A. Wright 62. Hull 62.
Group: FV.

156. GARTON SLACK 40. Disembodied male skull in grave under round barrow, no associations. 40yrs p230, at feet of burial B. Hull 99.
Group: BA.

157. GARTON SLACK 75. Contracted female inhumation on old ground surface under round barrow with Food Vessel, bronze awl and plano-convex flint knife. 40 yrs p222, burial 1. Wright 25. Hull 25.
Group: FV.

158. GARTON SLACK 75. Contracted female inhumation in grave under round barrow with Food vessel, jet disc necklace and bronze awl. 40yrs p222, burial 2. Wright 23. Hull 23.
Group: FV.

159. GARTON SLACK 75. Contracted male inhumation in grave under round barrow with Beaker. 40yrs p223, burial 3; Clarke 1298, S1. Wright 24. Hull 24.
Group: BB.

160. GARTON SLACK 81. Contracted female inhumation in grave under round barrow with v-bored, conical, jet button. 40yrs p240, burial 2. Hull.
Group: BA.

161. GARTON SLACK 82. Contracted male inhumation in grave under round barrow with 2 flint flakes. 40yrs p233, burial F. Wright 39. Hull 39.
Group: BA.

162. GARTON SLACK 82. Contracted male inhumation in grave under round barrow, no associations. 40yrs p234, burial H. Wright 41. Hull 41.
Group: BA.

163. GARTON SLACK 82. Contracted female inhumation in grave under round barrow, no associations. 40yrs p234, burial I. Wright 38. Hull 38.
Group: BA.

164. GARTON SLACK 82. Contracted male inhumation in grave under round barrow, no associations. 40yrs p234, burial J. Wright 40. Hull 40.
Group: BA.

165. GARTON SLACK 107. Contracted male inhumation in grave under round barrow, no associations. 40yrs p230, burial A. Wright 21. Hull 21.
Group: BA.

166. GARTON SLACK C40. Contracted male inhumation in grave under round barrow with Food Vessel and several splinters of flint. 40yrs p244, burial 1/a. Wright 30. Hull 30.
Group: FV.

167. GARTON SLACK C40. Contracted male inhumation in grave under round barrow with Food Vessel. 40 yrs p244, burial B. Wright 26. Hull 26.
Group: FV.

168. GARTON SLACK C41. Contracted female inhumation in grave under round barrow with handled Food Vessel and Accessory Vessel. 40yrs p259, burial 1. Wright 33. Hull 33.
Group: FV.

169. GARTON SLACK C41. Contracted male inhumation in grave under round barrow with pig bones. 40yrs p259, burial 2. Wright 34. Hull 34.
Group: BA.

170. GARTON SLACK C52. Contracted female inhumation in grave under round barrow with bronze awl and two splinters of flint. 40yrs p217, burial 1. Wright 49. Hull 49.
Group: BA.

171. GARTON SLACK C52. Contracted male inhumation in grave under round barrow, no associations. 40 yrs p217, burial 2. Hull 97.
Group: BA.

172. GARTON SLACK C52. Contracted male inhumation in grave under round barrow with jet button, flint dagger and knife. 40yrs p217, burial 5. Wright 20. Hull 20.
Group: BA.

173. GARTON SLACK C55. Contracted male inhumation in grave under round barrow with two splinters of flint. 40yrs p219, burial J/1. Wright 11. Hull 11.
Group: BA.

174. GARTON SLACK 155. Contracted male inhumation in grave under round barrow, no associations. 40yrs p219, burial 2. Wright 10. Hull 10.
Group: BA.

175. GARTON SLACK 156. Contracted female inhumation in grave under round barrow with bronze awl and two splinters of flint. 40yrs p220, burial 1. Wright 15/47. Hull.
Group: BA.

176. GARTON SLACK 157. Contracted female inhumation in grave under round barrow, no associations. 40yrs p259, burial 1. Wright 16. Hull 16.
Group: BA.

177. GARTON SLACK 162. Contracted male inhumation in grave under round barrow, no associations. 40yrs p213, burial 2. Wright 54. Hull 54.
Group: BA.

178. GARTON SLACK 162. Contracted male inhumation in grave under round barrow, no associations. 40yrs p213, burial 5. Wright 52. Hull 52.
Group: BA.

179. GARTON SLACK 162. Contracted male inhumation in grave under round barrow with plano-convex flint knife. 40yrs p213, burial 6. Wright 55. Hull 55.
Group: FV.

180. GARTON SLACK 162. Contracted male inhumation in grave under round barrow, no associations. 40yrs p213, burial 7. Hull.
Group: BA.

181. GARTON SLACK 163. Contracted male inhumation in grave under round barrow with Beaker and flint knife. 40yrs p214, burial 1, grave B; Clarke 1304, N3. Wright 12. Hull 12.
Group: BB.

182. GARTON SLACK 163. Contracted male inhumation in grave under round barrow with Beaker, bone pin, polished flint axe, flint knife and three flint flakes. 40yrs p215, burial 2; Clarke 1305, N3. Wright 14. Hull 14.
Group: BB.

183. GARTON SLACK 163. Contracted male inhumation in grave under round barrow with Beaker, bronze pricker and seven flint flakes. 40 yrs p215, burial 3; Clarke 1306, N3. Hull 96.
Group: BB.

184. GARTON SLACK 163. Contracted female inhumation in grave under round barrow, no associations. 40yrs p215, burial 4. Wright 13. Hull 13.
Group: BA.

185. GARTON SLACK 167. Contracted female inhumation in grave under round barrow, no associations. 40yrs p243, burial 5. Wright 58. Hull 58.
Group: BA.

186. GARTON SLACK 171. Contracted female inhumation under round barrow, no associations. 40yrs p225, ?burial. Wright 61. Hull 61.
Group: BA.

187. GARTON SLACK 171. Contracted female inhumation under round barrow, no associations. 40yrs p225, ?burial. Wright 60. Hull 60.
Group: BA.

188. GARTON SLACK 171. Contracted male inhumation under round barrow, no associations. 40yrs p225, ?burial. Wright 59. Hull 59.
Group: BA.

189. GOODMANHAM 99. Contracted male inhumation in grave under round barrow, no associations. GRBB p308, ln21. Schuster 190. London SK1984.
Group: BA.

190. GOODMANHAM 103. Contracted male inhumation in grave under round barrow with Food Vessel. GRBB p313, ln19. Schuster 193. London SK1987.
Group: FV.

191. GOODMANHAM 111. Contracted female inhumation in grave under round barrow, no associations. GRBB p319, ln17. Schuster 199. London SK1993.
Group: BA.

192. GOODMANHAM 111. Contracted female inhumation on old ground surface under round barrow with flint block at face. GRBB p320, ln12. Schuster 201. London SK1995.
Group: BA.

193. GOODMANHAM 112. Contracted female inhumation in grave under round barrow with single pointed bronze awl. GRBB p321, ln14. Schuster 202. London SK1996.
Group: FV.

194. GOODMANHAM 113. Disturbed female inhumation in grave under round barrow, no associations. GRBB p323, ln4. London SK2000.
Group: BA.

195. GOODMANHAM 117. Contracted male inhumation in grave under round barrow, no associations. GRBB p327, ln15. Schuster 212. London SK2005.
Group: BA.

196. GOODMANHAM 120. Contracted male inhumation in grave under round barrow, no associations. GRBB p329, ln20. London SK2007.
Group: BA.

