# THE LARGE MAMMAL FAUNA FROM KLASIES RIVER

*By*

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# Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

# Abstract/ Opsomming

The large mammal faunal sample, excavated since 1984 from the Late Pleistocene Klasies River main site, was studied. There are 27 species in eight genera represented. The bovids from the LBS member (110 000 years) and the Upper member (70 000 years) shows an increase in grazers relative to the fauna from the SAS member (100 000 years). This confirms previous research. The study of body part frequencies does not confirm the selective transport of the carcasses of larger bovids or that scavenging played an important role in the accumulation of the fauna. It is concluded that availability of marine mammals were the attraction of the locality and that all size classes of bovids were actively hunted and their carcasses returned to the site.

KEYWORDS: Klasies River, Late Pleistocene, large mammal fauna, hunting.

Die groot soogdier fauna van die Laat Pleistoseen vindplaas Klasies River main site, opgegrawe vanaf 1984, is bestudeer. Sewe-en-twintig spesies in agt genera is verteenwoordig. Die bokke van die LBS member (110 000 jare) en die Upper member (70 000 jare) toon 'n styging in grasvreters relatief tot dié van die SAS member (100 000 jare). Dit bevestig 'n vorige ondersoek. Die bestudering van ligaamsdeel frekwensies van alle groottes bokke bevestig nie dat selektiewe vervoer van groter bokkarkasse plaasgevind het nie, of dat aas 'n rol in die akkumulasie van die fauna gespeel het nie. Die gevolgtrekking is gemaak dat die teenwoordigheid van marine soogdiere die rede was vir die keuse van hierdie vindplaas was. Alle groottes bokke is doelbewus gejag en hulle karkasse is teruggebring na die vindplaas.

SLEUTELWOORDE: Klasies River, Laat Pleistoseen, groot soogdiere, jag.

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Special thanks must go to my parents and friends. Without their support and encouragement this thesis would still be a dream. If you don't dream how can you have a dream come true?

# Conventions

In line with other in-house research at the Klasies River sites the following conventions are adopted:

- Middle and Later Stone Age are not abbreviated to MSA and LSA.
- Klasies River and not Klasies River Mouth is the locality name.
- Klasies River main site: main site is not written in capitals.
- Cave is written in the lower case except at the beginning of a sentence.
- All measurements are in millimetres (mm) unless otherwise specified.
- Height and distances are given in metres (m).
- Member is written with a small m.
- Witness Baulk is capitalised.
- LB = large bovid; LMB = large medium bovid; SMB = small medium bovid; SB = small bovid; IB = indeterminate bovid.
- Following Grayson (1984), a specimen refers to a bone or tooth, or fragments thereof, originating from an archaeological or palaeontological site. An element refers to a single complete bone or tooth in the skeleton of an animal.

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# Chapter 1

# Introduction

This thesis presents a study of the large mammal fauna excavated since 1984 from the Klasies River main site. The site (34º6' S, 24º24' E) is a long sequence of Late Pleistocene deposits (Deacon & Geleijnse 1988) preserved against a cliff and in a series of caves on the Tsitsikamma coast, Eastern Province, South Africa (Figure 1). The country rock is quartzite of the Cape Supergroup and the ground waters are acid. Bone is not normally preserved under such circumstances. In this case there is a local source of lime-charged water draining from a fossil dune that has favoured the preservation of faunal remains.

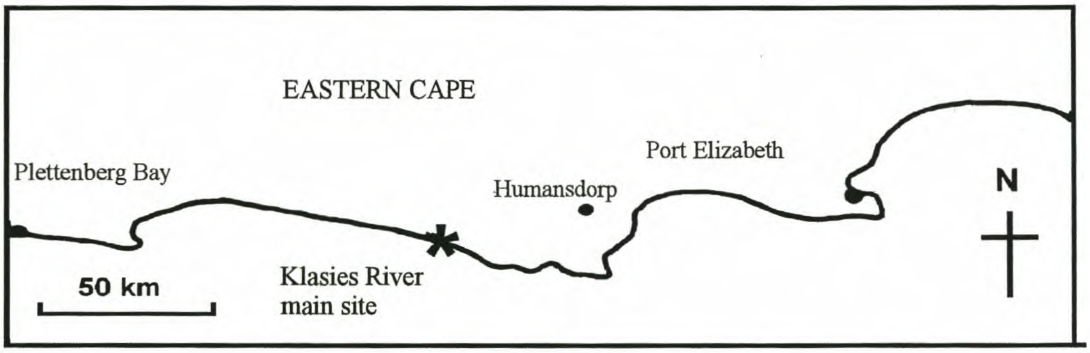


**Figure 1: The geographic location of Klasies River main site.**

The large mammal fauna has accumulated through the activities of people living at the site. The bones are associated with hearths, stone artefacts and shellfish food remains. Animals also used the shelter of the cliff and the caves and their activities have contributed faunal elements. An initial programme of excavation (Singer & Wymer 1982) at main site produced a very large sample of fauna. In recovering these materials only those faunal elements considered identifiable were retained. Inevitably there was some loss of information. The ongoing re-investigation, begun in 1984 (Deacon, H.J. 1995), has produced a small but unselected sample for study. It is the large mammal component of this sample that is the subject of this thesis.

The approach has been to identify the fragmentary remains to body part and where possible to taxon. The results have been quantified and comparisons drawn between the faunas in different stratigraphic divisions. In the long, main site sequence, spanning perhaps 60 000 years, it is possible to investigate changes in the fauna through time. Such changes could result from different factors, changes in environments, changes in human behaviour and extraneous factors like differences in preservation in the layers of the site. A theme developed in the thesis is a discussion of the temporal changes in the composition of the fauna.

Faunal assemblages from Late Pleistocene African archaeological sites include a diverse range of bovids. This site is no exception. The identification of the different body parts in four bovid size classes has provided a set of data that can be compared to the data from the analysis of the sample previously excavated. This comparison makes it possible to assess the bias introduced by the recovery methods used in the 1967 and 1968 excavations. Important inferences on hunting and scavenging and on the transport of kills were based on the study of the selected older sample. These inferences are reviewed from the perspective of the new data available.

The Klasies River main site has become well-known through the finds of human remains identified as anatomically modern (Singer & Wymer 1982, Rightmire & Deacon 1991). These are among the oldest modern human remains known anywhere and date to periods of some 90 000 and 115 000 years (Deacon, H.J. 1995). The site also provides some of the earliest evidence for the use of marine resources, shellfish and marine mammals, and birds. The deposits are well stratified and there is abundant evidence of human occupation. Artefacts, shellfish remains, hearths and bone can be seen in exposed sections. It is in this sense that this is a rich site. It is also a complex site. The deposits have suffered varying degrees of post-depositional alteration through the decay of plant residues and partial dissolution of shell. Post-depositional processes have affected the large mammal remains. The bone is very fragmentary and the condition ranges from friable to semi-mineralised. It is very difficult to control for differential preservation of faunal elements. The taphonomic factors that influence the sampling of any assemblage are an issue that is discussed in the thesis.

The thesis integrates the results of the faunal analysis begun by J.S. Brink of the National Museum, Bloemfontein, with the analysis of additional material, excavated since 1991, notably from part of main site known as the Witness Baulk. It has been possible to ensure continuity and standardisation of reporting the results through close collaboration and the sharing of institutional facilities.

This study is part of a wider programme of research on Late Pleistocene environments and the archaeology of early modern humans. As such it contributes directly and indirectly to a number of issues and debates on the emergence of modern humans and on their behaviour.

In Chapter 2 there is a discussion of the various approaches to the analysis of faunal samples. The influence of taphonomic factors on the preservation of bone and quantitative methods are evaluated in respect of the current study.

The literature review in Chapter 3 presents the competing hypotheses that have been proposed to account for the accumulation of the large mammal fauna at the Klasies River main site. The interpretations of Klein (1976) and Binford (1984) have engendered considerable debate on the relative importance of hunting and scavenging at the site. This debate has implications for human behaviour in the Late Pleistocene. The evidence from the site, the range of finds, of which the fauna is only a part, and formation processes, has been used to argue for the early emergence of modern behaviour (Deacon, H.J. 1985, 1989, 1992, 1995). The interpretation is at variance with those previously proposed and implies that the Late Pleistocene groups were competent hunters.

The site, its context in time and place, is the focus of Chapter 4. The plan and location of the excavation are discussed as is the general stratigraphy and dating of the site.

The results of the analysis of the fauna are presented in Chapter 5. The species composition of the fauna is set out in a table that is a summary of the project results. This is complemented by the data on the frequencies of bovid body parts. In this study there is frequent reference to the sampling bias incurred in the selective collecting procedures adopted in the 1967-68 excavation. This bias is best shown in a comparison of samples obtained by the different protocols, from the same part of main site. These data are given in this chapter.

Chapter 6 is a concluding discussion. The results that are presented in Chapter 5, are evaluated and linked to the general arguments about human behaviour in the Late Pleistocene.

# Chapter 2

# Archaeological Faunal Analysis

## INTRODUCTION

There are two basic goals in the analysis of faunal remains in archaeology (Lyman 1994). The first is the reconstruction of human behaviour, diet and procurement strategies and predator-prey relations. The second is the reconstruction of the palaeoenvironment, the composition of the fauna and the implications for palaeoenvironmental history. These zooarchaeological and palaeozoological approaches (Ringrose 1993) are not mutually exclusive. The first is an interest in what information the assemblage carries on human activities. The second emphasises the community of animals that is represented.

The challenge in reconstructing past behaviour and past environments is that observations of the past are indirect (Gifford 1981, Behrensmeyer 1991) and strategies must be created to bridge the gap between past and present. One strategy is taphonomy. The investigation of how and why a site was formed and modified over time is central to any faunal analysis. The different ways in which a faunal assemblage can be interpreted will be discussed in terms of the identification of agents of accumulation, post-depositional processes, excavational methods and faunal counts.

### MAKAPANSGAT: A CASE STUDY IN FAUNAL ANALYSIS

The publication of faunal analyses supporting the Osteodontokeratic Culture hypothesis (Dart 1957a, 1957b) is a benchmark in taphonomic studies in South Africa and more widely. The argument depended on showing that some skeletal elements were under or over represented because they were used as weapons and tools. The hypothesis was detailed in Robert Ardrey's (1958) *African Genesis*. He embellished it by labelling the australopithecines at Makapansgat not only as killer apes, but also as having the mark of Cain. The assumption was that the australopithecine and other animal bones had got into the deposit through the predatory behaviour of this early ancestor. The implications were far reaching if the hypothesis was valid. This was a spur to other studies and was one of the stimuli for the development of taphonomy in Quaternary science.

Makapansgat is a solution cavern system of filled with five recognised sedimentary layers (Members 1-5) (Brain 1981, Deacon & Deacon 1999). The bone rich deposit includes specimens that Dart originally labelled *Australopithecus prometheus*, a species which is now sunk into *Australopithecus africanus.* Dated to about 3 million years ago, the Makapansgat site is one of the oldest of South Africa's australopithecine sites and the deposits were first exposed by lime miners more than 50 years ago. From 5 tonnes of bone-rich breccia sorted from the mine dumps, J. Kitching and A. Hughes identified some 4560 elements from a total of 7159 bone fragments (Dart 1957a). The significant contribution of this research was that the elements were identified not only by taxon but also by body part.

Dart believed that the dentition of these gracile australopithecines indicated that they were omnivores. Further he believed that fauna showed that they were competent hunters who had used the site as a 'home base'. Bovids make up 91.7 % of the total faunal assemblage. Baboons are the most numerous finds in the non-bovid component, followed by suids, hyaenas, porcupines and small carnivores in lesser numbers. It was the body part analysis and particularly the unequal representation of different skeletal elements that promoted the concept of an Osteodontokeratic Culture. Why should there be so many mandibles if they were not used as tools? And why should tail vertebrae be absent, unless they were carried away to use as whips? The flaw in this argument was to assume that the site was an australopithecine 'home base'. What was needed was a more convincing explanation of how the bones got into the site, a taphonomic evaluation. The important contribution of this initial research at Makapansgat was in the methods, the quantification of the taxa and the body parts and not in the explanation of the process of accumulation.

In the late 1960s Brain (1967, 1969) undertook a test of Dart's Osteodontokeratic hypothesis through actualistic and ethnographic studies. He quantified the results of the Topnaar Khoekhoen in butchering and cooking goats and in disposing of the bones. He collected and analysed all the goat bones from a settlement in the Namib. The goats had been butchered, cooked and eaten on site. The bones were then fed to the dogs and what remained were gnawed by rodents and weathered by the sun and wind. This simulated the progressive stages of modification that bones of prey animals would undergo from initial capture to incorporation in a deposit. Brain was able to show that the body part representation at the Topnaar encampment was similar to that recorded at Makapansgat. This research established a basic taphonomic principle. It is that hard dense bones, like mandibles, the most abundant element at both Makapansgat and the Topnaar settlement, preserve best in the fossil record. The conclusion was that the Makapansgat faunal evidence did not demand a cultural explanation. It was a lack of understanding of the processes of taphonomy that made the Osteodontokeratic hypothesis seem logical.

From the mid 1960s, the emphasis in faunal studies shifted from taxonomy to taphonomy. Subsequent studies reflect this advance. The initial 1967-68 excavation at Klasies River was undertaken before the lesson of Makapansgat had been adequately learnt. Only those specimens presumed to be identifiable to taxon were collected and fragmentary remains were discarded. This has reduced the taphonomic value of the 1967-68 sample and weakened the basis for interpretation. The debate (Binford 1984; Klein 1976; Marean 1998) in the literature, about the interpretation of the Klasies River fauna, like those about the Makapansgat fauna, has been a further stimulus for taphonomic research. The difference is that at Klasies River, the focus is on the behaviour of early modern humans and not some remote ancestor.

## TAPHONOMY

Taphonomy is the "analysis and interpretation of complete bone assemblages or representative samples of them" (Brain 1981:7). Taphonomy is a catch-all term that deals with the transformation of remains from a dynamic live state to static fossil assemblage. Brain (1981) considers the aims of taphonomy to include the following:

- to reconstruct the faunal composition of the original community
- to give an understanding of the nature of the original community
- to document the nature of the environment in which the community lived
- to show the process of community succession
- to determine the relative ages of different communities
- to identify the agent(s) of bone accumulation at a site
- to extrapolate the behaviour of humans and other animals that interacted with them

Efremov (1940) coined the term taphonomy. Literally, it means the 'laws of burial' and covers all aspects of the transition of plant and faunal remains from the biosphere to the lithosphere (Behrensmeyer & Hill 1980, Lyman 1994). Here, taphonomy refers to larger mammal remains, as they are the focus of this research. The scope of taphonomy is as wide as the issues addressed by researchers. Taken at its broadest, taphonomy describes, defines and systematises the nature and effects of the processes that act on organic remains after death (Gifford 1981). Ringrose (1993) defines taphonomy as the study of the transition between past live communities and excavated specimens, but the definition of Behrensmeyer & Kidwell (1985) may be more pertinent. They state that taphonomy is "the study of the processes of preservation and modification, and how they affect geological and cultural information in the geological record" (Lyman 1994:30). Klein & Cruz-Uribe (1984) define taphonomy as the study of those factors that cause a fossil assemblage to differ from the life and death assemblages as deposited in the ground. To reiterate Brain's (1981:7) definition: taphonomy is the "analysis and interpretation of complete bone assemblages or representative samples of them". The concept of taphonomy is used below as a basis for discussing different approaches to faunal analysis.

A general taphonomic history or pathway can be illustrated as a flow diagram (Figure 2). The diagram is an amalgamation of different views expressed in the literature cited above. The assumption is that uniformitarian principles hold and that the factors that affect the preservation and accumulation of bones in the present affected the fauna in the past in essentially the same way (Gifford 1981). The arrows represent the various stages in the transition from one state of preservation to the next.