197. GREENGATE HILL, PICKERING. Contracted male inhumation in grave under round barrow, no associations. CB, text accompanying CB plates 2,3. London SK58.
Group: BA.

198. GREENGATE HILL, PICKERING. Contracted male inhumation in grave under round barrow, no associations. CB, text accompanying CB plates 2,3. London SK59.
Group: BA.

199. HANGING GRIMSTON 27. Contracted male inhumation in grave under round barrow with Food Vessel. 40yrs p110. Hull 79.
Group: FV.

200. HANGING GRIMSTON 56. Contracted female inhumation in grave under round barrow with Beaker. 40yrs p99, burial 3. Wright 42. Hull 42.
Group: BB.

201. HEDON HOWE 281. Disturbed female inhumation in cist. 40yrs p348, grave 3, body 2. Hull 106.
Group: ON.

202. HEDON HOWE 281. Crouched male inhumation in cist under round barrow. 40yrs p349, burial 5. Wright 56. Hull 56.
Group: ON.

203. HELPERTHORPE 41. Contracted male inhumation in grave under round barrow with flint knife and two antler tines. GRBB p191, last line. Rolleston p617; Schuster 125. London SK1919.
Group: BA.

204. HELPERTHORPE 49. Contracted male inhumation on old ground surface under round barrow with bronze dagger. GRBB p207, ln7; Gerloff 79, Type Masterton. Schuster 141. London SK1934.
Group: WG.

205. HESLERTON 5. Contracted male inhumation in grave under oval barrow with Food Vessel. GRBB p142, ln6. Rolleston p579; Schuster 96. London SK1891.
Group: FV.

206. HUGGATE AND WARTER WOLD 264. Sitting male inhumation in grave under round barrow, no associations. 40yrs p319. Hull.
Group: BA.

207. LANGTON 2. Contracted male inhumation on ground surface under round barrow with flint flake. GRBB p136, last line. Rolleston p603; Schuster 93. London SK1887.
Group: BA.

208. LANGTON 2. Contracted female inhumation in round barrow mound with three bronze awls (one single pointed), jet disc bead, shell and bone beads and boars tusk implement. GRBB p137, last line. Schuster 94. London SK1888.
Group: FV.

209. LIFF HILL 294. Contracted male inhumation in grave under round barrow with bronze rivetted knife dagger, flint knife and several splinters of flint. 40yrs p203, burial 1. Hull 93.
Group: WG.

210. LIFF HILL 294. Contracted female inhumation in round barrow mound with flint knife and scraper. 40yrs p204, burial 2. Hull 94.
Group: BA.

211. LIFF HILL 294. Contracted female inhumation in grave under round barrow with Food Vessel. 40yrs p204, burial 3. Wright 51. Hull 51.
Group: FV.

212. LONDESBOROUGH 123. Contracted male inhumation in grave under round barrow, no associations. GRBB p332, ln4. Schuster 218. London SK2011.
Group: BA.

213. MILL HILL, BROUGH. Male inhumation found in gravel pit with bronze dagger and pin. Antiquary, 38 (1902) p80; Gerloff 125, Armorico-British B, Type Cressington. Hull 111.
Group: FV.

214. PAINSTHORPE WOLD 98. Contracted female inhumation in grave under round barrow, no associations. 40 yrs p131, burial A. Hull 82.
Group: BA.

215. PAINSTHORPE WOLD 98. Contracted male inhumation in grave under round barrow with Food Vessel. 40yrs p131, burial B. Wright 28. Hull 28.
Group: FV.

216. PAINSTHORPE WOLD 98. Contracted male inhumation in grave under round barrow with Food Vessel and worked flint point. 40yrs p132, burial C. Wright 27. Hull 27.
Group: FV.

217. PAINSTHORPE WOLD 118. Contracted male inhumation in grave under round barrow with jet link. 40yrs p127, burial M. Wright 57. Hull 57.
Group: LN.

218. RUDSTON 61. Contracted female inhumation in grave under round barrow with Beaker and antler pick. GRBB p231, ln1; Clarke 1366, N2. Schuster 156. London SK 1950.
Group: BB.

219. RUDSTON 63. Contracted male inhumation in round barrow mound, no associations. GRBB p248, ln12. London SK1955.
Group: BA.

220. RUDSTON 63. Contracted male inhumation in round barrow mound with Food Vessel and flint barbed and tanged arrowhead. GRBB p248, line 3 from bottom; Green 323. Rolleston p591. Schuster 165. London SK1958.
Group: FV.

221. RUDSTON 63. Contracted male inhumation on old ground surface under round barrow, no associations. GRBB p250, ln19. Schuster 166. London SK1959.
Group: BA.

222. RUDSTON 68. Contracted male inhumation in grave under round barrow with bronze knife, perforated stone battle-axe and flint point. GRBB p265, ln24. Roe 274,IIc. London SK1962.
Group: WG.

223. RUDSTON 224. Multiple inhumation/cremation deposit in long barrow, male skull. GRBB p497, p501 ln1. London SK1802.
Group: EN.

224. RUDSTON 224. Multiple inhumation/cremation deposit in long barrow, male skull. GRBB p501, ln6. Rolleston p613; Schuster 19. London SK1803.
Group: EN.

225. SHERBURN 7. Contracted female inhumation on old ground surface under round barrow. GRBB p146, ln35. Rolleston p609; Schuster 99. London SK1894.
Group: ON.

226. SHERBURN 13. Contracted female inhumation in grave under round barrow with Food Vessel and flint plano-convex knife. GRBB p152, ln23. Schuster 104. London SK1899.
Group: FV.

227. SHERBURN 13. Contracted male inhumation in grave under round barrow with Food Vessel. GRBB p154, ln1. Schuster 105. London SK1900.
Group: FV.

228. STAXTON 5. Burial 5, contracted male inhumation on subsoil, no covering mound, flint block on chest. Yorkshire Archaeological Journal 40 (1959) 129-145, p133. Denston, ibid, p139.
Group: BA.

229. TOWTHORPE 7. Contracted male inhumation on old ground surface under round barrow, no associations. 40yrs p22. Hull 68.
Group: BA.

230. TOWTHORPE 21. Contracted female inhumation in grave under round barrow with Beaker. 40yrs p12, bottom of grave; Clarke 1400, S2. Hull 65.
Group: BB.

231. TOWTHORPE 43. Contracted male inhumation under round barrow with Food Vessel. 40yrs p14, burial 1. Hull 66a.
Group: FV.

232. TOWTHORPE 106. Contracted male inhumation in grave under round barrow, no associations. 40yrs p13, burial A. Hull.
Group: BA.

233. WEAVERTHORPE 42. Disembodied female skull on old ground surface under round barrow with quartzite hammerstone. GRBB p193, ln9. London SK1920.
Group: BA.

234. WEAVERTHORPE 42. Contracted male inhumation on old ground surface under round barrow with Beaker. GRBB p193, ln14; Clarke 1403, N3. Schuster 127. London SK1921.
Group: BB.

235. WEAVERTHORPE 43. Contracted male inhumation in round barrow mound, no associations. GRBB p195, ln18. London SK1926.
Group: BA.

236. WEAVERTHORPE 43. Contracted male inhumation in grave under round barrow with flint knife and flake. GRBB p195, ln33. Schuster 133. London SK1927.
Group: BA.

237. WEAVERTHORPE 44. Contracted male inhumation in round barrow mound with flint plano-convex knife. GRBB p198, ln11. Rolleston p619. Schuster 134. London SK1928.
Group: FV.

238. WEAVERTHORPE 46. Contracted male inhumation on old ground surface under round barrow with flint flake. GRBB p200, ln19. Rolleston p571, Schuster 135. London SK1929.
Group: BA.

239. WEAVERTHORPE 46. Contracted female inhumation in mound of round barrow with hammerstone. GRBB p200, ln11 from bottom. Schuster 136. London SK1930.
Group: BA.

240. WESTOW 223. Secondary female burial contracted in cist in long barrow mound. GRBB p492, ln8. Schuster 13. London SK1801.
Group: BA.

241. WHARRAM PERCY 65. Contracted male inhumation in grave under round barrow with a circular piece of worked flint. 40yrs p48, burial 1. Wright 32. Hull 32.
Group: BA.

242. WHARRAM PERCY 66. Upper half of female body in round barrow mound with plano-convex flint knife. 40yrs p49, burial 2. Hull 77.
Group: FV.

243. WHITEGROUNDS. Multiple inhumation deposit under round barrow, female skull. Brewster 1984 p8, skeleton 1. Dawes,ibid, p25.
Group: ON.

244. WHITEGROUNDS. Multiple inhumation deposit under round barrow, female skull. Brewster 1984 p8, skeleton 2. Dawes, ibid, p25.
Group: ON.

245. WHITEGROUNDS. Contracted male inhumation in grave under round barrow with jet slider and Seamer-type flint axe. Brewster 1984 p10. Dawes, ibid, p25.
Group: LN.

246. WHITEGROUNDS. Multiple inhumation deposit under round barrow, male skull. Brewster 1984 p10. Dawes, ibid, p25.
Group: ON.

247. WILLERBY 33. Contracted female inhumation in grave under round barrow, no associations. GRBB p183, ln7. Schuster 121. London SK1915.
Group: BA.

248. WOLD NEWTON 284. Contracted female inhumation on old ground surface under round barrow. 40yrs p350, burial 2. Wright 17. Hull 17.
Group: ON.

249. WOLD NEWTON 284. Contracted male inhumation in round barrow mound with leaf shaped flint arrowhead. 40yrs p351, burial 7; Green 325. Wright 18. Hull 18.
Group: ON.

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## Appendix Four.

## CRANIOMETRIC DATA.

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 001 | 186 | 144 | 100 | | | 135 | 113 | 120 | 119 | 104 | 104 | | | | | | | | | |
| 002 | 191 | 151 | 104 | | | | | | | | | 74 | | | 34 | 43 | 52 | 27 | 53 | 42 |
| 003 | 180 | 140 | 95 | 109 | 137 | 125 | 126 | 110 | 109 | 114 | 91 | 64 | 103 | 97 | 32 | 39 | 47 | 23 | 43 | 43 |
| 004 | 170 | 134 | 92 | 107 | 134 | 119 | 112 | 115 | 106 | 100 | 98 | 63 | 101 | 96 | 35 | 39 | 49 | 26 | 44 | 36 |
| 005 | 188 | 140 | 99 | 113 | 149 | 135 | 127 | 114 | 116 | 114 | 96 | 65 | 112 | 99 | 30 | 42 | 52 | 26 | 43 | 44 |
| 006 | 186 | 137 | 94 | | | 124 | 127 | 114 | 110 | 113 | 96 | 64 | | | 32 | 37 | 49 | 23 | 44 | 44 |
| 007 | 176 | 151 | | | | | | | | | | | | | | | | | | |
| 008 | 174 | 141 | 91 | | | 119 | 128 | 108 | 100 | 113 | 88 | 63 | | | 33 | 39 | 48 | 23 | | |
| 009 | 198 | 134 | 106 | 107 | | 132 | 142 | 123 | 117 | 126 | 100 | 68 | | | 32 | 42 | 52 | 23 | | |
| 010 | 180 | 140 | 100 | 108 | 147 | 132 | 116 | 118 | 114 | 104 | 96 | 76 | 108 | 92 | 34 | 41 | 57 | 26 | 46 | 44 |
| 011 | 191 | 155 | 105 | 116 | 149 | 130 | 135 | 124 | 116 | 121 | 100 | 71 | 109 | 90 | 34 | 40 | 55 | 24 | 42 | [illegible] |
| 012 | 190 | 142 | | | | 130 | 150 | | 112 | 131 | | 70 | | | 34 | 39 | 55 | 24 | 51 | [illegible] |
| 013 | 184 | 142 | | | | | | | | | | | | | | | | | | |
| 014 | 192 | 150 | 103 | 115 | 137 | 149 | 144 | 122 | 122 | 129 | 99 | 59 | 97 | 92 | 29 | 39 | 48 | 22 | 43 | 41 |
| 015 | 173 | 152 | 97 | 119 | 133 | 123 | 122 | 103 | 110 | 106 | 89 | 62 | 103 | 96 | | | 46 | | 47 | [illegible] |
| 016 | 185 | 150 | 105 | 104 | 142 | 128 | 129 | 111 | 108 | 117 | 85 | 72 | 108 | 93 | 34 | 37 | 56 | 25 | 42 | 41 |
| 017 | 188 | 147 | 104 | 114 | 136 | 131 | 130 | 119 | 113 | 117 | 94 | 67 | 107 | 104 | 32 | 42 | 52 | 24 | 49 | [illegible] |
| 018 | 181 | 147 | | | | | | | | | | | | | | | | | | |
| 019 | 163 | 138 | 92 | 111 | 137 | 126 | 127 | 102 | 106 | 111 | 82 | 58 | 95 | 94 | 33 | 37 | 45 | 22 | 46 | 36 |
| 020 | 181 | 149 | 104 | 112 | 138 | 133 | 134 | 114 | 110 | 119 | 93 | 63 | 102 | 95 | 34 | 37 | 51 | 24 | 44 | 42 |
| 021 | 171 | 143 | 94 | 113 | 125 | 121 | 115 | 119 | 102 | 104 | 89 | 51 | 92 | 85 | 27 | | 38 | | 38 | [illegible] |
| 022 | 189 | 140 | 100 | 112 | 149 | 130 | 131 | 122 | 112 | 116 | 99 | | 111 | 94 | | | | | | |
| 023 | 175 | 141 | 97 | 113 | 129 | 129 | 130 | 115 | 111 | 115 | 87 | 63 | 94 | 92 | 32 | 40 | 51 | 23 | 43 | 47 |
| 024 | 178 | 135 | 99 | 109 | 139 | 124 | 118 | 115 | 110 | 107 | 97 | 67 | 108 | 103 | 32 | 40 | 49 | 25 | 46 | [illegible] |
| 025 | 206 | 139 | 101 | 115 | 126 | 135 | 134 | 134 | 115 | 120 | 101 | 71 | 100 | 107 | 33 | 42 | 52 | 24 | 46 | [illegible] |
| 026 | 190 | 133 | 95 | 110 | 131 | 121 | 136 | 121 | 110 | 120 | 100 | 71 | 102 | 95 | 34 | 40 | 54 | 22 | [illegible] | [illegible] |
| 027 | 193 | 139 | | | | | | | | | | | | | | | | | | |
| 028 | 198 | 136 | 104 | 111 | | 145 | 154 | 116 | 124 | 136 | 98 | | | | 33 | 37 | 52 | 23 | | |
| 029 | 173 | 140 | 99 | 110 | 121 | 110 | 125 | 106 | 96 | 114 | 88 | 63 | 97 | 88 | | | | | | |
| 030 | 173 | 146 | 97 | 112 | 131 | 129 | 114 | 110 | 110 | 104 | 87 | 75 | 101 | 101 | 33 | [illegible] | 50 | 22 | [illegible] | [illegible] |