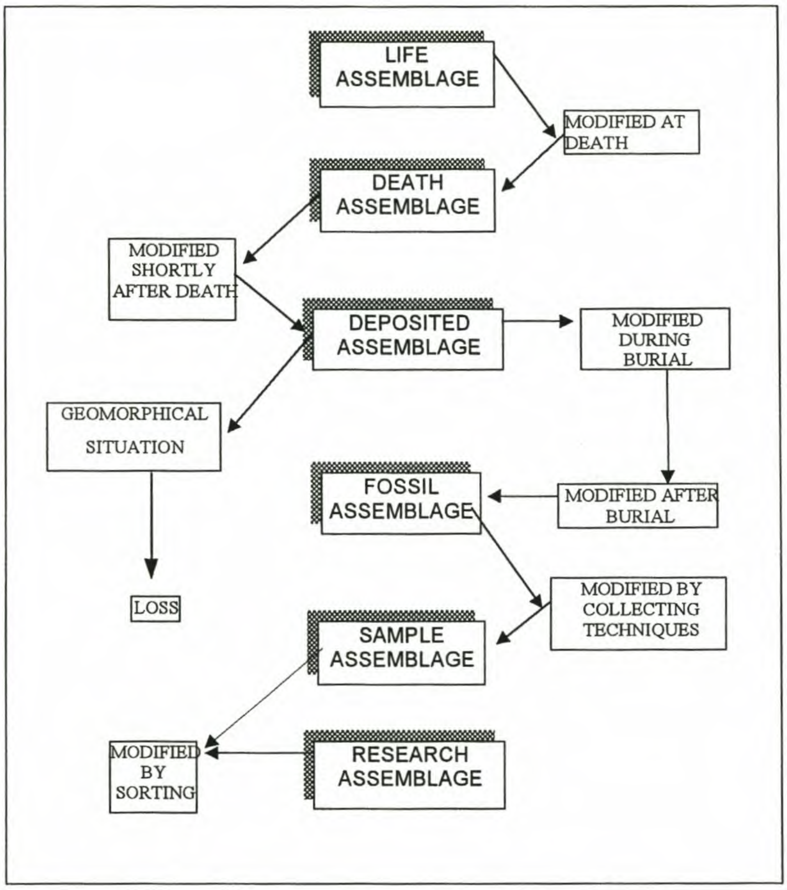


**Figure 2: Taphonomic pathway**

Certain variables may intervene in the transition between life and death assemblages. Only under conditions of catastrophic mortality would the death assemblage mirror the living. It has been suggested that the mortality profile of *Taurotragus oryx* (eland) at Klasies River reflects catastrophic events, like driving herds over cliffs (Klein 1976). Attritional mortality will bias the death assemblage and prime individuals will be underrepresented. This has been suggested as an explanation for the age profiles of *Syncerus caffer* (Cape buffalo) individuals at Klasies River (Klein 1976). Further bias may be introduced if the death assemblage is the result of selective hunting by carnivores or humans. The destruction or transport of the remains can result in the further loss of information (Gifford 1981). The normal end result is that skeletal part representation in an excavated sample is an indirect reflection of both the living community and the death assemblage.

The transition from the death to the deposited assemblage may involve the intervention of bone accumulation agents. Examples are humans, hyenas, porcupines or water. Transport to, and activities on a site, are reflected in the deposited assemblage. During the action of these processes, evidence may be destroyed or the skeletal parts may become disassociated (Klein & Cruz-Uribe 1984; Ringrose 1993). At this stage the agents of accumulation may leave traces of their activities in the form of cut marks, chew marks, gnaw marks or polish and abrasion.

In the process whereby the deposited assemblage becomes the fossil assemblage, other factors come into play. Principle among these is diagenesis. Diagenesis determines what elements are preserved for recovery and concerns all the post-depositional processes involved in the alteration of bone assemblages. The effects of the diagenetic alteration of bone can vary within and between layers in a site. There are intrinsic and extrinsic factors influencing the degree of alteration of bone. Intrinsic factors are the size, porosity, chemical and molecular structure of the bone itself. Extrinsic factors are factors like soil chemistry, water and temperature regimes. There are five variables within the possible diagenic process (Lyman 1994). These variables may act individually or in concert, enhancing or mitigating the effect on preservation (Chaplin 1971; Klein & Cruz-Uribe 1984; Lyman 1994).

1. The greater the porosity of the bone, the greater the potential diagenetic change and the faster the chemical exchanges will take place.

2. Climate or temperature can affect the rate and types of chemical reactions that may take place.

3. The rate of deposition or the duration of exposure to weathering is a factor. Weathered and un-weathered bones have different physical and chemical properties.

4. The acidity, chemistry, moisture content, permeability and other properties of the surrounding sedimentary matrix affect the diagenic processes.

5. The duration for which the bone has been buried and therefore exposed to the diagenic processes may influence the degree of alteration evident.

Diagenetic alteration is complex (Price *et al.* 1992), easy to discuss in general terms but difficult to assess in the field. For the most part, taphonomists are forced to accept the consequences without fully understanding the processes. The spectre of selective preservation, why some bones preserve and others do not, always concerns the researcher. There may be no simple answers.

The mass of the overlying sediment may be sufficient to compact the underlying layers and deform bone material. The mass may cause fragmentation and contribute to further diagenesis and increase the chance that the bone may become unidentifiable. Hard dense, unfragmented bone will preserve better in the fossil record. Small dense bones will preserve better than larger dense bones as they have a smaller surface area exposed to diagenic processes. This is the reason why micromammal bones preserve better than large mammal bones at Late Pleistocene sites like Boomplaas and Klasies River.

The transition from the fossil to the sample assemblage is the only stage that can be controlled by recovery methods. The sample assemblage should be identical to the fossil assemblage but this ideal is not easily achieved. The palaeontologist or archaeologist can be seen as a taphonomic agent. The sampling process of excavation, sieving, sorting and ultimately identification contribute to differences between the fossil and the recovered sample available for study in a museum.

Taphonomy is an admission that fossil record has inherent biases (Noë-Nygaard 1987). Identifying the biases is a means to compensate for them. As

Figure 2 shows, there is invariably some loss of information between death and recovery, and this has the potential to affect the interpretation of the fossil record. However, Gifford (1981) points out that an emphasis on bias, while partially valid, is not very productive. There are positive aspects to taphonomic research. These allow more confidence in interpreting the meaning of faunal samples and expose the researchers to the constraints under which they are working. The taphonomic approach has encouraged the study of processes whereby the bones are accumulated by different agencies and become deposited in the ground. The establishment of taphonomic principles has meant the loss of the innocence that was so well exemplified in the assumption that the missing skeletal elements at Makapansgat were used as tools. Australopithecines may have been predatory and used bone tools but a preponderance of mandibles and missing vertebrae in the samples of breccia from that site did not demand that conclusion.

## SAMPLING TECHNIQUES

The ideal sample assemblage should mirror the fossil assemblage closely. The three-dimensional position of each item in a site should be recorded. In practice it is impossible to record every item in a site and sampling is aimed at recovery of representative data. The larger the sample the more probable it will be representative of the subsistence activities of humans or carnivores and the palaeoenvironmental setting (Grayson 1981, 1984).

A standard method for the recovery of a faunal sample, especially unplotable fragmentary and smaller elements, is by sieving. The choice of screen size can have a significant effect on the type of material recovered or lost at site (Grayson 1984). The most commonly used mesh size (Grayson 1984) seems to be the ¼ inch (6.4 mm). The effects of ¼ inch screening and the biases in interpretation have been poorly understood and explained (Shaffer 1992). Singer & Wymer (1982) used 1 inch and ½ inch sieves during their excavation of the Klasies River sites and these mesh sizes would be considered unacceptably large under current excavation procedures. Experimental sieving (Payne 1972a, 1975; Shaffer 1992) has shown that the use of ¼ inch and larger screens inherently biases the sample towards larger specimens and complete elements. This kind of bias is reflected in the composition of the 1967-68 sample of fauna from the Klasies River main site. Indeed, Turner (1989) has argued that the size of the sieves used, invalidate some of the interpretations of the faunal sample offered in the literature. In the excavations there since 1984, screens with a mesh size of 2, 3 and 10 mm have been used.

## BONE IDENTIFICATION AND THE DETERMINATION OF AGE AND SEX

### IDENTIFICATION AND SORTING

Identification of osteological material is made using a comparative anatomy approach. In the identification of recent assemblages the general assumption is made that the taxa present will be the same as the extant or historically known ones in the area or in similar habitats in the same biogeographic province. The use of comprehensive comparative skeletal collections is a way of minimising mis-identifications. Experience increases the level of accuracy of sorting and identification (Klein 1980a).

The appropriate way in which to explain the process of identification is to discuss it in terms of what should be noted upon examination (Brain 1974, Lyman 1994). Bone material can generally be divided into two broad categories: identifiable and non-identifiable. Identifiable bone should be identified to at least family level and at best to species level. Non-identifiable bone is usually fragmentary. However, it may provide useful information in the degree of fragmentation and in damage marks on individual fragments. A high degree of fragmentation is usually associated with human rather than carnivore activities. This makes archaeological samples more of a problem to analyse than carnivore accumulated samples.

In any African large terrestrial mammal fauna, the bovids will be prominent. There are more than thirty extant species of bovids in southern Africa (Brain 1974, 1981; Smithers 1983) and fossil faunas may include extinct species. Bovid diversity is a challenge to the comparative anatomist. Dental material and horn cores generally provide the most reliable identifications at the species level. The bovid post-cranial elements are less readily identified to species, though literature on comparitive post-cranial morphology is growing.

The common procedure followed is to group sets of bovid taxa in size classes. In the analysis of the sample from the Pliocene site of Makapansgat (Dart 1957a, 1975b) four bovid size classes were defined, based on measurements of shaft bone and tooth crown diameters. The extant representatives in these size classes are listed in Table 1. This scheme has been amended by Brain (1974) (Table 2) and it is his grouping of large bovids that is widely accepted. With minor differences the same classes are recognised by Klein (1976) and Milo (1994). As their scheme has been devised to describe Middle-Late Pleistocene remains for the Cape region, it is the one followed in this thesis, with one difference. These researchers placed the extinct *Pelorovis antiquus* (giant buffalo) in a fifth, very large bovid class. This is not followed here. The abbreviations SB (small bovid), SMB (small medium bovid), LMB (large medium bovid) and LB (large bovid) are introduced to describe the size classes (Table 3).

**Table 1: Bovid size classes, after Dart (1957b:36)**

| **Size Class** | **Taxa** |
|---|---|
| Large bovids | kudu and eland,<br>wildebees and hartebees,<br>roan and sable antelope,<br>buffalo. |
| Medium bovids | nyala, bushbuck, springbok,<br>sassaby, bontebok and blesbok,<br>lechwe and waterbuck. |
| Small bovids | steenbok, grysbok and klipspringer,<br>reedbuck, mountain reedbuck. |
| Very Small bovids | red and blue duikers. |

**Table 2: Bovid size classes, after Brain (1974)**

| Class | Live-weight range | Upper Limit |
|---|---|---|
| Antelope I | 0-23 kg | Large (female) common duiker |
| Antelope II | 23- 84 kg | Large (male) blesbok |
| Antelope III | 84- 296 kg | Large wildebeest or roan antelope |
| Antelope IV | >296 kg | Size > wildebeest or roan |

**Table 3: Klasies River bovid size classes, mass and taxa. After Brain (1974) and Klein (1976)**

| Class | Category | | Mass | Taxa |
|---|---|---|---|---|
| 1 | Small | SB | 0-23 kg | *Raphicerus melanotis* (grysbok)<br>*Cephalophus monticola* (blue duiker)<br>*Sylvicapra grimmia* (grey duiker) |
| 2 | Small medium | SMB | 23-84 kg | *Antidorcas sp.* (springbok)<br>*Pelea capreolus* (vaalribok)<br>*Redunca fulvorufula* (mountain reedbuck)<br>*Tragelaphus scriptus* (bushbuck) |
| 3 | Large medium | LMB | 84-296 kg | *Alcelaphus buselaphus* (hartebeest)<br>*Connochaetes sp.* (wildebeest)<br>*Damaliscus sp.* (bastard hartebeest)<br>*Hippotragus leucophaeus* (blue antelope)<br>*Redunca cf. arundinum* (southern reedbuck)<br>*Tragelaphus strepsiceros* (kudu) |
| 4 | Large | LB | 296-400 kg<br>>900 kg | *Syncerus caffer* (Cape buffalo)<br>*Taurotragus oryx* (eland)<br>*Pelorovis antiquus* ("giant" buffalo) |

## DETERMINATION OF SEX AND AGE

Sexual dimorphism is marked in most mammal species and it is to the advantage of the analyst. In equids, males have large canines whilst the female have none or at the most small vestigial ones (Klein & Cruz-Uribe 1984). In bovids, females often lack horns or the horns differ in size and shape. Other skeletal elements used to identify sex are the pelvis and the sacrum as they must accommodate the birth canal. Such elements are relatively fragile and may be affected by post-depositional processes, making them less useful in practice. As males tend to be larger, size measurements may provide evidence for sex profiles in fauna. However age and environmental conditions (nutrition) can also be reflected in size differences.

Age or mortality profiles (Stallibrass 1982, Stiner 1990) can be constructed for particular species based on specimens that can be aged. Attritional and catastrophic mortality profiles refer to the manner and timing of death of individuals within a population. If the deaths reflect attritional mortality the age curve would be 'U' shaped. A larger proportion of very young and very old individuals would be present with a marked absence of prime aged adults. A catastrophic mortality profile is one that reflects the live animal population. Prime age adults are equally represented. Very large samples are required to make inferences on mortality patterns (Klein & Cruz-Uribe 1983). As noted, mortality profiles have been used to develop arguments on the hunting of eland and buffalo at Klasies River, based on the 1967-68 sample (Klein 1976). The sample of fauna generated since 1984 is too small to offer scope for such analyses.

## APPROACHES TO FAUNAL COUNTS

A primary question in the study of any faunal sample is the number of individuals of each species represented. Chase & Hagaman (1986) identify two ways for achieving this aim. Firstly, there are those methods involve counting bones and/or bone fragments. Secondly, there are those methods that take into account the mass of bones and fragments. Of importance in this discussion is the set of methods involving counting that estimate the number of bones of individuals in a sample. Counting bones requires an understanding of the relationship between the sample and the taphonomic processes outlined in Figure 2.

### NUMBERS OF IDENTIFIED SPECIMENS (NISP)

This is the simplest method of quantifying faunal materials. All the identifiable bone and bone fragments are classified by taxon and body part. The result is an estimation of taxonomic abundance in the living community, death assemblage, or the deposited assemblage (Chase & Hagaman 1986, Ringrose 1993). NISP counts can be used to measure differences in body part representation between samples. However, there are problems in interpreting the results (Grayson 1984; Ringrose 1993). The NISP count ignores the fact that some animals have more bones or identifiable elements than others do and the count gives larger values to taxa reaching the site whole. As many specimens may come from the same animal the NISP count can be an overestimate. Differential preservation and fragmentation can affect the number of bones that can be identified. In the case of shaft bones, frequencies may reflect the degree of fragmentation, which may skew results (Chase & Hagaman 1986).

Despite the inherent limitations of NISP values, this method of quantification has been used in preference to MNI estimates in this study. The reasons have to do with the small size of the sample and the detail available on the stratigraphic provenance of the faunal material.

### MINIMUM NUMBER OF INDIVIDUALS (MNI)

The aim of this method is to calculate the "smallest number of individual animals needed to account for the specimens of that taxon in a location" (Ringrose 1993:126). The usual approach is to calculate the MNI for each element of a taxon, and then to use the highest MNI for the value accepted (Ringrose 1993). The MNI estimates of different researchers may not be comparable, as there is no complete consensus on how the estimate should be calculated (Klein & Cruz-Uribe 1984).

MNI estimations are relatively insensitive to the biases associated with NISP counts. MNI estimations can be affected by the sample size, particularly small samples, and by the stratigraphic resolution of the excavation. The larger the number of stratigraphic units recognised in a sample, the higher the MNI estimates will be (Klein 1980b; Grayson 1984; Plug & Plug 1990). Fragmentation of remains leads to difficulties in calculating MNI estimates. In the literature (Chase & Hagaman 1986, Plug & Plug 1990) reservations have been expressed about the validity of the methods used in computing the estimates. According to Klein (1980b), the major disadvantages of MNI counts are that they are difficult to calculate and that they can be seriously affected by the precision of excavating and sorting. Another drawback to using MNI estimates for quantification is that it increasingly underestimates the number of represented individuals as the NISP values increase.

# CONCLUSION

Counting bones is part of the analysis of any fauna. It is a description of what is present and the counts are a measure of relative abundance of taxa and skeletal elements. The data can be expressed in various forms depending on the problem being investigated. Although all remains are potentially identifiable it has become standard to sort samples into identifiable and non-identifiable categories and to sort the identifiable fraction according to body part frequencies (NISP), grouping them in turn into taxonomic classes. Calculation of the number of individuals in a taxon represented in a site assemblage represents a further level of abstraction. The focus of this thesis is on the body part representation and the frequencies of the different taxa found in the sample excavated since 1984. Taphonomic processes operative at the site are a further point of interest. As discussed in the next chapters, the results of the 1984- faunal analysis provide a control for some biases evident in the results of the studies of the much larger 1967-68 sample.

# Chapter 3

# Subsistence Activities

## *Indicated by the large mammal fauna*

### INTRODUCTION

The significance of the Klasies River large mammal faunal assemblage lies in its association with the earliest known evidence of anatomically modern humans. The fauna, together with the stone artefacts and other features like hearths, are germane to the debate about the emergence of modern behaviour. The large mammal component is direct evidence of human subsistence behaviour. In the literature three strategies for the exploitation of large fauna have been proposed. Two are variations of the hunting hypothesis; one argues for a less efficient form of hunting than seen in the Later Stone Age and the other argues that the abilities were on a level with Later Stone Age subsistence strategies. The third, and most controversial one, is of obligate scavenging.

### THE 1967-68 EXCAVATION

Ronald Singer and John Wymer (1982) directed the 1967-68 excavation at the Klasies River. Several hundred tons of deposit were removed in 14 months. The site was excavated in stratigraphic layers ranging from 28 cm to a metre or more in thickness, with limited attention to contextual detail (Deacon, H.J. 1985). Preliminary sorting of the fauna was done in the field and only the readily identifiable bones were kept (Klein 1976, 1980b; Deacon, H.J. 1985; Turner 1989). Shaft bones without articular ends were discarded (Milo 1998). This selective sampling undoubtedly reduced the study value of the assemblage. As a large mesh screen (10 mm or 0.5 inch, Singer & Wymer 1982) was the smallest used, some identifiable bones and teeth were not recovered. This explains why the smaller bovids are under represented in the 1967-68 assemblage analysed by Klein (1976) in relation to the data presented here. The paucity of contextual detail available for the 1967-68 sample has meant that some of the complexities of the site, not apparent at the time, cannot be taken to account in any re-interpretation. The site is made up of discrete horizons of human occupation associated with hearths, artefacts, large fauna and/or shell (Deacon, H.J. 1985) interbedded with culturally sterile lenses, or units associated with carnivore activity. It is this diversity of contexts in which the faunal materials occurred that went largely unrecorded.

## SUBSISTENCE PATTERNS

To facilitate discussion, the two hunting hypotheses have been labelled model one (less efficient than Later Stone Age) and model two (as efficient as Later Stone Age).

### HUNTING: MODEL ONE

Klein (1976) had two major goals in his analysis of the 1967-68 assemblage. The first was to determine the basis of human subsistence. The second was to interpret the behavioural implications of the body part frequencies. It was anticipated that the analysis of body part frequencies would provide insights on the exploitation and butchery of the animal carcasses. Bovids are the most numerous remains in the 1967-68 sample and their body part frequencies could be shown to differ according to the size of the animal. Small and small medium bovids showed similar body part representation. The body part representation of large bovids (class IV), *Taurotragus oryx* and *Syncerus caffer,* seemed to fall into an intermediate group that was butchered in a different way (Milo 1994, 1998) to very large (class V) bovids and the smaller bovids (classes I-III). This could account for some of the differences in body part frequencies of the bovid classes. The ratio of cranial to post-cranial elements was found to increase with bovid body size, whilst the limb to foot element ratio decreased. Klein contended that this pattern was the result of a "schelpp effect" (Klein 1976:87). This effect operates when the whole carcasses of the smaller animals are brought back to the site, while only the useful elements of larger animals are returned. The explanation offered for the relative frequency of large bovid foot bones was that they were left attached to the skins which were used a carriers. The concept of the selective transport of carcasses is supported by ethnographic work amongst the Hadza (Bunn *et al.* 1988, O'Connell *et al.* 1988, 1990). The contention that a 'schlepp effect' was involved has met with criticism. (Binford 1981, 1984; Turner 1989; Marean 1998; Marean & Kim 1998). Binford (1984) considered that 'schlepp effect' lacked a theoretical grounding and was an after-the-fact-explanation of events. Turner (1989) argued that a bias was introduced in the collection of the 1967-68 sample by discarding fragments and labelling limb bones without articular ends as 'unidentifiable'. He contends this bias would explain the pattern observed and that it was not necessary to involve a 'schlepp effect'.

There are alternative explanations. For example, as discussed later, Binford (1984) has argued that the explanation lies in the smaller bovids being mainly hunted and the larger bovids primarily scavenged. The contrast between larger and smaller bovid skeletal part representation may also reflect selective preservation combined with a bias in recovery. Differences in the size, shape, structure and morphology of bones ensures than some bones are more susceptible to destruction. The limb bones of large taxa are very susceptible to diagenesis because of their larger surface area. Some smaller bones were certainly lost in the sieving process. This would suggest that it may not be necessary to involve a 'schlepp effect' to explain the body part representation in the 1967-68 sample.

In determining different age classes in the main bovid species in the 1967-68 sample, Klein (1976) made an original contribution. He identified a catastrophic mortality profile in *T. oryx* remains by showing that individuals of all age classes were obtained. This lead Klein (1975, 1976) to suggest that the docile *T. oryx* were being driven over cliffs, so that an entire herd was killed in a single incident. The *S. caffer* and *Pelorovis antiquus* remains showed attritional mortality profiles, with only the very young and old individuals being represented. From these results Klein has argued that the

Middle Stone Age people lacked the ability to hunt prime adults of the dangerous species of large bovids. This contrasted with the hunting abilities of the Later Stone Age people who were able to hunt buffalo in their prime.

A review of the mortality profiles of all bovid species (Klein 1978, 1979, 1981, 1989) shows that there are no apparent differences in bovid age profiles in the Middle Stone Age and Later Stone Age samples. The mortality profiles of larger bovids are associated with different species, not with different technologies. Species specific behaviour, it would seem is more important than human technology (Klein 1994). Klein (1981) notes that the mortality profile of smaller bovids is catastrophic, meaning that all ages were hunted. The implication is that there were no differences in the hunting methods adopted or the capabilities of the hunters between the Middle and Later Stone Age samples.

In arguing that the Middle Stone Age people of southern Africa had limited hunting and planning abilities (Klein 1976, 1983) has stressed that they did not fish or catch flying birds, nor did they hunt the prime adult dangerous animals. That their visits to coastal sites were not timed to coincide with the availability of juvenile seals suggests to Klein (1989) that they were not able to use resources as optimally as later people did. The concept of optimality underpins the neural hypothesis proposed by Klein (1995). The neural hypothesis equates the behaviour of Middle Stone Age people with that of the Eurasian Neandertals. The Neandertals are not considered to have been behaviourally modern.

## HUNTING: MODEL TWO

The second hunting hypotheses holds that people in the Middle Stone Age exploited the large mammals in the environment, in the same way as their Later Stone Age successors. This hypothesis has increasing support in the literature (Deacon, H.J. 1985, 1993, 1995, 1998; Henshilwood & Sealy 1997; Marean 1998). It takes a more holistic view of the available data and does not rest on faunal data alone. Deacon, H.J. (1985) maintains that the protein provided by meat and shellfish supplemented the staple plant carbohydrate diet of the Late Pleistocene hunter-gatherers. The numerous carbonised units and ash lenses at main site, together with ethnographic research substantiate the dietary importance of plant foods. High reliance on plant staples like geophytes implies the management and awareness of seasonality and the availability of plant foods.

In this the Middle Stone Age subsistence pattern is similar to that in the Later Stone Age, and different from that in the preceding Acheulian period (Deacon 1998). The Middle and Later Stone Age people exploited similar habitats and, unlike the Acheulian groups, were able to occupy all terrain positions. They also arranged their domestic space in similar ways, hearths from both Middle and Later Stones Age occupation sites are storeyed one on top of the other (Deacon, H.J. 1995) suggesting rules for occupying space within the living area. While the Middle Stone Age people would have been aware of fish as food, they must have lacked the technology to catch them in quantity. Deacon, H.J. (1989) suggests that shellfish collecting was practised in preference to fishing as collecting involved minimal energy expenditure. In support of the argument for modern behaviour in the Middle Stone Age it is contended that all sizes of bovids were hunted. The Middle Stone Age people made use of animal resources as diverse as in the Later Stone Age.

## SCAVENGING

There are two types of scavenging (Blumenshine 1986, 188). The first is obligate scavenging, where meat is only acquired by scavenging. The second is opportunistic scavenging and is well documented amongst modern hunter-gatherers (O'Connell *et al.* 1988). There are three criteria for the recognition of scavenging in the archaeological record. The first is a skeletal pattern dominated by cranial and foot bones, which has been referred to as the 'Klasies pattern' (Marean & Kim 1998). The second is the presence of carnivore tooth marks on bone fragments. Lastly, there is the infrequent occurrence of cut marks, with these not usually located on fleshy long bones.

When Binford (1984) undertook the analysis of Klasies River fauna as part of a trilogy of books (1978, 1981) discussing faunas and human behaviour, he was in search of those three criteria. He considered that he had found them. This is because he was arguing from the belief that prior to the Upper

Palaeolithic and the emergence of modern people in Europe, all people were scavengers rather than hunters. Binford's (1984) concern was in distinguishing between hunting and scavenging in the archaeological record. He argued that the earlier Late Pleistocene people in southern Africa would have been obliged to scavenge because of the limitations of their behaviour. Binford sought evidence for scavenging in the pattern that Klein had explained by the 'schlepp effect'. In his opinion, the anomalous cranial and foot bone representation in the larger bovid classes suggested that people were scavenging carnivore kills. Cranial and foot elements are parts of the carcass that have a low dietary utility index (Blumenschine 1988). This would indicate that people did not have access to higher ranked elements, as would have been the case if they had been the primary agents in making the kill. The scavenging of the larger bovids was self evident to Binford, but he did allow for an increasing level of the hunting of small bovids in the younger levels of the main site deposit.

In support of his argument, Binford cited the evidence of the placements of cut marks, suggesting these indicated that the large bovid carcasses had been ravaged by carnivores and in some cases, had become desiccated before humans had access to them (Turner 1989, Marean 1998). Binford relied on a naked-eye examination of the bones. The illustration of a human tooth mark, identified by Binford (1984:151, fig. 4.24) (Deacon, H.J. 1985), appears to be a puncture mark made by a hyaena canine. This calls into question the criteria Binford used for the identification of marks of bone modification. Milo (1994, 1998) has carried out a more comprehensive microscopic examination of the marks on bones in the 1967-68 sample Binford studied. He found that very few of the bones showed traces of carnivore activity, whilst even fewer bones had marks from porcupine gnawing. Humans were responsible for the majority of the marks (Milo 1994), with some of the carnivore tooth marks being superimposed over cut marks. Instead of humans scavenging from carnivores it seems much more likely that carnivores were scavenging at the site after the humans had left (Brink 1987; Marean 1998).

Singer and Wymer (1982) recorded the occurrence of an articulated leopard skeleton in Layer 15 in cave 1. This showed leopard and other carnivores used the cave as dens and sometimes died there. These animals would have preyed on small bovids and hyrax. Thackeray (1990) showed there was a correlation between *Raphicerus*, hyrax, baboon and leopard remains in the sample, suggesting that, at times, predators occupied the deeper recesses of cave 1. The 1967-68 sample included materials from primary human occupation and from the back fill of the deeper cave recesses and this means the contributions of human hunting and carnivore predation are not easily factored out. In particular, it renders suspect Binford's use of *Raphicerus melanotis* / *T. oryx* and *R. melanotis* / *Hippotragus leucophaeus* ratios, to support his contention that small bovids were hunted and that hunting increased in time. The sample analysed in this study raises questions on whether valid conclusions on the frequencies of small bovids can be made from the 1967-68 sample.

In a critique of the scavenging model, Marean (Marean 1998; Marean & Kim 1998) has concluded that there is no evidence that scavenging was the dominant faunal exploitation strategy in the Middle Stone Age. The fauna does not suggest differences in the mix of scavenging and hunting in the behaviour of recent and early modern humans. The samples from the archaeological sites that have been used to argue for the importance of scavenging are biased in some way. Klasies River, Combe Grenal, Grotta Guattari, Grotta dei Moscerni and Grotte Vaufrey are all caves or rock shelters with reasonably long Middle Stone Age or Middle Palaeolithic sequences that have provided samples. In each case, during or after excavation at these sites, the long bone shaft elements were discarded from the collections. Marean (1998) holds that this is the reason for the cranial/foot dominant skeletal part frequencies. Using Kobeh and Die Kelders as control samples, he has re-evaluated the samples from these five caves. If long shaft bone data are excluded from Kobeh (Marean & Kim 1998) and Die Kelders (Marean 1998) results, these two sites show skeletal part frequencies similar to the other five sites. With the inclusion of long bone shafts, the classic cranial/foot pattern reverts to a non-scavenged profile, with a predominance of fleshy long bones and a lower frequency of elements that would preserve poorly. The 'Klasies pattern' is a reflection of what the fragments were retained at excavation, not how carcasses were utilised (Marean 1998).

Binford (1984) saw the increase in hunting towards the top of the main site sequence as the local expression of the European Middle to Upper Palaeolithic transition. On his evaluation, the people who inhabited main site prior to this transition were obligate scavengers, incapable of planning a hunt. Further he held that the caves served as convenient shelters near a water hole, in a savannah type habitat where small parcels of scavenged food could be selfishly consumed. This scenario is difficult to support because it does not take into account the setting or much of the evidence from the site (Deacon, H.J. 1985).

## CONCLUSION

The importance of the Klasies River large mammal fauna lies in its association with early anatomical humans. The fauna reflects the life and times of those ancestors. The three strategies discussed above emphasise different interpretations of the faunal evidence. The first hunting model has up till now enjoyed the greatest following although the second model is receiving increasing support as more, newer excavations are undertaken. The scavenging hypothesis has all but lost its credibility. In large part the present study was undertaken to redress the sampling bias that occurred with the excavation of the 1967-68 sample, and to test the conclusions drawn from that sample. These aspects are addressed in the following chapters.

# Chapter 4

# The site

## INTRODUCTION

Ronald Singer and John Wymer first excavated the Klasies River sites in 1967-68 and the results were published in 1982 in a monograph entitled *The Middle Stone Age at Klasies River Mouth in South Africa*. This monograph detailed the situation of the site, the statigraphy, dating and the artefact contents. Importantly for this thesis, the monograph provided a summary of the evidence from Klein's (1976) study of the fauna that is lodged in the South African Museum component of the Southern Flagship Institution. The numerous finds from the site have been the focus of a wide range of studies, many devoted to the analyses of the fauna. In 1984, H.J. Deacon initiated a rehabilitation and re-investigation of the Klasies River sites. This study presents an analysis of the faunal sample obtained in the new investigation. Details of the 1984- investigation that are relevant to the context of this faunal sample are given here. Only the large mammal fauna was analysed.

## THE 1984- EXCAVATION

Main site (Deacon, H.J. 1995) has been described as a single depository, an open site in the lee of a cliff. The deposits are banked up against the cliff wall and spill over into cave-like openings in the cliff. A Holocene high sea level has truncated the original cone of deposit, leaving a natural section exposing the strata. The 1967-68 excavations created a further series of artificial sections in different areas of the site, designated as caves 1, 1A, 1B and 2. The 1984- excavations were on a limited scale designed to provide information on the context of the finds rather than to produce large samples of material like mammal bones. Small excavations were made off the sections through the full stratigraphic sequence (Figure 3).

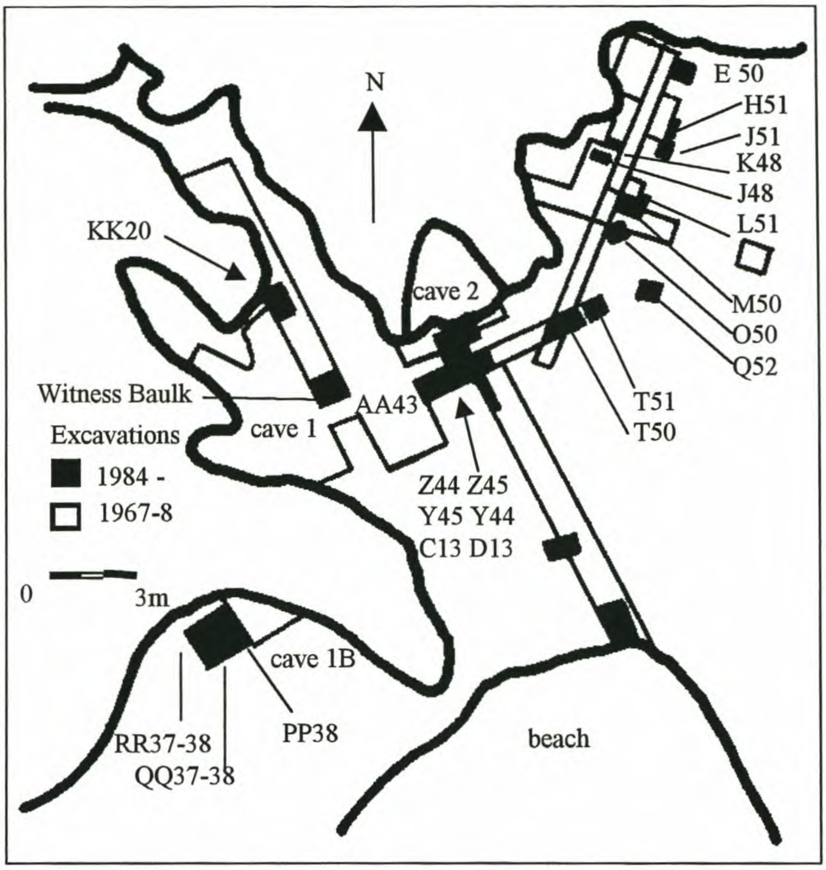


**Figure 3: Klasies River main site plan showing the numbering of the squares excavated since 1984.**

The 1984- excavations were started in the top deposit exposed at some 20 m above sea level, in grid squares E50, H51 and J51. These deposits, with many carbonised horizons and culturally sterile interbeds rich in mircofauna, are grouped in the Upper member (Deacon & Geleijnse 1988). In the culture stratigraphic scheme proposed by Singer & Wymer (1982), these layers are the equivalent of the Howiesons Poort and the MSA III. The Upper member has provided one sample division for the discussion of results of the faunal analysis.