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 031 | 188 | 145 | 102 | 114 | 145 | 137 | 134 | 115 | 121 | 118 | 96 | 73 | 106 | 94 | 34 | 43 | 53 | 26 | 46 | 39 |
| 032 | 197 | 147 | 98 | 119 | 140 | 145 | 135 | 128 | 125 | 121 | 103 | 70 | 106 | 99 | 34 | 41 | 53 | 25 | 44 | 38 |
| 033 | 187 | 140 | 93 | | 132 | 128 | 135 | 125 | 112 | 120 | 101 | 60 | 99 | 95 | 30 | 38 | 44 | 22 | 44 | 38 |
| 034 | 205 | 144 | 95 | 121 | 143 | 137 | 134 | 145 | 118 | 123 | 116 | 70 | 105 | 98 | 32 | 43 | 51 | 23 | 46 | 47 |
| 035 | 200 | 139 | 102 | 116 | 139 | 130 | 130 | | 114 | 121 | | | 106 | | | | | | | |
| 036 | 196 | 142 | | | | | | | | | | | | | | | | | | |
| 037 | 186 | 127 | | | | | | | | | | | | | | | | | | |
| 038 | 185 | 132 | 94 | | | 126 | 119 | 125 | 110 | 111 | 99 | | | | | | | | | |
| 039 | 190 | 142 | 99 | 118 | | 129 | 127 | 129 | 115 | 115 | 104 | | | | | | | | | |
| 040 | 172. | 129 | 87 | | | 125 | 127 | 109 | 106 | 116 | 89 | | | | | | | | | |
| 041 | 182 | 134 | 101 | 101 | 127 | 123 | 130 | 110 | 107 | 113 | 91 | 69 | 97 | 98 | 31 | 39 | 51 | 22 | 48 | 37 |
| 042 | 197 | 135 | | | | | | | | | | | | | | | | | | |
| 043 | 183 | 132 | | | | | | | | | | | | | | | | | | |
| 044 | 186 | 141 | 99 | 114 | 135 | 129 | 118 | 121 | 110 | 107 | 96 | 71 | 106 | 103 | 29 | 40 | 51 | 26 | 47 | 40 |
| 045 | 179 | 147 | 97 | 119 | 138 | 126 | 121 | 111 | 112 | 112 | 93 | 74 | 106 | 102 | 28 | 42 | 53 | 23 | 48 | 42 |
| 046 | 186 | 139 | 100 | 108 | 128 | 127 | 126 | 120 | 109 | 115 | 96 | | | | | | | | | |
| 047 | 186 | 132 | 97 | 112 | 138 | 130 | 134 | 118 | 112 | 120 | 99 | 64 | 104 | 97 | 31 | 38 | 49 | 21 | 43 | [illegible] |
| 048 | 188 | 139 | 103 | | | 136 | 139 | 119 | 115 | 124 | 95 | | | | | | | | | |
| 049 | 175 | 151 | 99 | | | 132 | 124 | 112 | 116 | 110 | 94 | | | | | | | | 45 | [illegible] |
| 050 | 182 | 142 | 94 | 112 | 138 | 126 | 121 | 124 | 110 | 109 | 101 | | 105 | 88 | | | | | | |
| 051 | 183 | 137 | 101 | 105 | | 132 | 120 | 112 | 114 | 108 | 92 | | | | | | | | 44 | [illegible] |
| 052 | 185 | 144 | 100 | | | 126 | 142 | 115 | 106 | 125 | 98 | | | | | | | | 46 | 47 |
| 053 | 196 | 144 | 93 | | | 125 | 130 | 126 | 113 | 119 | 101 | | | | | | | | 45 | [illegible] |
| 054 | 191 | 159 | 100 | 126 | | 139 | 133 | 121 | 119 | 121 | 101 | 71 | | | 34 | 42 | 51 | 25 | 47 | 47 |
| 055 | 201 | 133 | 99 | 115 | 142 | 143 | 135 | 135 | 124 | 125 | 111 | 71 | 106 | 100 | 36 | 41 | 52 | 22 | 48 | [illegible] |
| 056 | 184 | 155 | 101 | 108 | 132 | 135 | 120 | 125 | 110 | 108 | 98 | 72 | 103 | 98 | 32 | 42 | 54 | 22 | 43 | [illegible] |
| 057 | 191 | 150 | 93 | 120 | | 145 | 120 | | 117 | 111 | | 61 | | | | | 53 | 28 | 45 | [illegible] |
| 058 | 184 | 152 | 108 | 119 | | 142 | 125 | | 128 | 112 | | 72 | | | | | 54 | 30 | [illegible] | [illegible] |
| 059 | 201 | 149 | 96 | 124 | 142 | 150 | 144 | 121 | 126 | 131 | 96 | 72 | 111 | 104 | 34 | 39 | 57 | 20 | [illegible] | [illegible] |
| 060 | 203 | 141 | | | | | | | | | | | | | | | | | | |