Underlying the Upper member is a series of shell and artefact-rich units grouped in the SAS member. The total thickness is more than 10 m. These have been sampled in areas in caves 1A and 1 (Figure 4). The fauna from a series of grid squares K48, J48, L51 and M50/N49 make up the SAS t (top) faunal sample. The strata in squares O50, T51 and those in T50, overlying unit SM5, contributed the SAS m (middle) sample. The SAS b (base) sample was obtained from square T51 unit SM5, C13, D13, Y44, and from units above SCB2 in AA43 and Z44. The sample of fauna from the lowest stratigraphic member, the LBS member, was excavated from the lower units (below SCB2) in squares AA43 and Z44. The largest sample of fauna came from the 1991-1995 Witness Baulk excavation. The fauna from the upper part of the sequence exposed in the Witness Baulk has been included in the SAS m. Stratigraphically this is the equivalent of the SAS W sub-member (Layer 15 of Singer & Wymer 1982) and the faunal materials have been included in the SAS m sample. The lower part of the Witness Baulk excavation is the stratigraphic equivalent of the SAS U sub-member (Layer 16 of Singer & Wymer 1982) and these materials have been included in the SAS b sample. The results from the fauna analysed by J.S. Brink from part of the 1B sequence have not been included. Again, the fauna from square KK20 in the WS member in cave 1, which is dominated by cormorant with few very young bovid individuals, is not discussed here.

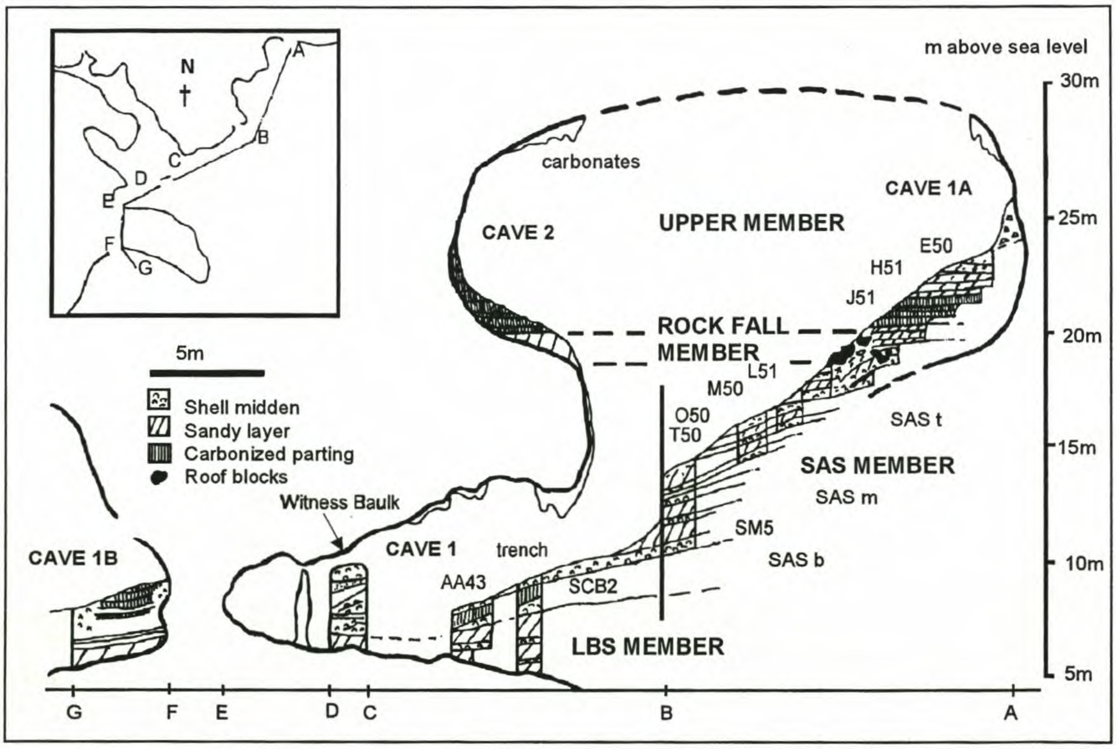


**Figure 4: The general stratigraphy of Klasies River main site (after Deacon & Geleijnse 1988)**

The excavation procedures followed were different from those in the 1967-68 excavation. Fine mesh screens (2 and 3 mm) were used for sieving and all materials were retained. These materials included all bone, even cancellous and burnt fragments. Minimum observable excavation units, some only a few millimetres in thickness, were defined in sampling the deposits. Each unit represents a discrete interval of time and numbers of units have been grouped into the stratigraphic divisions noted above. The fine sampling of the deposit has made it possible to use NISP values instead of MNI estimations in reporting the results of the analysis.

The analysis of the large mammal fauna from the re-investigation was initiated by J.S. Brink of the National Museum, Bloemfontein. He analysed the samples from caves 1A and 1B and has made the data available for inclusion in this thesis. The analysis of the fauna from the Witness Baulk excavation has followed the same procedures adopted in the analyses of the cave 1A materials and in identification use was made of the comparative collection housed in the National Museum.

## DATING

The sequence at main site has been dated by a series of different techniques (Deacon, H.J. *et al.* 1988; Deacon, H.J. 1992, 1995; Vogel, *in press*). This discussion summarises the results relevant to the discussion of the fauna.

The deposits of the Upper Member are dated to beyond the range of radiocarbon (Vogel, *in press*) or older than 50 000 years. The Upper member includes the layers containing the typologically distinctive Howiesons Poort artefacts and there has been considerable interest is the age of these layers. An age centred on 70 000 years proposed by H.J. Deacon (1992) is widely accepted. Recent uranium series dating by Vogel (*in press*) gives an estimate of 65 000 years, which is somewhat younger than estimates based on the epimerization of the amino acid isoleucine (Miller *et al.* 1999; Miller *et al.* 1992). Ages in this range would place the Upper member in MIS 4, a period of sea level regression.

The SAS member is a thick deposit. The uranium series dating by Vogel (*in press*) suggests sedimentation was slow and the member spans a time range of some 25 000 years, between some 100 000 years and less than

78 000 years. The isotope stratigraphy from the sequences (Deacon, H.J., *et al.* 1988) suggests correlation with MIS 5c and in part with MIS 5b. This would indicate an age range between 103 000 years and about 90 000 years. The SAS lower faunal sample can be accepted as having an age of about 100 000 years. The ages of the SAS middle and top divisions cannot be resolved with adequate precision at present.

The lowest stratigraphic division in the main site sequence, the LBS member, is securely dated. The isotope stratigraphy (Deacon, H.J. *et al.* 1988; Grün *et al.* 1990) places the accumulation of these deposits in MIS 5d. Vogel (*in press*) estimates the age at 110 000 years, which is the age of MIS 5d. MIS 5d would correspond to a period of sea level regression.

The ages of the faunal samples all fall in the first half of the Late Pleistocene. In this time there were relatively rapid changes in climate and sea levels. These changes would have affected the composition of the biota in this coastal or near coastal situation. The large mammal fauna itself provides biostratigraphic dating evidence and is proxy evidence for environmental changes. The latter are discussed below.

## LATE PLEISTOCENE ENVIRONMENTS

The situation of main site on a coast with a steep bathymetric profile (Van Andel 1989) means that the effects of sea level changes were not as marked as further west in the region of the Agulhas Bank. Van Andel (1989) has estimated that even in MIS 4, a three-quarter glaciation, the coast at main site would have been within 10 km of its present position. This means that when the site was occupied in the Late Pleistocene it was not bordered by extensive coastal plain even at the height of a regression. Indeed, it can be assumed that the site was only occupied when sea levels were high enough for the sea to be used as a base for obtaining marine foods like *Arctocephalus pusillis* and shellfish.

Sea level regressions (Deacon, J. & Lancaster 1988) would have corresponded to cooler stadia in the Last Interglacial *sensu lato*, MIS 5d and

MIS 5b and to the beginning of the plenniglacial, MIS 4. The distance of the mountains from the coast influences precipitation in the coastal zone and for this reason, local climates during regressional phases would have tended to be drier than in the present. However, there would have been other factors influencing precipitation. The effects of these are difficult to quantify.

At the height of the Last Interglacial, MIS 5e, climates would have been as warm or warmer than the Present Interglacial. Sea levels were at or above those of the maximum for the Holocene. It was as sea levels fell from this high that main site became inhabitable. Main site (Deacon, H.J. 1995) is very exposed at the present and it needed the establishment of a back-of-the-beach-bordering dune to make the location inhabitable. This could only have happened as sea levels fell after the end of the Last Interglacial at some 118 000 years ago. This is a maximum age for the occupation of main site. The dating evidence discussed here suggests the initial occupation during the accumulation of the LBS member was centred on 110 000 years. The prediction is that the fauna from this member should reflect habitat conditions during the regression in MIS 5d corresponding to this age. The faunal analysis of Klein (1976) and that undertaken in this study indicate that grazers were relatively more prominent during this stadial. Periods of sea level regression are registered in the sequence in an increase in grazers. A contrast can be predicted when sea levels were high as in the SAS member, that is correlated at least in part with MIS 5c. The expectation is that more browsers would be evident in the fauna in the SAS member. As discussed in later chapters, this prediction is supported. The important point is that the large mammals in their habitat requirements were sensitive to environmental changes.

# Chapter 5

# Results

## INTRODUCTION

It is assumed that people primarily accumulated the large mammal remains (Milo 1994) and that the fauna reflects the local environment and what prey species were selected. The fauna from the excavations since 1984 is referred as the 1984- sample. The taxonomic composition and species frequencies in the sample are discussed. An important part of the discussion is the body part frequencies. The data on cranial and post-cranial elements contribute to the larger argument about human behaviour and selective transport or the 'schlepp effect' that is considered further in Chapter 6. A comparison with the data from the 1967-68 faunal sample, highlights the differences in the sampling methods used in the two investigations.

## TAXONOMIC COMPOSITION

The frequencies of the species identified in the fauna from the 1984- Witness Baulk excavations in cave I and from the 1984- excavations of cave 1A are given in Table 4. The frequencies are NISP values as the MNI estimates are low. A total of 27 species in eight genera and nine orders have been identified. The bovid remains, unidentifiable to species, are listed in four body size classes. For completeness, a fifth class of indeterminate bovids has been included in Table 4 and in Appendix 1. This is to accommodate remains that cannot be referred to bovids of a particular size class. Carnivore remains that could not be identified to species have been placed in a class of indeterminate carnivores. Remains that can be identified only as 'mammal' have also been classed as indeterminate.

## Table 4: Klasies River large mammal fauna (1984-) NISP values

Stratigraphy: UPPER member, SAS member (t=top; m=middle; b=bottom), LBS member
Bovid size:IB=indeterminate bovid; LB=large bovid; LMB=large medium bovid; SMB=small medium bovid; SB=small bovid
Vegitative cover (cov.) abreviations: c=closed; o=open Dietary abreviations: g=grazer; b=browser; m=mixed

| **ORDER** ***Species*** | **common name** | **size** | **cov.** | **diet** | **UPPER** | **SAS** | | | **LBS** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | t | m | b | | |
| PRIMATA | | | | | | | | | | |
| *Homo sapiens* | humans | | | | 2 | - | 1 | 8 | 2 | 13 |
| *Papio ursinus* | baboon | | | | - | - | 1 | 2 | - | 3 |
| CARNIVORA | | | | | | | | | | |
| Indet carnivore | | | | | 20 | 3 | 19 | 12 | 4 | 58 |
| *Hyaena brunnea* | brown hyaena | | | | - | - | - | 7 | - | 7 |
| *Aonyx capensis* | clawless otter | | | | 1 | - | - | 2 | - | 3 |
| *Panthera pardus* | leopard | | | | 3 | - | - | - | - | 3 |
| *Arctocephalus pusillus* | Cape fur seal | | | | 83 | 29 | 89 | 79 | 26 | 306 |
| HYRACOIDAE | | | | | | | | | | |
| *Procavia capensis* | rock dassie | | | | 139 | 26 | 71 | 322 | 51 | 609 |
| TUBULIDENTATA | | | | | | | | | | |
| *Orycteropus afer* | aardvark | | | | 4 | - | - | 1 | - | 5 |
| PERISSODACTYLA | | | | | | | | | | |
| *Equus sp.* | zebra | | | | 2 | - | 2 | 4 | 3 | 11 |
| CETACEA | | | | | | | | | | |
| Indet Cetacea | whale-dolphin | | | | - | - | - | 1 | 1 | 2 |
| RODENTIA | | | | | | | | | | |
| *Bathyergus suillus* | Cape mole rat | | | | 3 | - | 1 | 5 | - | 9 |
| *Hystrix africae-australis* | porcupine | | | | - | 1 | 10 | 26 | - | 37 |
| LAGOMORPHA | | | | | | | | | | |
| *Lepus sp. (L. capensis)* | Cape hare | | | | - | - | 1 | 3 | - | 4 |
| Indet mammal | | | | | 1 | 22 | 207 | 412 | 42 | 684 |
| ARTODACTYLA | | | | | | | | | | |
| Indet Suid | pig | | | | 2 | - | 2 | 1 | 1 | 6 |
| *Hippopotamus amphibus* | hippopotamus | | | | - | - | 2 | 8 | 5 | 15 |
| *Taurotragus oryx* | eland | LB | c | m | 4 | 6 | 14 | 57 | 5 | 86 |
| *Tragelaphus strepsiceros* | kudu | LMB | c | b | 3 | 1 | - | 18 | 1 | 23 |
| *Tragelaphus scriptus* | bushbuck | SMB | c | b | - | - | 2 | 21 | - | 23 |
| *Tragelaphus sp.* | | IB | | | - | - | - | 2 | - | 2 |
| *Syncerus cafffer* | Cape buffalo | LB | c | g | 8 | 3 | 5 | 24 | 3 | 43 |
| *Pelorovis antiquus* | 'giant buffalo' | LB | o | g | 12 | - | - | 5 | 5 | 22 |
| *Sylvicapra grimmia* | grey duiker | SB | c | b | - | - | 2 | 5 | 2 | 9 |
| *Cephalophus monticola* | blue duiker | SB | c | b | - | - | 1 | - | - | 1 |
| *Redunca arundinum* | southern reedbuck | LMB | o | g | 1 | 2 | 4 | - | - | 7 |
| *Redunca sp.* | | IB | | | - | - | - | 5 | 1 | 6 |
| *Kobus sp.* | waterbuck | IB | o | g | 1 | - | - | - | - | 1 |
| *Hippotragus leucophaeus* | blue antelope | LMB | c | g | 2 | - | 1 | 14 | 6 | 23 |
| *Hippotragus sp.* | | LMB | c | g | 1 | - | 2 | 4 | - | 7 |
| *Alcelaphus/Connochaetes* | hartebees/wildebees | LMB | o | g | 6 | - | 7 | 11 | 3 | 27 |
| *Damaliscus dorcas* | bontebok/blesbok | SMB | o | g | 2 | - | 1 | - | - | 3 |
| *Megalotragus priscus* | 'giant wildebees' | IB | o | g | 1 | - | - | - | - | 1 |
| *Pelea capreolus* | vaalribbok | SMB | o | m | 3 | - | 4 | 3 | 4 | 14 |
| *Raphicerus melanotis* | Cape grysbok/steenbok | SB | c | b | 17 | 1 | 26 | 61 | 3 | 108 |
| *Antidorcas sp.* | springbok | SMB | o | g | 2 | - | - | 1 | - | 3 |
| Indet bovid (IB) | | | | | - | 4 | 48 | 148 | 14 | 214 |
| Large bovids (LB) | | | | | 108 | 43 | 45 | 233 | 65 | 494 |
| Large medium bovids (LMB) | | | | | 178 | 18 | 91 | 312 | 127 | 726 |
| Small medium bovids (SMB) | | | | | 122 | 17 | 122 | 268 | 66 | 595 |
| Small bovids (SB) | | | | | 287 | 55 | 358 | 413 | 35 | 1146 |
| total | | | | | 1018 | 231 | 1139 | 2498 | 475 | 5359 |

## ORDERS

### *Primates*

*Homo sapiens*: Human remains have been recovered in all the members except for the SAS t division. The highest concentration of human remains occurs in the SAS b division and this has been related to episodic cannibalism (White 1987, Deacon, H.J. 1992). Of the eight pieces in the SAS b division, seven are from the Witness Baulk excavation. These seven pieces include a distal hand phalange, half a deciduous molar, one premolar and two molars, one right fifth metatarsal and one left second metatarsal. A second distal hand phalange was found in the SAS m divisions, also from the Witness Baulk excavation. The premolar and molar teeth apart, the remains come from different individuals. The standard anatomical measurements suggest the remains are within the range of modern humans. G.P. Rightmire will study these remains in detail.

*Papio ursinus*: Possibly introduced by carnivores, *P. ursinus* is a rare component in the assemblage. It only occurs in the SAS m and SAS b divisions.

### *Carnivora*

Carnivores occur throughout the sequence though never in large numbers. Five families appear to be represented: Viverridae, Canidae, Hyaenidae, Felidae and Otariidae. Of the small carnivores, genet cats are still found locally. *Aonyx capensis* is another local species. *Hyaena brunnea* and *Panthera pardus* occur in the SAS b division and Upper member respectively. The proximity of the site to the coast is reflected in high frequencies of *Arctocephalus pusillus* (Figure 5) throughout the sequence.

**Figure 5: *Arctocephalus pusillus***

### *Hyracoidae*

*Procavia capensis* (Figure 6) is the most common identifiable species in the site. It would have been a resident species and was possibly prey for both humans and carnivores.

**Figure 6: *Procavia capensis***

### *Tubulidentata*

*Orycteropus afar* only occurs in the Upper member and SAS b division.

### *Perissodactyla*

An equid species, *Equus capensis*, occurs in low frequencies throughout the sequence with the exception of the SAS t division.

### *Cetacea*

The occurrence of a whale vertebra and a vertebral epiphysis in the SAS b division and LBS member respectively can be attributed to wash-ups or beaching.

### *Lagomorpha and Rodentia*

*Lepus capensis* and *Bathyergus suillus* occur in low frequencies in the SAS b and SAS m divisions, whilst *B. suillus* also occurs in the Upper member. *Hystrix africae-australis* (Figure 7) occurs throughout the SAS member but is best represented in the SAS b division. All can be considered resident species.

**Figure 7: *Hystrix africae-australis***

### *Artiodactyla*

Three families represent the order Artiodactyla: Suidae, Hippopotamidae and Bovidae. Suids and *Hippopotamus amphibius* occur in low frequencies. *H. amphibius* is better represented in the SAS m, SAS b divisions and in the LBS member. Bovids make up the bulk of the fauna. There are 19 species representing seven tribes in five sub-families listed below.

- Tribe Tragelaphini: *Taurotragus oryx,* (Figure 8) *Tragelaphus strepsiceros and T. scriptus* are representatives of this tribe. *T. oryx* is the most numerous of these remains and is well represented throughout the sequence.

**Figure 8: *Taurotragus oryx***

**Figure 9: *Syncerus caffer***

- Tribe Bovini: Two species of this tribe are present, *Syncerus caffer* and *Pelorovis antiquus. S. caffer* (Figure 9), like *T. oryx* occurs throughout the sequence in relatively high frequencies. *P. antiquus* is absent in the SAS m and SAS t divisions.

- Tribe Cephalophini: The two representative species are *Sylvicapra grimmia* and *Cephalophus monticola*. They are absent in the Upper member and the SAS t division. Both occur in the SAS m division, while only *S. grimmia* is found in the SAS b division and the LBS member. *C. monticola*, the forest duiker, is a habitat indicator species.

- Tribe Hippotragini: *Hippotragus leucophaeus*, the extinct blue antelope, rather than *H. equinus*, probably accounts for all the relevant remains and is only absent in the SAS t division.

- Tribe Reduncini: Redunca arundinum and Kobus sp. represent this tribe. *R. arundinum* occurs in all members whilst *Kobus* sp. only appears in the Upper member.

- Tribe Alcelphini: As many as four different species may be present, although the species in the genera *Connochaetes* and *Alcelaphus* have can be distinguished, they have been grouped as Alcelaphines for this study. *Megalotragus priscus* and *Damiliscus dorcas* are the other species present. No alcelaphines were recorded in the SAS t division. *D. dorcas* only occurs in the Upper member and SAS m division, whilst *M. priscus* only occurs in the Upper member.

- Tribe Neotragini: The remains are referred to *Pelea capreolus* and *Raphicerus* sp.. *P. capreolus,* though in very low frequencies, is only absent in the SAS t division. The *Raphicerus* remains are most probably all referable to *R. melanotis* (Figure 10), which still occurs in the area. It accounts for most of the bovid remains and only *P. capensis* and *A. pusillus* are represented by more remains.

**Figure 10: *Raphicerus melanotis***

- Tribe Antilopini: This tribe is represented by one species, referred to either *Antidorcas marsupialis* or *A. australis*. It is found in the Upper member and in the SAS b division.

The small size of the SAS t sample is perhaps the reason why so many species are absent from this division. The taxonomic composition of this division is a product of sampling rather than a reflection of the Late Pleistocene environment.

## SPECIES FREQUENCIES

### *Species Abundance*

Five species occur throughout the sequence (Table 4). These species are *A. pusillus; P. capensis*; *R. melanotis*; *T. oryx* and *S. caffer*. Only *A. pusillus* and *P. capensis* occur in relatively high frequencies (Table 5) and *P. capensis* represents over 50% of the total of the identifiable species.

**Table 5: Prey species occurring throughout the sequence (NISP and percentages)**

| | *A. pusillis* | | *P. capensis* | | *R. melanotis* | | *T. oryx* | | *S. cafffer* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **NISP** | % | **NISP** | % | **NISP** | % | **NISP** | % | **NISP** | % |
| UPPER | **83** | 33 | **139** | 55 | **17** | 7 | **4** | 2 | **8** | 3 |
| SAS t | **29** | 45 | **26** | 40 | **1** | 2 | **6** | 9 | **3** | 5 |
| SAS m | **89** | 43 | **71** | 35 | **26** | 13 | **14** | 7 | **5** | 2 |
| SAS b | **79** | 15 | **322** | 59 | **61** | 11 | **57** | 10 | **24** | 4 |
| LBS | **26** | 30 | **51** | 58 | **3** | 3 | **5** | 6 | **3** | 3 |

*A. pusillus* is a marine mammal. *P. capensis* is a local resident, whilst the three bovid taxa represent the three different feeding niches that are discussed later. There is a small reduction in *A. pusillus* frequencies from the SAS t to the Upper member, though in this sample the decrease from the LBS to the SAS b divisions seems to be more significant. In the 1967-68 sample Klein (1976) noted a reduction in *A. pusillus* remains in the Upper member, which he equated with a possible retreat of the coastline associated with the onset of the Last Glacial. Both *R. melanotis* and *T. oryx* tend to have higher frequencies in the SAS members while S. caffer is constantly present in low frequencies.

The most abundant prey species are shown in Table 6. The data exclude *P. capensis* as hyraxes were not necessarily only the prey of people. The

**Table 6: Most abundant prey species through the sequence (NISP values)**

| | Upper | | SAS t | | SAS m | | SAS b | | LBS | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | SPECIES | NISP | SPECIES | NISP | SPECIES | NISP | SPECIES | NISP | SPECIES |
| **1** | 83 | *A. pusillis* | 29 | *A. pusillis* | 89 | *A. pusillis* | 79 | *A. pusillis* | 26 | *A. pusillis* |
| **2** | 17 | *R. melanotis* | 6 | *T. oryx* | 26 | *R. melanotis* | 61 | *R. melanotis* | 6 | *H. leucophaeus* |
| **3** | 12 | *P. antiquus* | 3 | *S. cafffer* | 14 | *T. oryx* | 57 | *T. oryx* | 5 | *H. amphibus* |
| **4** | 8 | *S. cafffer* | 2 | *R. arundinum* | 7 | Alcelaphines | 24 | *S. cafffer* | 5 | *T. oryx* |
| **5** | 6 | Alcelaphines | 1 | *R. melanotis* | 5 | *S. cafffer* | 21 | *T. scriptus* | 5 | *P. antiquus* |
| **6** | 4 | *T. oryx* | 1 | *T. strepsiceros* | 4 | *P. capreolus* | 18 | *T. strepsiceros* | 4 | *P. capreolus* |
| **7** | 3 | *P. capreolus* | - | | 4 | *R. arundinum* | 14 | *H. leucophaeus* | 3 | *Equus* |
| **8** | 3 | *T. strepsiceros* | - | | 2 | *Equus* | 11 | Alcelaphines | 3 | *R. melanotis* |
| **9** | 2 | *H. sapiens* | - | | 2 | *Indet Suid* | 8 | *H. sapiens* | 3 | Alcelaphines |
| **10** | 2 | *Equus* | - | | 2 | *H. amphibus* | 8 | *H. amphibus* | 3 | *S. cafffer* |

species have been ranked in the order of abundance in the five stratigraphic divisions. *A. pusillus* has the highest frequency of the 10 abundant species. Other species with a high relative frequency, ranking four out of the top five are *R. melanotis*, *T. oryx*, and *S. caffer*. What this ranking shows is that the species composition of the sample from the LBS member is significantly different from that in the overlying divisions.

### *Bovid habitat and feeding niche*

In the analysis of the 1967-68 sample Klein (1976) was able to show a shift from open habitats in the base of the sequence (LBS member) to more closed habitats in the middle of the sequence (SAS member). A further change, back to open habitats, occurred in the top of the sequence (Upper member). Open habitat indicators like equids and alcelaphines declined in the SAS member while the frequencies of browsers and mixed feeders like *Raphicerus* sp. and tragelaphines increased. In this study the bovid taxa used as indicators of habitat cover and diet are listed in Table 4. Bovids preferring closed environments outnumber those preferring open environments (Figure 11). Grazers and browsers are the main groups in the fauna, with grazers more numerous in the LBS and Upper members (Figure 12). Browsers occur in higher frequencies in the SAS b and SAS m divisions. Mixed feeders are the best represented group in the small SAS t sample and they remain relatively constant throughout the sequence. These results are in close agreement with those of Klein (1976).

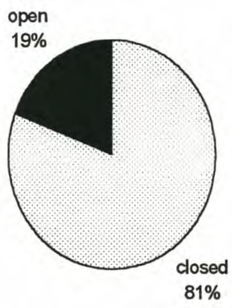


**Figure 11: Ratio open to closed habitat cover.**

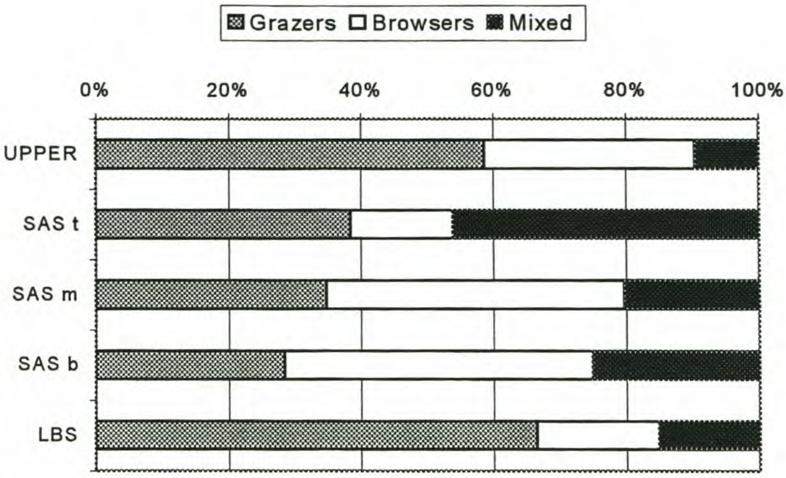


**Figure 12: Ratio of different bovid feeding niches through the sequence**

It is reasonable to assume that people living at main site would have hunted animals living in close proximity to the cave. Thus changes in the species of animals found in the sequence will reflect changes in the species that lived in the area. Changes in the proportions of animals, with preferences for open grassy habitats versus closed bushy habitats, can be used to infer changes in the extent of these environments around the cave. In the Late Pleistocene after MIS 5e, climates have been cooler and at times drier than the present and sea levels have been lower. Hunters would have ranged into areas now covered by sea. There have been dynamic changes in the local environment for which the large mammals provide evidence. The validity of the changes observed can be tested statistically

**Table 7: Actual frequencies for habitat cover**

| Unit | closed | open | TOTAL |
|---|---|---|---|
| **Upper** | 35 | 28 | 63 |
| **SAS t** | 11 | 2 | 13 |
| **SAS m** | 53 | 16 | 69 |
| **SAS b** | 211 | 30 | 231 |
| **LBS** | 21 | 12 | 33 |
| **Total** | 331 | 78 | 409 |

The null hypothesis is that the relative proportions of animals that lived in either open or closed habitats in the sequence remained constant. Using a chi-squared test, it is possible to test whether the relative frequencies of animals indicative of open and closed habitats in the different stratigraphic divisions could be drawn from the same sample. The tables below show the actual frequencies (Table 7) and the expected frequencies (Table 8).

The chi-squared test allows rejection of the null hypothesis at the 0.001 confidence level. It can be accepted that through the main site sequence there were significant changes in faunal indicators of habitat.

**Table 8: Expected frequencies for habitat cover**

| Unit | closed | open | TOTAL |
|---|---|---|---|
| **Upper** | 50.99 | 12.01 | 63 |
| **SAS t** | 10.52 | 2.48 | 13 |
| **SAS m** | 55.84 | 13.16 | 13 |
| **SAS b** | 186.95 | 44.05 | 69 |
| **LBS** | 26.71 | 6.29 | 231 |
| **Total** | 331.01 | 77.99 | 409 |

From a closer examination it appears that the LBS and Upper members are similar in the ratio of animals representing closed and open habitats. The tables below show the actual frequencies (Table 9) on the left and the expected frequencies (Table 10) on the right.

**Table 9: Actual frequencies for the Upper and LBS members**

| Unit | closed | open | TOTAL |
|---|---|---|---|
| **Upper** | 35 | 28 | 63 |
| **LBS** | 21 | 12 | 33 |
| **Total** | 56 | 40 | 96 |

**Table 10: Expected frequencies for the Upper and LBS members**

| Unit | closed | open | TOTAL |
|---|---|---|---|
| **Upper** | 36.75 | 26.25 | 63 |
| **LBS** | 19.25 | 13.75 | 33 |
| **Total** | 56 | 40 | 96 |

The null hypothesis was that the samples from these two members could have been drawn from the same sample. The chi-squared test shows there is no significant difference in the ratios of closed and open habitat indicators and the null hypothesis can be accepted at better than the 0.1 % confidence level. This result does not mean that local habitat conditions were identical during the accumulation of these two members. However, it can be concluded that the vegetation around the site was able to support a similar ratio of animals with preferences for open and closed vegetation.

## BODY PART FREQUENCIES

Over 70 % of the 1984- faunal sample are bovid remains. These remains are most likely to have been accumulated through active hunting or opportunistic scavenging. The composition is primarily a reflection of human behaviour. The bovid body part frequencies have been the focus of much study and debate

(Klein 1976; Binford 1984; Milo 1994; Marean 1998). A concept of selective transportation was introduced to explain the body part frequencies observed in the 1967-68 sample (Klein 1976). The validity of this concept can be explored through the analysis of the 1984- sample and hence the reason for the interest in the analysis of body part frequencies.

All the materials under consideration can be identified as bovid (Figure 13). Where no further level of identification is possible, these elements are referred to the category of indeterminate bovid. As discussed in Chapter 2 elements that carry information on size have been referred to one of the four size classes (Table 3 in Chapter 2), 'Large bovids' (LB), 'Large medium bovids' (LMB), 'Small medium bovids' (SMB) and 'Small bovids' (SB). This would include all the post-cranial elements. Although some of these are potentially identifiable to species, only the dental elements have been given specific identifications.