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 061 | 200 | 140 | 99 | 116 | 133 | 121 | 145 | 115 | 109 | 128 | 95 | | 113 | | | | | | 53 | 46 |
| 062 | 199 | 131 | 102 | 112 | 146 | 134 | 141 | 120 | 118 | 126 | 99 | 65 | 113 | 107 | 29 | 40 | 46 | 23 | 45 | 38 |
| 063 | 189 | 129 | 94 | | | 130 | 124 | | 115 | 116 | | 65 | | | 33 | 43 | 48 | 23 | | |
| 064 | 188 | 130 | | | | | | | | | | | | | | | | | | |
| 065 | 194 | 142 | 98 | 115 | 130 | 127 | 131 | 124 | 111 | 117 | 96 | 70 | 101 | 100 | 32 | 41 | 49 | 22 | 44 | 43 |
| 066 | 199 | 145 | 101 | 110 | 156 | 134 | 124 | 151 | 121 | 116 | 121 | 75 | 109 | 99 | 35 | 39 | 52 | 23 | 46 | 39 |
| 067 | 194 | 144 | 98 | 116 | 133 | 131 | 132 | 126 | 112 | 118 | 102 | 77 | 103 | 99 | 37 | 40 | 59 | 24 | 46 | 36 |
| 068 | 191 | 134 | 102 | 111 | 145 | 130 | 118 | 124 | 116 | 108 | 99 | 73 | 122 | 115 | 37 | 40 | 56 | 23 | 45 | 44 |
| 069 | 197 | 132 | 93 | | | 135 | 134 | 118 | 116 | 118 | 97 | | | | | | | | | |
| 070 | 185 | 142 | 99 | 114 | | 126 | 124 | 122 | 108 | 112 | 99 | | | | | | | | | |
| 071 | 190 | 135 | 94 | 109 | 140 | 137 | 134 | 120 | 119 | 122 | 100 | 69 | 103 | 99 | 33 | 41 | 53 | 26 | 44 | [illegible] |
| 072 | 190 | 135 | 92 | 109 | | 125 | 135 | 124 | 110 | 123 | 98 | 58 | | | 29 | 42 | 46 | 24 | | |
| 073 | 176 | 135 | | | | | | | | | | | | | | | | | | |
| 074 | 205 | 137 | | | | | | | | | | | | | | | | | | |
| 075 | 189 | 136 | 97 | 113 | 131 | 125 | 133 | 119 | 111 | 118 | 97 | | | | | | | | | |
| 076 | 195 | 137 | 99 | 115 | 140 | 132 | 135 | 125 | 115 | 124 | 101 | 67 | 105 | 95 | 31 | 39 | 54 | 20 | 42 | [illegible] |
| 077 | 198 | 129 | 95 | 109 | | 126 | 142 | 125 | 112 | 125 | 102 | | | | | | | | | |
| 078 | 197 | 135 | 102 | | | 132 | 136 | 126 | 115 | 123 | 100 | | | | | | | | | |
| 079 | 195 | 133 | | | | | | | | | | | | | | | | | | |
| 080 | 194 | 135 | 96 | | | 132 | 132 | 129 | 115 | 119 | 103 | | | | | | | | | |
| 081 | 206 | 131 | | | | | | | | | | | | | | | | | | |
| 082 | 187 | 137 | 98 | 115 | | 131 | 132 | | 114 | 118 | | | | | | | | | | |
| 083 | 196 | 144 | 99 | 117 | 137 | 134 | 145 | 127 | 115 | 130 | 97 | | 104 | | | | | | | |
| 084 | 199 | 142 | | | | | | | | | | | | | | | | | | |
| 085 | 189 | 154 | 103 | 115 | 143 | 142 | 129 | 120 | 122 | 119 | 94 | 73 | 108 | 94 | 35 | 44 | 56 | 27 | [illegible] | [illegible] |
| 086 | 191 | 151 | 96 | 115 | 147 | 123 | 128 | 132 | 114 | 120 | 103 | 71 | 106 | 96 | 32 | 47 | 46 | 26 | [illegible] | [illegible] |
| 087 | 168 | 145 | 99 | | | 124 | 122 | 118 | 108 | 102 | 89 | 69 | | | 33 | 43 | 53 | 27 | | [illegible] |
| 088 | 185 | 146 | 103 | 118 | 150 | 140 | 131 | 111 | 118 | 117 | 91 | 73 | 115 | 111 | 30 | 37 | 55 | 26 | [illegible] | [illegible] |
| 089 | 178 | 150 | 95 | 116 | | 125 | 123 | 117 | 108 | 110 | 95 | 67 | | | 35 | 40 | 50 | 22 | | |
| 090 | 200 | 143 | 103 | 120 | | 138 | 127 | 129 | 122 | 115 | 104 | 78 | | | 40 | 44 | 56 | 26 | | |

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 091 | 183 | 154 | 102 | 112 | | 133 | 119 | 117 | 113 | 108 | 97 | | | | | | | | | |
| 092 | 202 | 149 | 100 | | | 134 | 140 | | 114 | 126 | | 74 | | | 34 | 43 | 52 | 25 | 45 | 38 |
| 093 | 181 | 147 | 97 | 108 | | 134 | 125 | 121 | 115 | 113 | 101 | 64 | | | 34 | 43 | 50 | 22 | 44 | 33 |
| 094 | 173 | 154 | 103 | 112 | 139 | 138 | 125 | 104 | 114 | 111 | 87 | 76 | 105 | 97 | 36 | 40 | 57 | 23 | 41 | 40 |
| 095 | 180 | 149 | 100 | 112 | 133 | 127 | 133 | 104 | 111 | 111 | 91 | | | | | | | | | |
| 096 | 182 | 149 | | | | | | | | | | | | | | | | | | |
| 097 | 196 | 135 | 97 | 110 | 137 | 130 | 137 | 112 | 113 | 122 | 91 | 74 | 111 | 102 | 36 | 41 | 51 | 21 | 46 | 35 |
| 098 | 195 | 154 | 111 | 123 | 138 | 145 | 127 | 129 | 119 | 114 | 101 | 68 | 102 | 100 | 33 | 41 | 52 | 26 | 49 | 34 |
| 099 | 168 | 150 | 96 | 112 | 131 | 131 | 111 | 104 | 112 | 99 | 92 | | 99 | | | | | | | |
| 100 | 180 | 130 | | | | 128 | 132 | | | | | | | | | | | | | |
| 101 | 179 | 144 | 104 | 111 | 132 | 120 | 125 | 120 | 103 | 110 | 98 | 63 | 102 | 98 | 28 | 37 | 46 | 23 | | |
| 102 | 193 | 142 | 101 | 114 | 145 | 147 | 127 | 119 | 123 | 113 | 96 | 71 | 106 | 102 | 32 | 41 | 53 | 24 | 46 | 44 |
| 103 | 182 | 155 | 99 | | | 133 | 127 | | | | | | | | | | | | | |
| 104 | 197 | 141 | 100 | 114 | 137 | 127 | 141 | 119 | 112 | 125 | 100 | 75 | 106 | 96 | 34 | 42 | 58 | 23 | 52 | 52 |
| 105 | 206 | 138 | 93 | | | 151 | 142 | 126 | 121 | 130 | 100 | | | | | | | | | |
| 106 | 184 | 139 | 97 | 116 | 136 | 116 | 123 | 120 | 104 | 110 | 99 | | 111 | 98 | 31 | 39 | | | 44 | 33 |
| 107 | 188 | 148 | 98 | 113 | 133 | 129 | 136 | 117 | 113 | 123 | 92 | | 105 | | 33 | 40 | | | | |
| 108 | 179 | 136 | 96 | 100 | 127 | 119 | 135 | 117 | 103 | 116 | 92 | | 96 | | | | | | | |
| 109 | 191 | 132 | 95 | 105 | | 128 | 126 | 126 | 111 | 116 | 101 | | | | | | | | | |
| 110 | 202 | 140 | 96 | 120 | 143 | 138 | 125 | 146 | 119 | 116 | 113 | 69 | 102 | 96 | 32 | 38 | 52 | 20 | 45 | 38 |
| 111 | 200 | 137 | 89 | | | 139 | 129 | 134 | 123 | 115 | 112 | | | | | | | | | |
| 112 | 196 | 140 | 101 | 114 | 143 | 133 | 129 | 137 | 114 | 121 | 109 | 66 | 106 | 98 | 34 | 39 | 52 | 22 | 45 | 39 |
| 113 | 189 | 136 | 96 | 115 | 133 | 121 | 140 | 132 | 106 | 127 | 108 | 63 | 97 | 88 | 31 | 39 | 49 | 22 | 41 | [illegible] |
| 114 | 185 | 140 | 100 | 112 | 138 | 130 | 150 | 112 | 113 | 130 | 94 | 68 | 103 | 97 | 33 | 41 | 54 | 25 | 47 | [illegible] |
| 115 | 196 | 132 | 94 | | | 127 | 142 | 115 | 112 | 127 | 98 | | | | | | | | | |
| 116 | 189 | 135 | 88 | | | 139 | 121 | 139 | 112 | 112 | 112 | | | | | | | | | |
| 117 | 187 | 138 | 92 | 116 | 140 | 124 | 135 | 129 | 110 | 125 | 107 | | 101 | | 31 | 38 | 51 | 24 | 38 | [illegible] |
| 118 | 181 | 136 | 90 | 109 | 140 | 126 | 142 | 120 | 110 | 125 | 100 | 58 | 98 | 88 | 30 | 38 | 48 | 22 | 47 | [illegible] |
| 119 | 177 | 132 | 84 | | 140 | 128 | 136 | 118 | 110 | 119 | 99 | 63 | 97 | 88 | | | 48 | 21 | 39 | [illegible] |
| 120 | | | 90 | | 142 | | | | | | | 65 | 98 | | 32 | 37 | 51 | 22 | 40 | [illegible] |