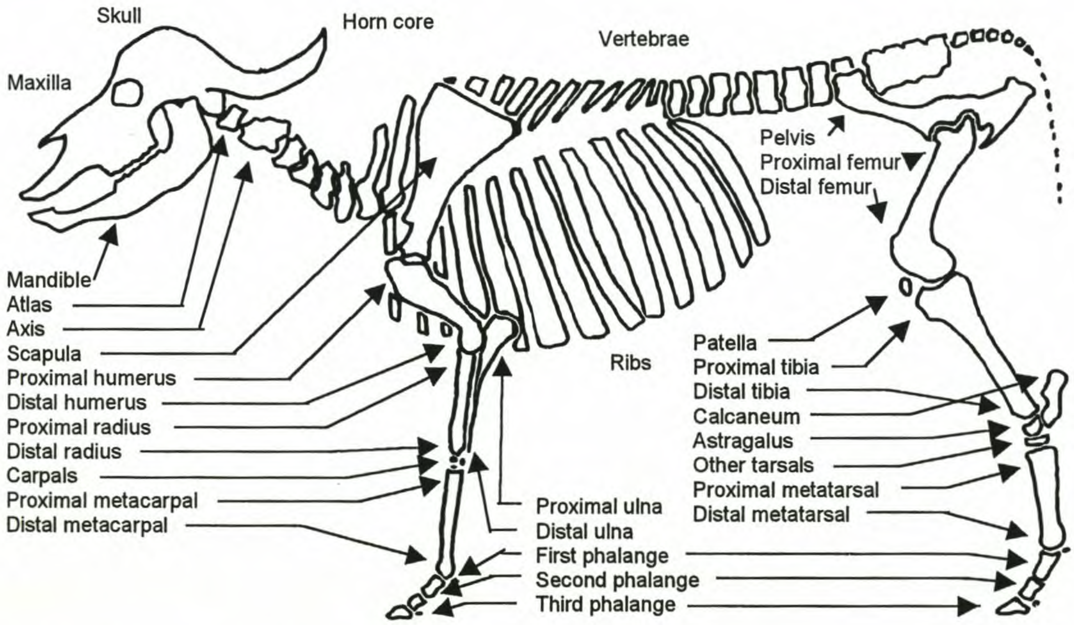


**Figure 13: The bovid skeleton**

Most of the faunal sample consists of bone fragments and fragmentation is very high. Fragments range in size from <5 mm to >100 mm. Attempts were made to refit shaft bone fragments from the same units without success. The sizing of distal and proximal elements in order to find matching pairs was attempted but in most cases it has to be assumed that the proximal and distal elements belonged to different individuals. The degree of fragmentation places a limit on the precision of any analysis.

## ANATOMICAL GROUPINGS

The mammalian remains from main site are discussed in terms of the cranial and post-cranial remains. The post-cranial remains can be divided into the axial and appendicular skeleton. The primary data from which the following tables and charts are calculated can be found in Appendix 1.

### *Cranial material*

This material consists of skull material (Table 11), horn cores, isolated teeth and mandibular or maxillary fragments, with or without teeth. Skull material is highly fragmented and difficult to quantify at any level. For the most part horn cores are small fragments, only identifiable as indeterminate bovid. Teeth are the most readily identifiable element and can be identified to species. The most certain identification is of rows rather than isolated teeth and most elements are isolated teeth. As dentine is dense and teeth explode with heat, fragmentation due to burning is a factor. Although, in such cases specific identification may be impossible, the element may still be referred to a bovid size class. Other fragmentary teeth were classified in the same way. Maxillary and mandibular elements without identifiable teeth have been referred to size class.

**Table 11: Bovid cranial elements (NISP values)**

| | LB | LMB | SMB | SB |
|---|---|---|---|---|
| **horn core** | 20 | 18 | 2 | 3 |
| **skull** | 4 | 8 | 4 | 1 |
| **maxilla** | 4 | 4 | 2 | 18 |
| **dentes sup.** | 29 | 28 | 23 | 44 |
| **mandible** | 23 | 17 | 17 | 52 |
| **dentes inf.** | 69 | 51 | 17 | 45 |
| **dentes indet.** | 50 | 58 | 7 | 4 |
| **hyoid** | 1 | - | - | - |
| **NISP** | 200 | 184 | 72 | 167 |

### *Post-cranial material*

The axial skeleton (Table 12) refers to vertebrae and rib fragments. Few of these are complete but they are readily identifiable to body part. Vertebral

**Table 12: Bovid post-cranial elements (NISP values)**

| | LB | LMB | SMB | SB |
|---|---|---|---|---|
| **vertebrae** | 60 | 128 | 109 | 197 |
| **rib fragments** | 52 | 102 | 75 | 57 |
| **scapula** | 5 | 14 | 14 | 39 |
| **pelvis** | 3 | 8 | 9 | 17 |
| **fore limb** | 16 | 31 | 27 | 77 |
| **hind limb** | 28 | 21 | 20 | 80 |
| **foot** | 152 | 196 | 209 | 469 |
| **indet. shaft** | 37 | 12 | 5 | - |
| **misc.** | 97 | 116 | 98 | 187 |
| **NISP** | 450 | 628 | 566 | 1123 |

bodies, spines and epiphyses are common, as are rib articulations. The appendicular skeleton includes scapula, fore limbs, pelvis, hind limbs, phalanges, indeterminate shaft bones and miscellaneous elements such as patellae and carpalia. For the purposes of discussion limb bones are defined as including the humerus, radius, ulna, femur and tibia, but excluding metacarpals, metatarsals, metapodials and phalanges, which are included as foot elements.

### IDENTIFYING SELECTIVE TRANSPORTATION

The contention that there was selective transport of body part elements related to bovid size contributes to the debate about human behaviour in the Late Pleistocene (Klein 1976, Binford 1984). The hypothesis has been outlined in Chapter 3 and is discussed further in Chapter 6. What are listed below are the set of criteria proposed by Klein (1976) that allow the identification of selective transport as a factor. The data from the 1984-sample that allow assessment of how far these criteria are met in this sample, are presented below. The criteria are as follows:

- Cranial remains better represent large bovids than smaller bovids (Figure 14).
- Post-cranial remains (Figure 14) better represent smaller bovids.
- Large bovid remains are dominated by cranial and foot remains (Figure 15). The term trunk has been used to designate the axial skeleton and the upper limb bones, as defined above. The foot elements are the

metacarpals, metatarsals, metapodials and phalanges. These definitions follow the usage of Klein (1976) with whose work comparisons are made in the following discussions.

- Limb bones (Figure 16) better represent smaller bovids.
- Appendicular remains will have a higher frequency in the larger than the smaller bovid remains (Figure 17).

Figures 14-17 give a visual impression of the relative percentages of body elements in the different size classes. If the 'schlepp effect' had been a factor, it follows that the appendicular skeleton should be better represented than axial skeleton because the axial elements would have been left at the kill site. The question posed here and discussed further in Chapter 6 is whether evidence for this can be seen in the 1984- bovid sample.

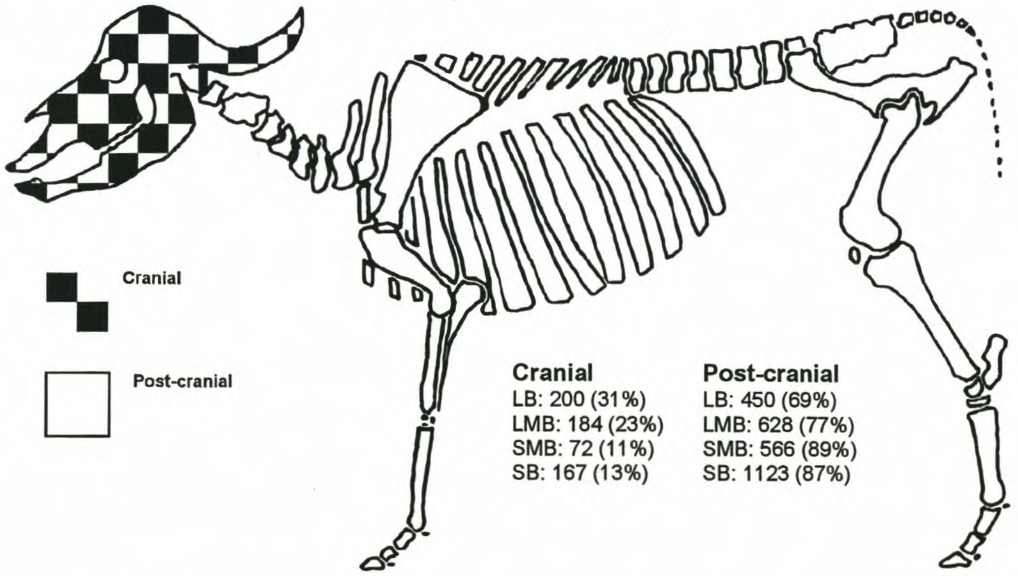
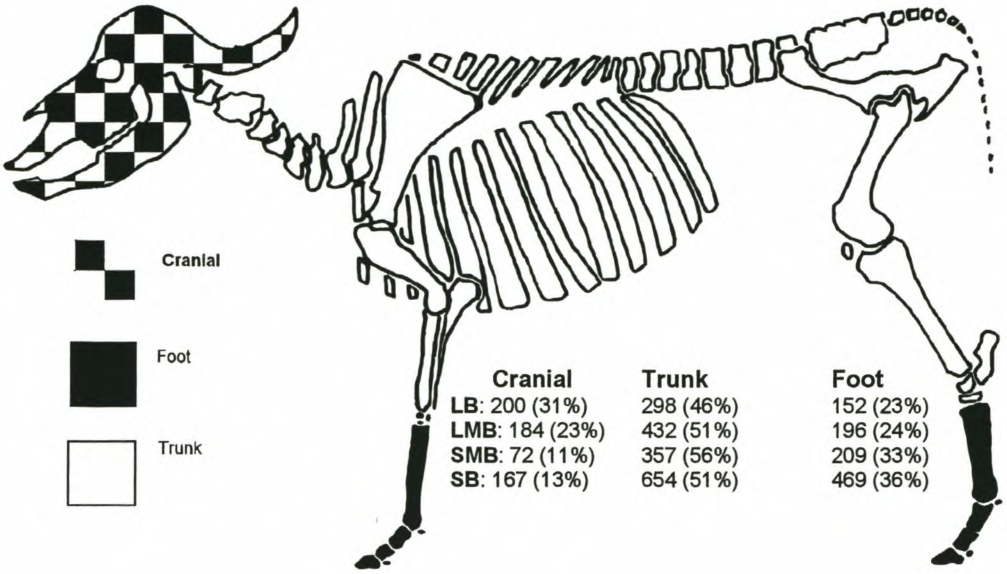
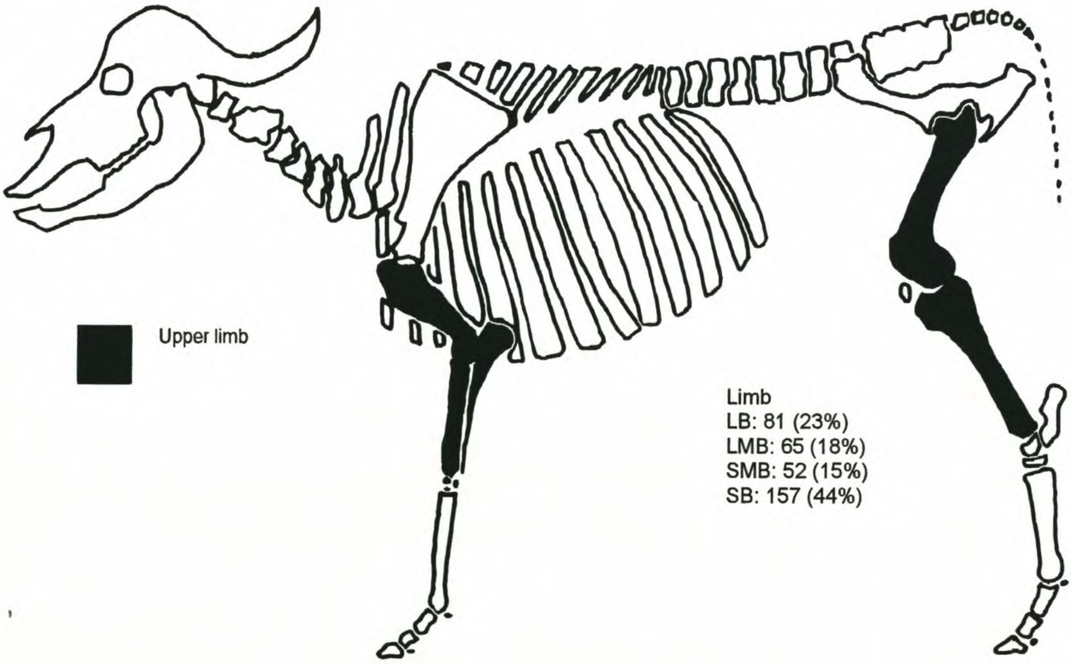


**Figure 14: Representation of cranial and post-cranial elements in bovid classes, NISP values and ratios**



| | Cranial | Trunk | Foot |
|---|---|---|---|
| **LB** | 200 (31%) | 298 (46%) | 152 (23%) |
| **LMB** | 184 (23%) | 432 (51%) | 196 (24%) |
| **SMB** | 72 (11%) | 357 (56%) | 209 (33%) |
| **SB** | 167 (13%) | 654 (51%) | 469 (36%) |

**Figure 15: Representation of cranial, trunk and foot elements in bovid classes, NISP values and ratios**



Limb
LB: 81 (23%)
LMB: 65 (18%)
SMB: 52 (15%)
SB: 157 (44%)

**Figure 16: Representation of bovid limb bones in size classes, NISP values and ratios**

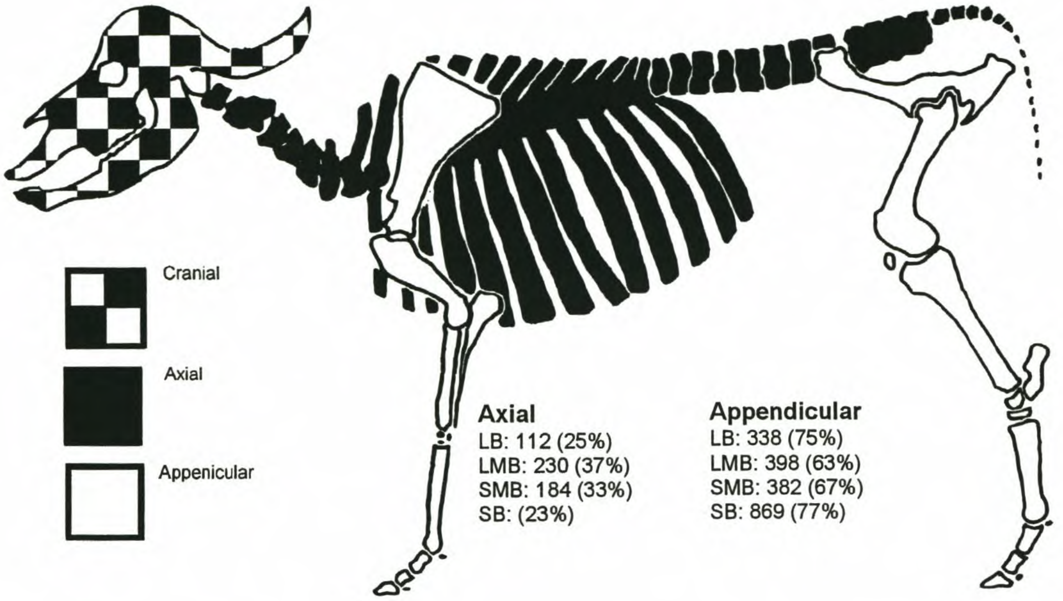


**Figure 17: Representation of the axial and appendicular skeleton in bovid classes, NISP values and ratios**

The abundance of individual elements in each bovid class are illustrated in Figures 18-21. Noteworthy, is the abundance of vertebrae in the 1984-sample. This is in stark contrast to the 1967-68 sample that was available to Klein (1976). It was the low frequency of axial elements in the 1967-68 sample that first led to the suggestion that selective transport may have been a factor in the faunal accumulation. A comparison of two samples from cave 1, one excavated in 1967-68 and the other excavated more recently from the Witness Baulk is given below. This illustrates the bias that recovery methods have had on the frequencies of elements recorded.

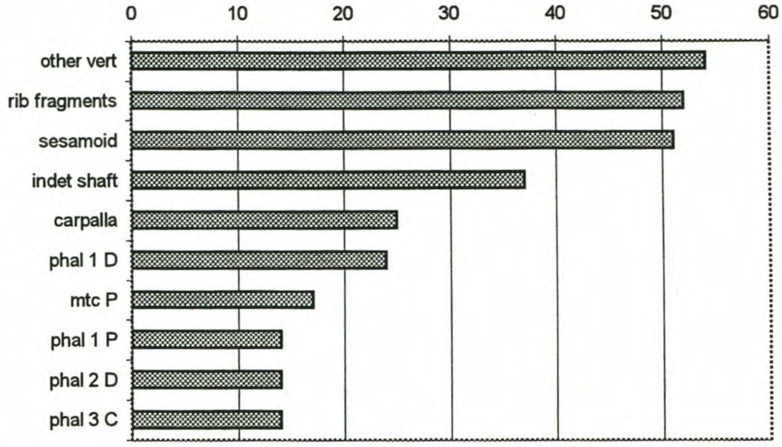


**Figure 18: Most abundant large bovid post-cranial elements, NISP values**

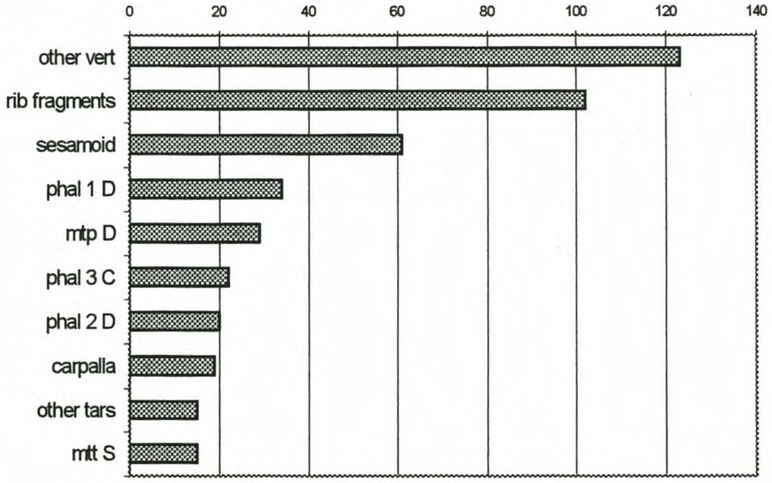


**Figure 19: Most abundant large medium bovid post-cranial elements, NISP values.**

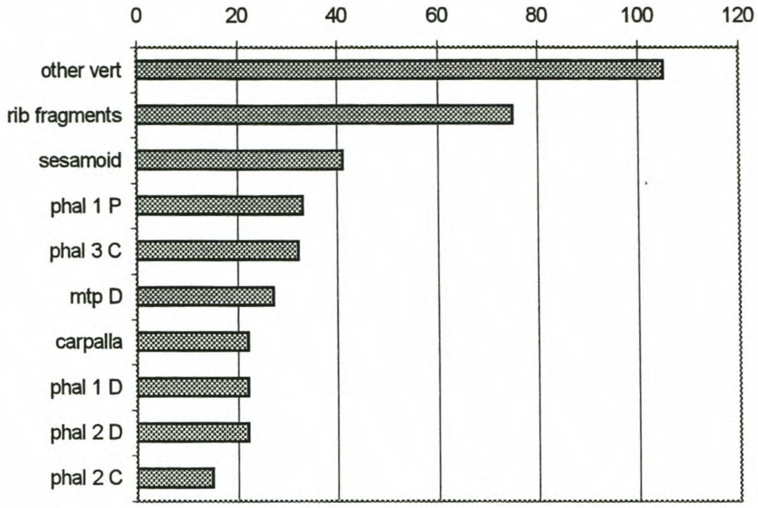


Figure 20: Most abundant small medium post-cranial elements, NISP values

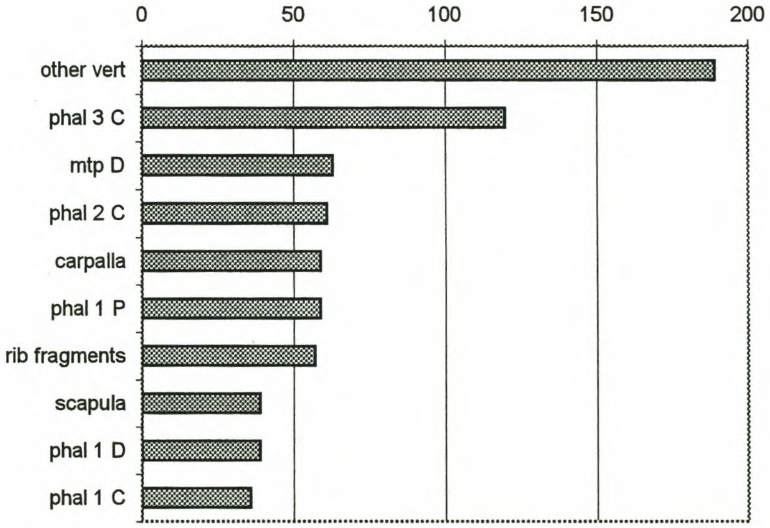


Figure 21: Most abundant small bovid post-cranial elements, NISP values

## A COMPARISON OF THE 1967-68 AND 1984- FAUNAL SAMPLES

Data for the 1967-68 bovid sample from the Middle Stone Age layers from cave 1, drawn from Milo (1994), have been compared to the data for the Witness Baulk (1984-WB) (Table 13). The 1984-WB sample is equivalent to layers 15 and 16 of the 1967-68 excavation. There are small discrepancies in the listings of classes of elements. Milo (1994) did not include horn cores or isolated teeth in his study so these elements could not be included in the data presented. It follows that the sum of the cranial elements in the 1967-68 sample maybe underestimated. The frequencies of all vertebrae, apart from the atlas and axis, have been considered as a single class. As the 1967-68 sample does not include shaft and metapodial elements these were not included in the comparison. For the 1984-WB sample, proximal and distal fragments of phalanges were counted as complete elements. There are very few phalanges recorded in the 1967-68 sample. To facilitate comparison the data are grouped by anatomical region. The raw data from which Figures 22-25 were compiled is given in Appendix 2.

**Table 13: Comparison of the 1967-68 and 1984-WB bovid results (NISP values and percentages)**

| | LB | | LMB | | SMB | | SB | | total |
|---|---|---|---|---|---|---|---|---|---|
| 1967-68 | 2911 | 54% | 1213 | 22% | 619 | 11% | 693 | 13% | 5436 |
| 1984-WB | 650 | 19% | 812 | 24% | 638 | 19% | 1290 | 38% | 3390 |

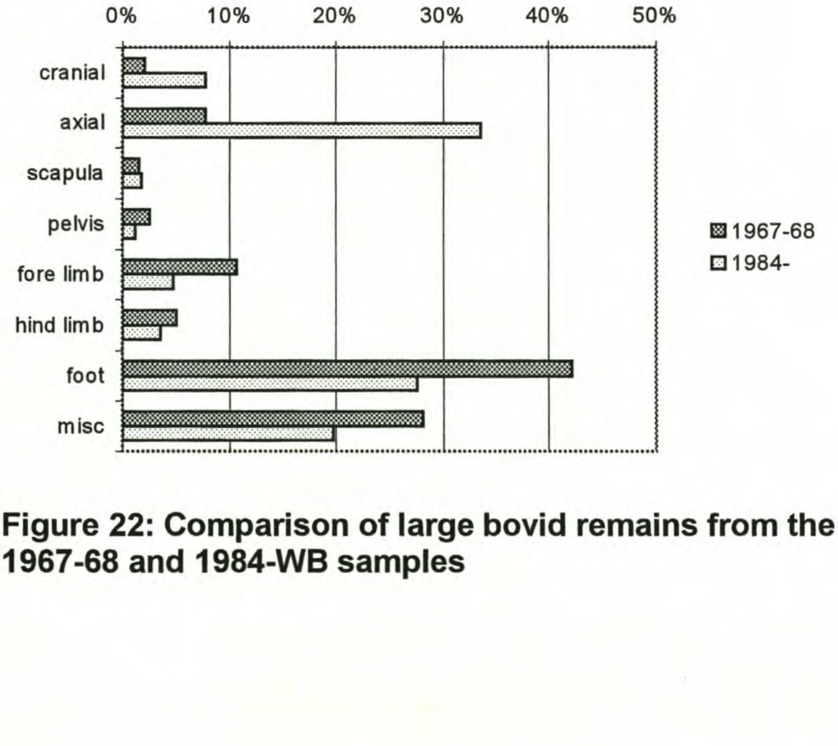


**Figure 22: Comparison of large bovid remains from the 1967-68 and 1984-WB samples**

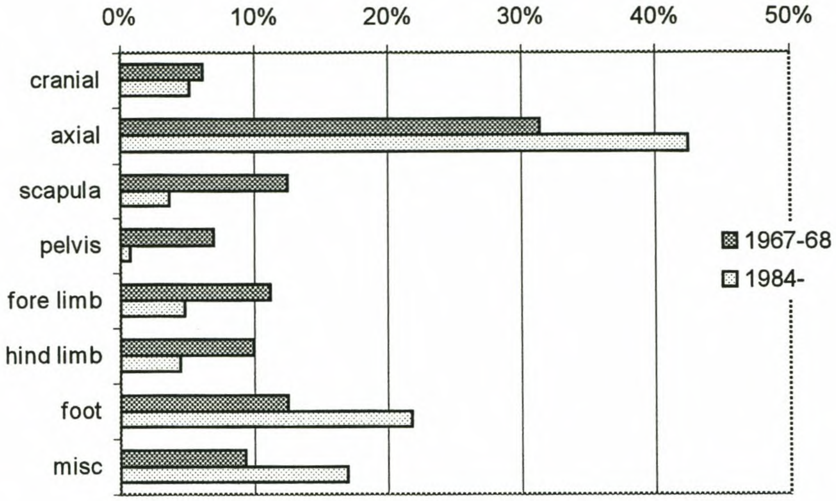


Figure 23: Comparison of large medium bovid remains from the 1967-68 and 1984-WB samples

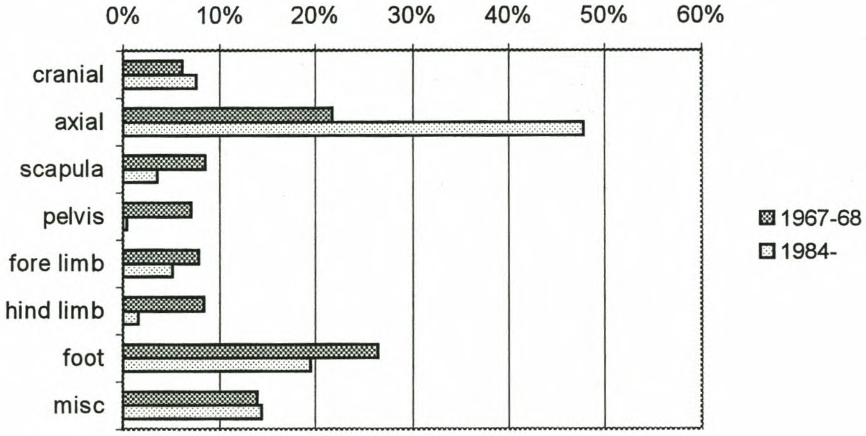


Figure 24: Comparison of small medium bovid remains from the 1967-68 and 1984-WB samples

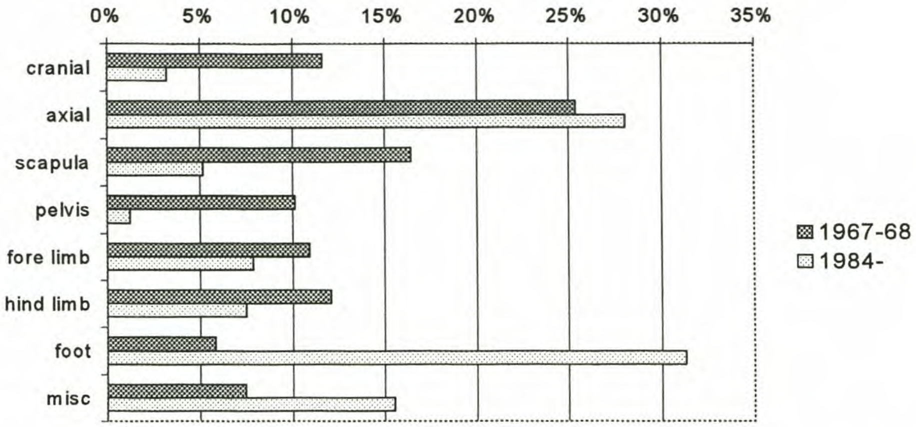


**Figure 25: Comparison of small bovid remains from the 1967-68 and 1984-WB samples**

As detailed in Chapter 6, the comparison of the data from the two investigations shows the extent to which the 1967-68 sample is biased in favour of physically larger skeletal elements. The special interest in the data from the 1984- sample is the relative frequencies of axial and foot elements because this has a direct bearing on the issue of selective transport.

## SUMMARY

The purpose of the chapter has been to present the primary data on the large mammal fauna, recovered from main site, in the excavations undertaken since 1984. These data relate to the taxa identified and the relative frequencies of different skeletal elements in the fauna. The list of taxa (Table 4) identified shows this to be a typical Late Pleistocene or Florisian Land Mammal Age fauna (Hendey 1974, 1983). The genera and species are modern with the presence of some taxa that became extinct towards the end of the Pleistocene. The composition of the fauna changes through the sequence and this has significance for understanding Late Pleistocene habitats.

The body part frequencies are the lowest level of data presented. These data on the relative frequencies of skeletal elements in the different bovid size classes lead to important conclusions on how the remains of bovids accumulated in the strata at main site

# Chapter 6

# Concluding Discussion

## INTRODUCTION

Assumptions are made when analysing and discussing archaeological faunal remains. Firstly that humans accumulated the bulk of the fauna. Secondly is that human behaviour can be inferred from the way in which the animals were obtained and their carcasses used. What animals did these prehistoric people hunt and how did they hunt them? What do the animal remains tell us about how people lived? Chapter 3 discusses some inferences on human behaviour in the Late Pleistocene, drawn from analysis of the faunal sample from the 1967-68 excavation (Klein 1976, Binford 1984). The present study provides an opportunity to review the validity of these inferences through the analysis of a smaller but more complete faunal sample. The discussion is about species and body part frequencies and comparisons between the 1967-68 and 1984- samples.

## SPECIES FREQUENCIES

It has been argued (Deacon, H.J. *in press*) that Middle Stone Age people were hunter-gatherers in the same sense as ethnographically known peoples and that they would have used protein and animal fat as a supplement to a predominantly carbohydrate diet of plant foods. *A. pusillus* would have been highly ranked as a source of protein supplement and the fatty tissues would have provided for any short fall in the calories from plant foods in the seasonal round. It follows that main site may have been occupied repeatedly over many millennia because it provided shelter against the cliff face in a situation that gave access to marine resources, seals.

From the bathymetric charts (van Andel 1989) it is impossible to establish whether there were seal rookeries onshore or offshore. The latter is more probable because of predation pressure but it does imply the carcasses were obtained from wash-ups. *A. pusillus* is a seasonal breeder, and where restricted to breeding territories on small rocky offshore platforms, the mortality of pups is high (Woodbourne *et al.* 1995). The availability of carcasses of seal pups would relate to the breeding cycle. If prehistoric hunter-gatherers wanted to maximise the opportunity to harvest carcasses they would have timed their visits to the main site accordingly. A study of the age distribution of individuals in the seal remains in the 1967-68 sample by Klein & Cruz-Uribe (1996) showed a range of ages to be represented. As the prehistoric groups did not preferentially time their visits to the coast, these authors argue that in the Middle Stone Age, in contrast to the Later Stone Age, planning was inadequate to make the best use of this and other food resources. This is part of their argument based on Stone Age economics that the Middle Stone Age people were not modern in their behaviour (Klein 1995). The weakness in this argument is that it equates optimisation with advancement and intelligence.

The 1984- sample is not large enough to provide an independent test of the age profiles of the seal remains. Certainly many of the seal bones recovered from the Witness Baulk excavation were from juveniles. Because of the recovery techniques adopted, juvenile *A. pusillus* remains may be underrepresented in the 1967-68 sample in the same way that small bovid remains are underrepresented. Even if larger, well-controlled samples, show that *A. pusillus* juveniles were not targeted intensively in the Middle Stone Age, it would be unwarranted to assume that these communities were unaware of different seasonal abundances in seal carcasses.

While seals and penguins could be clubbed or obtained by opportunistic scavenging, obtaining bovids would have required a more active strategy. The most common bovid remains are those of the *Raphicerus melanotis* (Cape grysbok). *R. melanotis*, like other small bovids is nocturnal and territorial (Klein 1980b). Amongst the Kalahari San they are obtained by trapping rather that hunting (Yellen 1991a, 1991b). In the Holocene Later Stone Age there is a marked increase in the remains of animals like *R. melanotis* in inland and coastal environments. Nelson Bay Cave (Inskeep 1987) is an example in comparable coastal habitat where such a pattern has been documented. An increase in the area of shrubland at the end of the Pleistocene and the extinction of some large animals can explain this later importance of small antelope. A more diverse bovid fauna was available to the Late Pleistocene hunters so there was less need for them to hunt *R. melanotis*.

The large bovid prey species are *Taurotragus oryx*, *Syncerus caffer* and *Pelorovis antiquus*. *T. oryx* is the best represented in NISP values in the 1984- sample and in the MNI estimates of the 1967-68 sample. *T. oryx* has all the attributes of a ready-made domesticate in being docile and easily driven, yet *T. oryx* has never been domesticated. They are mixed feeders, which allows them to maintain body fat levels better than obligate grazers and this may explain why they were highly ranked as a prey species. It is principally from evidence of a catastrophic mortality profile that Klein (1976, 1978) has argued that *T. oryx* remains in the Middle Stone Age at Klasies River main site and at Die Kelders show that herds were driven over cliffs. There are well-documented archaeological examples of driving herds of bison into fall traps in North America (Frison 1974), but none from South Africa. A better strategy would be to keep herds of antelope resident within a territory, by veld burning if necessary, and not frightening them by driving.