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | 181 | 135 | 86 | 112 | | 128 | 128 | 121 | 110 | 116 | 96 | | | | | | | | | |
| 122 | 200 | 133 | 100 | | | 145 | 140 | 113 | | | | 70 | | | | | | | | |
| 123 | 201 | 133 | 88 | | 132 | 134 | 143 | 130 | 119 | 127 | 104 | | | | | | | | | |
| 124 | 204 | 142 | 106 | 117 | 140 | 130 | 145 | 124 | 113 | 129 | 100 | 75 | | | | | | | | |
| 125 | 194 | 132 | 94 | | | 132 | 127 | | | | | 73 | | | | | | | | |
| 126 | 185 | 139 | 101 | | | | | | | | | | | | | | | | | |
| 127 | 196 | 132 | | | | | | | | | | | | | | | | | | |
| 128 | 190 | 152 | 101 | | 140 | 143 | 146 | 114 | | | | | | | | | | | | |
| 129 | 193 | 130 | 91 | | | 136 | 137 | 120 | 115 | 126 | 97 | | | | | | | | | |
| 130 | 187 | 131 | 99 | 108 | | 141 | 139 | 111 | 108 | 122 | 91 | | | | | | | | | |
| 131 | 172 | 139 | 100 | | 139 | 122 | 126 | 115 | 109 | 112 | 98 | 66 | 95 | 90 | 34 | 39 | 51 | 24 | 42 | [illegible] |
| 132 | 174 | 147 | 97 | 112 | 138 | 124 | 125 | 123 | 110 | 112 | 104 | | 100 | | | | | | | |
| 133 | 184 | 139 | 95 | | | 134 | 121 | 121 | 114 | 109 | 99 | | | | | | | | | |
| 134 | 184 | 148 | 99 | 115 | 147 | 135 | 130 | 115 | 119 | 118 | 95 | 69 | 108 | 101 | 31 | 41 | 54 | 23 | 45 | [illegible] |
| 135 | 175 | 143 | 100 | 110 | 141 | 132 | 128 | 105 | 117 | 112 | 94 | 66 | 100 | 99 | 33 | 41 | 47 | 23 | 42 | [illegible] |
| 136 | 200 | 134 | 97 | 110 | 149 | 138 | 134 | 128 | 123 | 122 | 102 | 70 | 105 | | | | | | [illegible] | [illegible] |
| 137 | 184 | 136 | 101 | 110 | | 123 | 132 | 110 | 108 | 118 | 88 | | | | | | | | | |
| 138 | 188 | 139 | 100 | | | 122 | 138 | 114 | 108 | 121 | 89 | | | | | | | | | |
| 139 | 182 | 148 | 93 | 104 | 135 | 135 | 128 | 113 | 116 | 115 | 90 | | 108 | | | | | | | |
| 140 | 203 | 141 | 106 | | | 130 | 133 | 122 | 112 | 120 | 103 | | | | | | | | [illegible] | [illegible] |
| 141 | 199 | 137 | 105 | 108 | | 135 | 135 | 125 | 116 | 122 | 102 | | | | | | | | | |
| 142 | 194 | 147 | 101 | | 142 | 143 | 130 | 129 | | | | 75 | 104 | 98 | | | 53 | 22 | | |
| 143 | 200 | 157 | 110 | 123 | | 141 | 132 | 124 | 119 | 119 | 96 | 73 | | | | | 55 | 23 | | |
| 144 | 188 | 142 | 105 | 118 | 136 | 120 | 119 | 130 | 106 | 111 | 106 | 73 | 112 | 117 | 34 | 40 | 55 | 24 | 47 | [illegible] |
| 145 | 195 | 142 | 106 | 109 | 139 | 124 | 136 | 122 | 111 | 121 | 101 | 71 | 105 | 100 | 32 | 38 | 53 | 24 | 47 | [illegible] |
| 146 | 182 | 144 | 98 | 114 | 131 | 129 | 130 | 113 | 112 | 118 | 96 | | 95 | | | | | | | |
| 147 | 193 | 141 | 102 | | | 121 | 121 | 125 | | | | | | | | | | | | |
| 148 | 192 | 132 | 91 | | | 134 | 132 | 115 | | | | 64 | | | 35 | 41 | [illegible] | | | |
| 149 | 186 | 134 | 107 | | | | | | | | | | | | | | | | | |
| 150 | 180 | 132 | 96 | | | 126 | 142 | 109 | 106 | 123 | 86 | | | | | | | | | |

| | BOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | PB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 151 | 184 | 138 | 95 | | | 133 | 135 | | 114 | 113 | 100 | | | | | | | | | |
| 152 | 173 | 128 | 95 | | | 120 | 135 | | | | | | | | | | | | | |
| 153 | 188 | 135 | | | | 139 | 131 | 113 | 115 | 118 | 94 | | | | | | | | | |
| 154 | 187 | 149 | 103 | 106 | 138 | 138 | 142 | 113 | 116 | 125 | 91 | 67 | | | 31 | | 50 | 26 | | |
| 155 | 183 | 142 | 87 | 114 | | 129 | 118 | 132 | 112 | 104 | 102 | | | | | | | | | |
| 156 | 188 | 142 | 96 | 107 | | 135 | 122 | 122 | 117 | 111 | 96 | | | | | | | | 44 | 35 |
| 157 | 181 | 143 | 97 | 107 | 120 | 124 | 115 | 122 | 109 | 104 | 100 | 56 | | | 31 | | 43 | 19 | 45 | 35 |
| 158 | 178 | 138 | 95 | | 132 | 122 | 121 | 115 | 108 | 107 | 96 | 61 | 103 | 98 | 31 | 40 | 48 | 25 | 48 | 45 |
| 159 | 185 | 145 | 103 | | 139 | 121 | 132 | 113 | 105 | 119 | 90 | 68 | 114 | 108 | 32 | 41 | 49 | 23 | 43 | 41 |
| 160 | 182 | 135 | 100 | 108 | 133 | 130 | 123 | 106 | 113 | 112 | 90 | 62 | 97 | 84 | 32 | 38 | 50 | 25 | 40 | [illegible] |
| 161 | 181 | 148 | 100 | 114 | | 134 | 127 | 99 | 117 | 114 | 81 | 62 | | | | | | | | |
| 162 | 191 | 147 | 103 | 110 | 139 | 147 | 125 | 112 | 127 | 112 | 92 | 78 | 100 | 93 | 39 | 41 | 55 | 26 | 45 | 34 |
| 163 | 182 | 145 | 88 | 106 | 130 | 121 | 112 | 127 | 105 | 102 | 100 | 57 | 96 | 88 | 32 | 38 | 47 | 23 | 39 | 41 |
| 164 | 185 | 145 | 103 | 101 | | 130 | 142 | 102 | 116 | 121 | 87 | 59 | | | 32 | 41 | 49 | 25 | 46 | 41 |
| 165 | 196 | 155 | 109 | 119 | 135 | 135 | 130 | 131 | 114 | 116 | 106 | 68 | 103 | 99 | 32 | 40 | 56 | 29 | 45 | 36 |
| 166 | 194 | 140 | 101 | | | 134 | 131 | 125 | 116 | 116 | 94 | 68 | | | | | | | 46 | |
| 167 | 180 | 157 | 102 | | 135 | 128 | 134 | 115 | | | | 64 | 101 | 95 | | | 50 | 28 | | |
| 168 | 177 | 143 | 93 | | 134 | 145 | 125 | 109 | | | | 62 | 95 | 92 | | | 51 | 25 | | |
| 169 | 185 | 146 | 98 | | | 132 | 129 | 119 | 117 | 113 | 99 | 78 | 114 | 92 | 39 | 43 | 57 | 24 | 43 | 40 |
| 170 | 166 | 136 | 97 | 94 | 130 | 124 | 110 | 110 | 106 | 103 | 89 | 64 | 98 | 92 | 32 | 36 | 48 | 24 | 44 | 40 |
| 171 | 196 | 141 | | | | | | | | | | | | | 32 | 45 | 51 | 25 | | |
| 172 | 185 | 140 | 104 | | | 131 | 126 | 118 | | | | 68 | | | | | 48 | 26 | | |
| 173 | 176 | 146 | 102 | 125 | | 134 | 122 | 114 | 116 | 109 | 95 | 67 | | | 34 | 37 | 46 | 24 | 49 | 37 |
| 174 | 182 | 152 | 106 | 105 | 142 | 132 | 127 | 117 | 114 | 113 | 97 | 70 | 105 | 98 | 31 | 45 | 56 | 26 | 51 | 41 |
| 175 | 169 | 138 | 94 | 111 | 136 | 132 | 118 | 107 | | | | 68 | 93 | 88 | 34 | 38 | 50 | 26 | | |
| 176 | 179 | 140 | 98 | | 130 | | | | | | | 61 | 101 | 91 | | | 47 | | | |
| 177 | 173 | 153 | 103 | 114 | 136 | 122 | 116 | 113 | 105 | 104 | 96 | 56 | 102 | 97 | 37 | 39 | 48 | 24 | | |
| 178 | 188 | 142 | 93 | 108 | | 133 | 129 | 109 | 111 | 115 | 89 | 58 | | | 32 | 42 | 49 | 27 | | |
| 179 | 168 | 146 | | | | | | | | | | | | | | | | | | |
| 180 | 189 | 137 | 100 | 119 | 137 | 129 | 139 | 112 | 109 | 120 | 93 | | 105 | | | | | | 50 | 40 |

| | BOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | PB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 181 | 194 | 145 | 104 | 121 | 150 | 138 | 129 | 122 | | | | 70 | 118 | 107 | 34 | 39 | 56 | 23 | | |
| 182 | 173 | 159 | 97 | 124 | 131 | 128 | 122 | 111 | 111 | 117 | 91 | 71 | 100 | 92 | 35 | 41 | 52 | 21 | 49 | 42 |
| 183 | 178 | 148 | 87 | 119 | 139 | 134 | 120 | 109 | 110 | 108 | 92 | | 104 | | | | | | | |
| 184 | 181 | 132 | 93 | | | 115 | 130 | | | | | | | | | | | | | |
| 185 | 177 | 131 | 85 | 107 | 126 | 116 | 115 | 109 | 105 | 105 | 93 | 63 | 104 | 102 | 32 | 35 | 49 | 24 | 37 | 39 |
| 186 | 186 | 147 | 101 | | 125 | 120 | 130 | 113 | | | | | | | | | | | | |
| 187 | 169 | 134 | 87 | | 138 | 120 | 114 | 109 | | | | | 101 | 99 | | | 49 | 25 | | |
| 188 | 190 | 149 | 102 | 117 | 153 | 136 | 127 | 116 | 121 | 117 | 102 | 71 | 116 | 99 | | | 49 | 23 | 45 | 36 |
| 189 | 192 | 147 | 100 | 115 | 141 | 136 | 130 | 118 | 120 | 117 | 97 | 72 | 107 | 94 | 32 | 43 | | | 46 | 41 |
| 190 | 189 | 137 | 101 | 109 | 153 | 124 | 130 | 116 | 110 | 115 | 99 | 66 | 120 | 107 | 33 | 41 | 50 | 27 | 43 | 42 |
| 191 | 167 | 142 | 92 | | | 131 | 112 | 118 | 111 | 100 | 97 | | | | | | | | | |
| 192 | 179 | 142 | 94 | | | 130 | 108 | 135 | 110 | 99 | 108 | | | | | | | | | |
| 193 | 174 | | | | 137 | 124 | 115 | 114 | 110 | 105 | 97 | 64 | 103 | 91 | 33 | 41 | 50 | 25 | 41 | 42 |
| 194 | 182 | 149 | 93 | | | 141 | 123 | 126 | 115 | 109 | 101 | | | | | | | | | |
| 195 | 180 | 140 | 100 | 107 | | 121 | 120 | 119 | 103 | 110 | 97 | 64 | | | 34 | 38 | 50 | | 43 | 39 |
| 196 | 186 | 154 | 102 | 121 | | 138 | 124 | 115 | 119 | 114 | 96 | | | | | | | | 45 | 39 |
| 197 | 180 | 142 | 96 | 110 | 134 | 127 | 136 | 112 | 110 | 118 | 84 | 64 | 104 | 99 | 32 | 39 | 48 | 23 | 47 | [illegible] |
| 198 | 191 | 144 | 104 | 112 | | 138 | 131 | 123 | 116 | 117 | 98 | | | | | | | | | |
| 199 | 197 | 144 | 99 | | 148 | 135 | 138 | 120 | 122 | 123 | 96 | | 111 | | | | | | | |
| 200 | 176 | 138 | 96 | | 135 | 130 | 131 | 102 | | | | 63 | 97 | 88 | | | 48 | 23 | | |
| 201 | 187 | 130 | 97 | 102 | | 122 | 129 | 122 | 107 | 118 | 102 | 60 | | | 33 | 43 | 50 | 19 | | |
| 202 | 194 | 138 | 98 | 111 | 142 | 139 | 139 | 131 | 121 | 124 | 105 | 67 | 103 | 100 | 31 | 36 | 52 | 24 | 40 | 37 |
| 203 | 198 | 139 | 101 | | | 124 | 133 | 125 | 113 | 122 | 106 | 73 | | | | | 48 | 24 | 47 | 42 |
| 204 | 196 | 148 | 100 | | | 132 | 136 | 120 | 119 | 124 | 96 | | | | | | | | | |
| 205 | 180 | 144 | 100 | 98 | 136 | 124 | 115 | 134 | 108 | 104 | 104 | 66 | 101 | 96 | 27 | 38 | 50 | 26 | 47 | [illegible] |
| 206 | 181 | 150 | 97 | 111 | 140 | 127 | 122 | 118 | 107 | 109 | 101 | 68 | 105 | 99 | 30 | 37 | 53 | 25 | 49 | [illegible] |
| 207 | 201 | 132 | 97 | 115 | 137 | 128 | 129 | 132 | 112 | 118 | 102 | 77 | 112 | 103 | 34 | 43 | 56 | 26 | 44 | [illegible] |
| 208 | 184 | 133 | 97 | 107 | 137 | 122 | 129 | 121 | 107 | 115 | 101 | 69 | 103 | 99 | 34 | 39 | 45 | 24 | 49 | [illegible] |
| 209 | 188 | 139 | 97 | 118 | | 126 | 134 | 121 | 110 | 118 | 100 | 64 | | | 32 | 41 | 53 | 22 | | |
| 210 | 175 | 141 | | 104 | 127 | 130 | 125 | 110 | 111 | 110 | 91 | 64 | 108 | | 33 | 40 | 53 | 29 | | 39 |

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 211 | 176 | 143 | 93 | 104 | | 131 | 125 | 120 | 111 | 113 | 94 | 68 | | | 33 | 38 | 52 | 27 | | |
| 212 | 181 | 149 | 101 | 121 | 139 | 131 | 131 | 113 | 114 | 115 | 90 | 69 | 101 | 92 | 33 | 37 | 50 | 24 | 44 | [illegible] |
| 213 | 181 | 138 | 99 | 109 | 134 | 125 | 130 | 110 | 110 | 115 | 92 | 66 | 99 | 92 | 29 | 39 | 49 | 26 | 47 | 43 |
| 214 | 182 | 137 | 98 | 107 | 149 | 127 | 128 | 105 | 114 | 112 | 92 | 57 | 119 | 110 | 30 | 38 | 43 | 23 | 45 | 35 |
| 215 | 194 | 139 | 95 | | | 125 | | | | | | 75 | | | | | | | | |
| 216 | 175 | 139 | 98 | 110 | 140 | 120 | 120 | 108 | 108 | 104 | 94 | 71 | 109 | 101 | 35 | 40 | 55 | 22 | 43 | 41 |
| 217 | 194 | 134 | 101 | | | 133 | 134 | 121 | | | | 71 | | | | | 52 | 26 | | |
| 218 | 180 | 146 | 103 | 111 | 134 | 126 | 119 | 117 | 110 | 108 | 93 | 67 | 116 | 106 | 36 | 43 | 51 | 24 | 44 | 43 |
| 219 | 190 | 147 | 97 | | | 130 | 135 | 125 | 109 | 119 | 101 | | | | | | | | | |
| 220 | 191 | 148 | 99 | 123 | 129 | 135 | 112 | 119 | 115 | 102 | 97 | 68 | 103 | 95 | 33 | 47 | 53 | 24 | 43 | 37 |
| 221 | 179 | 148 | 96 | | | 129 | 131 | | 111 | 117 | | | | | | | | | | |
| 222 | 215 | 160 | 108 | | | 136 | 140 | 135 | 122 | 126 | 110 | | | | | | | | | |
| 223 | 208 | 137 | 103 | 113 | | 134 | 129 | 138 | 116 | 120 | 107 | | | | | | | | | |
| 224 | 198 | 137 | 101 | 101 | | 132 | 138 | 135 | 118 | 123 | 106 | 75 | | | 38 | 40 | 52 | 23 | 49 | [illegible] |
| 225 | 182 | 124 | 87 | 102 | 133 | 128 | 121 | 122 | 107 | 111 | 97 | 70 | 97 | 83 | 34 | 39 | 53 | 25 | 41 | [illegible] |
| 226 | 163 | 144 | 93 | | | 119 | 124 | 108 | 106 | 110 | 88 | 68 | | | 35 | 38 | 50 | 22 | [illegible] | [illegible] |
| 227 | 187 | 137 | 97 | 112 | | 126 | 125 | 119 | 107 | 110 | 96 | 66 | | | 31 | 41 | 48 | 24 | | [illegible] |
| 228 | 192 | 146 | 99 | 119 | 135 | 129 | 131 | 124 | 115 | 120 | 105 | 74 | 100 | 92 | 36 | 44 | 55 | 21 | 43 | [illegible] |
| 229 | 192 | 131 | 89 | 101 | | 129 | 123 | 108 | 115 | 112 | 89 | | | | | | | | | |
| 230 | 183 | 129 | 98 | | | 128 | 130 | 104 | 114 | 116 | 87 | 65 | | | 35 | 41 | 49 | | | [illegible] |
| 231 | 178 | 143 | 97 | 113 | | 123 | 109 | 127 | 110 | 100 | 107 | 76 | | | 33 | 42 | 52 | 25 | 45 | [illegible] |
| 232 | 187 | 138 | 96 | 107 | 129 | 126 | 120 | 114 | 112 | 110 | 93 | 62 | 101 | 95 | 32 | 37 | 50 | 26 | 41 | [illegible] |
| 233 | 194 | 133 | 97 | | | 124 | 138 | 132 | 110 | 125 | 107 | | | | | | | | | |
| 234 | 183 | 159 | 100 | 127 | 132 | 127 | 140 | 117 | 110 | 121 | 93 | 75 | 99 | 88 | 31 | 39 | 58 | 26 | [illegible] | [illegible] |
| 235 | 191 | 154 | 101 | | | 139 | 132 | 129 | 121 | 116 | 99 | | | | | | | | | |
| 236 | 192 | 153 | 101 | | 120 | 139 | 138 | 112 | 118 | 122 | 90 | | 99 | | | | | | | |
| 237 | 199 | 135 | 97. | | | 138 | 135 | 122 | 121 | 119 | 98 | | | | | | | | | |
| 238 | 183 | 139 | 101 | 114 | | 125 | 123 | 125 | 112 | 113 | 106 | 70 | | | 31 | 39 | 46 | 24 | | |
| 239 | 169 | 140 | 101 | 106 | 128 | 120 | 126 | 99 | 103 | 109 | 83 | | 93 | | | | | | | |
| 240 | 172 | 140 | 101 | | | 118 | 120 | | 104 | 105 | | | | | | | | | | |

| | GOL | XCB | WCB | ASB | BBH | FRK | PAK | OCK | FRC | PAC | OCC | NAH | BNL | BAL | OH | OB | NH | NB | PL | FB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 241 | 193 | 151 | 103 | 122 | | 140 | 120 | 125 | 121 | 108 | 103 | 70 | | | 36 | 42 | 52 | 27 | 45 | 37 |
| 242 | 182 | 147 | 104 | 107 | 132 | 125 | 134 | 116 | 109 | 119 | 95 | 59 | 95 | 88 | 32 | 37 | 46 | 20 | 42 | 46 |
| 243 | 189 | 124 | 87 | | 125 | | 127 | 108 | | 111 | 86 | | | | | | | | | |
| 244 | 185 | 114 | 94 | 103 | 120 | 127 | 135 | | 110 | 111 | | 65 | 95 | 105 | | | | | | |
| 245 | 193 | 138 | 96 | 112 | 136 | 126 | 123 | 119 | 112 | 110 | 98 | 70 | 112 | 98 | 32 | 46 | | 28 | | |
| 246 | 194 | 139 | | 128 | 131 | | | 137 | | | 105 | | 100 | | | | | | | |
| 247 | 176 | 141 | 100 | 114 | 127 | 123 | 132 | 113 | 106 | 112 | 87 | | 92 | | | | | | | |
| 248 | 187 | 131 | 95 | | 133 | 130 | 135 | 120 | 112 | 121 | 98 | 66 | 95 | 90 | 34 | 36 | 52 | 24 | 53 | [illegible] |
| 249 | 206 | 135 | 100 | 113 | | 130 | 126 | 122 | 117 | 118 | 99 | | | | | | | | | |