*S. caffer* is a small but consistent component in the fauna. It has been Klein's (1976) contention that buffalo and giant buffalo represent dangerous as opposed to docile animals and, therefore, mainly very young or very old individuals are represented their remains. Again age profiles of the *S. caffer* remains cannot be tested here but the NISP values suggest that as a prey item buffalo were obtained in the same relative proportion throughout the sequence. These animals may have been obtained from local resident herds in the riverine bushveld.

The *P. antiquus* with a wide horn span seems to have occupied more open habitats. In a factor analysis, Klein (1976) was able to show *S. caffer* and

*P. antiquus* loaded on different factors, supporting the contention that these two bovines had different habitat preferences. *P. antiquus* only occurs in the lower and uppermost levels of the site when grazers are well represented. Possibly *P. antiquus*, with its large body mass and wide horn span was the ecological equivalent of the buffalo in being a coarse feeder in open as opposed to closed habitats.

The occurrence of carnivores throughout the sequence indicates that they were resident in the area. Far from humans scavenging from the carnivores (Milo 1994), it is more likely that carnivores scavenged from the waste left by people. The faunal composition in several units in the sequence has overlapping signals in the form of cut marks, chew marks and the occasional coprolite. This shows that the intervals between people leaving the site and carnivores entering it were relatively short. Bones remain a viable source of nutrition for scavenges for some time after being discarded (Blumenschine 1986). Some overlap in hunting versus scavenging signals is to be expected. Carnivore predation could account for some of the hyrax and small bovid remains. This would have to be verified by the identification of modification marks on the bones.

## HABITAT AND FEEDING NICHES

The steep offshore profile (Van Andel 1989) means that the effects of sea level change on habitat in the Last Interglacial (*sensu lato*) were somewhat muted. The coast is a rocky high-energy environment with the filter feeder *Perna perna* well represented in all horizons (Voigt 1982). In most divisions the main prey species are *A. pusillus*, *R. melanotis*, *T. oryx* and *S. caffer*. The fauna from the LBS member is different in that it is dominated by large medium bovids and of the main prey species only *A. pusillus* occurs in any abundance. *Hippotragus leucophaeus* and *Hippopotamus amphibius* are best represented in this member. The sample is relatively small, but the fauna is suggestive of an open grassland and marshland environment. The isotope stratigraphy (Deacon, H.J. *et al.* 1988) would place the accumulation of the LBS fauna in the transition from MIS 5e-5d, a period of sea level regression. It would have been a unique environment with the closest modern analogue the Bredasdorp coastal plain.

The NISP values point to a more closed vegetation mosaic during the accumulation of the SAS member. The correlation of these strata with a transgressive phase during MIS 5c has been noted. Not only are browsers in relatively higher frequencies in the divisions of the SAS member, but SAS m includes the only occurrence of *Cephalophus monticola*, the forest duiker. The SAS t sample is somewhat anomalous because of its small size and in this sample mixed feeders have the highest frequency.

In the Upper member, the higher relative frequency of grazers to browsers suggests a relatively open environment. The correlation of these strata with MIS 5a-4 indicates an open habitat during sea level regression. Although no reduction in the NISP values for *A. pusillus* was documented in the 1984-sample, the MNI counts for the 1967-68 sample do show such a reduction (Klein & Cruz-Uribe 1996). The 1967-68 and 1984- samples indicate an increased representation of obligate grazers in the Upper member. The habitat was different from that during the accumulation of the SAS member and more like that when the sediments of the LBS member were deposited.

## BODY PART FREQUENCIES

Body part frequencies are a reflection of how a carcass was transported and processed. The effects of taphonomic variables such as selective transportation and differential preservation, discussed in Chapter 2, also influence the body part frequencies (Lyman 1984). The evidence for the selective transportation of body parts of bovid classes ('schlepp effect') requires detailed discussion with reference to the 1984- sample. Each of the five criteria set out in Chapter 5 must be fulfilled for the 'schlepp effect' to be accepted. If selective transport is rejected as an explanation, then an alternative explanation has to be offered.

Should selective transport have been a factor in the accumulation of the fauna at Klasies River main site in the Late Pleistocene, cranial remains would better represent larger bovids than the smaller bovids. This can be observed in the 1984- sample. However, the differences between large and large medium bovids, and the large medium and small bovids (Figure 14 in Chapter 5) are not marked; the differences are 16 and 17 NISP values respectively. This does not suggest that there was conscious transport of more whole crania of large bovids relative to small bovids. Small medium bovids were not considered because their cranial elements are under represented. A possible explanation for this under representation was noted during the identification of the remains. The teeth of small medium and large medium bovids appear to show more frequent indications of fire damage than those of large and small bovids teeth. Such material can only be identified to indeterminate bovid. This factor may account for the under representation of small medium bovid cranial remains. It would seem that medium sized crania could be placed directly on the hearth but very large and very small crania were treated differently.

In the 1984- sample, small bovids are better represent by post-cranial remains than in the other classes (Figure 14). This conforms to the expectation that, as a result of selective transport, small bovids were introduced to the site as whole carcasses. For every small bovid cranial element, seven or eight post-cranial elements were found. The large medium bovid data, however, do not support the expectation. The NISP values of this class have the second highest frequency of post-cranial remains. The under representation of smaller bovid cranial elements may give the impression that these were not returned to the site. There seems no logical reason to suggest that small bovids were decapitated before their carcasses were transported. It would be more acceptable to assume that their pattern is a reflection of taphonomic factors in the recovery of what are small fragile remains.

The most relevant data to questions of selective transport are the frequencies of cranial and foot bones (Figure 15 in Chapter 5). Klein (1976) has hypothesised that the large bovid limb bones and axial elements would not have been returned to the site in the same frequency as cranial and foot elements. The 1984- sample shows that the ratios of cranial to trunk (limb and axial elements) and to foot bones are similar. There is no bias towards higher representation of cranial and foot elements in any bovid size class. The trunk of the bovid skeleton accounts for almost 50% of the remains in all classes. No class is dominated by either cranial or foot elements. People were bringing entire carcass back from the kill site, with no special regard for cranial elements or feet.

The fourth criterion for selective transport has to do with the representation of limb bones and is that most likely to have been affected by the sampling bias. The discard of shaft bones in the 1967-68 excavation has led to a serious underestimation of these elements in the sample. The low frequency of shaft bones led to the assumption that these had been left at the kill site (Klein 1976) and that people did not have primary access to the carcasses from carnivore kills (Binford 1984). In the 1984- sample (Figure 16 in Chapter 5) small and large bovids are the classes best represented by limb bones. This negates the contention that smaller bovids are better represent by limb bones. Limb bones tend to be fragmented because they were processed for marrow, fat and grease (Todd & Rapson 1988, Marshall & Pilgram 1991). This has rendered many fragments unidentifiable. Fragmentation also makes bone more susceptible to diagenesis. The result is that limb elements are underrepresented in the counts for all bovid classes.

The last criterion to be reviewed is that the appendicular skeleton will be better represented than the axial. This is supported by the data for the 1984-sample (Figure 17 in Chapter 5). The elements of the appendicular skeleton are made of harder and denser bone than the vertebrae and ribs of the axial skeleton. For taphonomic reasons, it is to be expected that in any sample the axial skeleton would be poorly preserved. Figures 18-21 in Chapter 5 show that vertebrae, other than the atlas and axis, are the most abundant element in all bovid classes. In all but small bovids, rib fragments rank second in abundance. At this level of analysis, the axial elements are well represented. The most abundant appendicular elements are hard, dense elements, with small surface areas such as phalanges. The inherent morphology of the appendicular elements has ensured that they preserve well. However, it is apparent that axial elements were not left behind at a kill site. They were brought back to the site as part of the carcass to be processed there. The case for selective transport of different sized bovids is weak. Data from the 1984- sample do not fit all five criteria necessary to substantiated the contention of a 'schlepp effect'.

## COMPARISON OF THE 1967-68 AND 1984- SAMPLES

In an attempt to evaluate the bias introduced by the sampling techniques, the faunal samples from cave 1 from the 1967-68 excavation of Singer & Wymer (1982) and the 1984- excavation of the Witness Baulk (1984-WB) have been compared. The 1967-68 excavation sampled a larger volume of the deposit (Figure 26), yet the total bovid NISP values for the two samples are very similar (Table 13 in Chapter 5). A comparison between the two samples shows that small bovids were underestimated in the 1967 - 68 sample. Conversely large bovids were over estimated that sample. The use of ¼ inch sieves resulted in a higher probability of recovering larger than smaller bovid elements. The effect of this can be seen in Table 13 in Chapter 5 where the ratio of NISP values in the large bovid class for the 1967-68 and 1984-WB samples are 6:1 respectively. In the large medium and small medium bovid classes the same ratios are 3:2 and 1:1. Although the volume of the

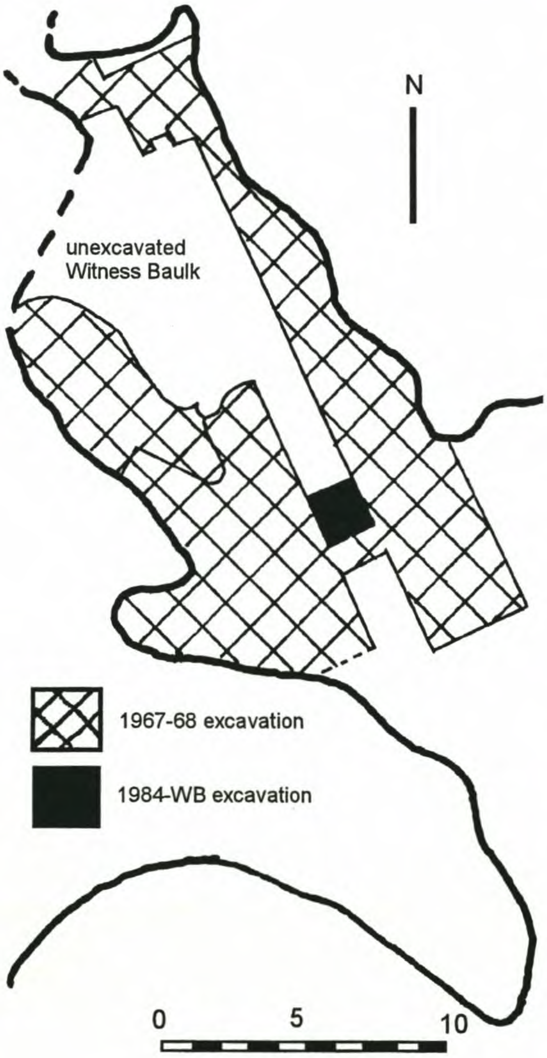


**Figure 26: The extent of the 1967-68 and 1984-WB excavations.**

deposit excavated in 1967-68 was perhaps an order of magnitude greater than that excavated in 1984- the NISP values for the small medium bovid class are virtually identical. The sieving factor has meant that small bovids are better represented in the 1984-WB sample and the ratio in this case is 1:2.

The comparison of the samples from the two excavations (Figure 22 in Chapter 5) shows that cranial and axial elements have been underestimated in the large bovid class in the 1967-68 sample, while foot and miscellaneous elements like patellae, have been over estimated. This pattern follows through to the large medium bovids (Figure 23 in Chapter 5), although it is not as strongly marked. The small medium bovid class (Figure 24 in Chapter 5) shows the axial, foot and miscellaneous elements in the 1967-68 sample are underestimated. The frequency of the small bovid (Figure 25 in Chapter 5) axial elements are similar to the 1967-68 sample, while foot elements, especially phalanges, were not recovered in the same frequency as in the 1984-WB sample.

The general pattern identified by Klein (1976) in the 1967-68 sample was that axial elements will increase with a decrease in bovid size and that foot elements will increase with an increase in body size. This does not hold true for the 1984-WB sample. Axial and foot element frequencies remain relatively constant with changes in bovid size. It is this observation that rules out selective transport as a factor in the accumulation of the fauna. Anomalies in the skeletal elements have more to do with differential preservation and sampling than human choice.

## CONCLUSION

The people at the Klasies River main site in the Late Pleistocene lived in changing environments. Habitat conditions changed with climate and the rise and fall of sea levels determined what bovid prey species were available. This can be documented in the relative frequencies of grazers and browsers hunted. The availability of *A. pusillus* was probably the most important factor next to the shelter offered by the cliff face in the selection of Klasies River main site as an occupation site. *A. pusillus* was part of the human diet with shellfish as a source of minerals and plant foods as staples. The terrestrial large mammals were an essential but probably smaller part of the diet. The selection of terrestrial prey species would have depended on what animals were present in the environment.

The contention that selective transportation can account for the relative frequencies of bovid body parts in the deposit at main site is not supported the study of the 1984- sample. The observed pattern is the product of the sampling regime adopted in the generation of the 1967-68 faunal sample. The 1984- sample shows that in all bovid classes the same skeletal elements were brought back to the site. No bovid size class is better represented by cranial or foot elements. Differences observed in body part representation between the classes can be accounted for in the way different sized carcasses were processed (Milo 1994) at the site rather than at a kill site. The presence of axial elements, particularly vertebrae, indicates that people had primary access to carcasses. This implies that they were involved in active hunting of all classes of bovids. The people living at Klasies River main site in the Late Pleistocene appear to have been hunters taking advantage of the opportunities provided by the local environments.

# Bibliography

Ardrey, R. 1958. African Genesis. London: Geoffrey Bles.

Behrensmeyer, A.K. 1991. Terrestrial vertebrate accumulations. In: Allison, P.A. & Biggs, D.E.G. (eds) Taphonomy: releasing the data locked in the fossil record: 291-335. Topics in geobiology Vol 9 New York: Plenum Press.

Behrensmeyer, A.K. & Hill, A.P. 1980. Introduction. In: Behrensmeyer, A.K. & Hill, A.P. (eds) Fossils in the making: vertebrate taphonomy and paleoecology. Chicago: University of Chicago Press.

Behrensmeyer, A.K. & Kidwell, S.M. 1985. Taphonomy's contribution to paleoecology. Paleobiology 11:105-119.

Binford, L.R. 1978. Nunamiut ethnoarchaeology. New York: Academic Press.

Binford, L.R. 1981. Bones: ancient men and modern myths. New York: Academic Press.

Binford, L.R. 1984. Faunal remains from Klasies River Mouth. London: Academic Press Incorporated.

Blumenshine, R.J. 1986. Carcass consumption sequences and the archaeological distinction of scavenging and hunting. Journal of Human Evolution 15:639-659.

Blumenshine, R.J. 1988. An experimental model for the timing of hominid and carnivore influence on archaeological bone assemblages. Journal of Archaeological Science 15:483-502.

Brain. C.K. 1967. Hottentot food remains and their bearing on the interpretation of fossil bone assemblages. Scientific Papers of the Namib Desert. Research Station No. 32.

Brain. C.K. 1969. The contribution of Namib Desert Hottentots to an understanding of Australopithecine bone accumulations. Scientific Papers of the Namib Desert. Research Station. No. 32.

Brain. C.K. 1974. Some suggested procedures in the analysis of bone accumulations from the South African Quaternary sites. Annals of the Transvaal Museum 29:1-5.

Brain. C.K. 1981. The Hunters or the hunted? An introduction to African cave taphonomy. Chicago: Chicago University Press.

Brink, J.S. 1987. The archaeozoology of Florisbad, Orange Free State. Memoiurs of the National Museum, Bloemfontein 24:1-151.

Bunn, H.T.; Bartram, L.E. & Kroll, E.M. 1988. Variability in bone assemblage formation from Hadza hunting, scavenging and carcass processing. Journal of Anthropological Archaeology 7:412-445.

Chaplin, R.E. 1971. The study of animal bones from archaeological sites. London: Seminar Press

Chase, P.G. & Hagaman,R.M. 1986. Minimum numbers of individuals and its alternatives: a probability theory perspective. Ossa 13:75-86

Dart, R.A. 1957a. The Makapansgat Australopithecine Osteodontokeratic Culture. In: Clark, J.D. (ed.) Third Pan-African Congress on Prehistory. London: Chatto & Windus.

Dart, R.A. 1957b. The Osteodontokeratic culture of *Australopithecus prometheus*. Transvaal Museum Memoirs no. 10:1-105.

Deacon, H.J. 1985. Book review: Faunal remains from Klasies River Mouth. South African Archaeological Bulletin 40:59-60.

Deacon, H.J. 1989. Late Pleistocene palaeoecology and archaeology in the southern Cape, South Africa. In Mellars, P. & Stringer, C. B. (ed.) The human revolution: 563-588. Edinburgh: Edinburgh University Press.

Deacon, H.J. 1992. Southern Africa and modern human origins. Philosophical Transactions of the Royal Society, London B 337:177-183.

Deacon, H.J. 1993. Planting an idea: an archaeology of Stone age gatherers. South African Archaeological Bulletin 48:86-93.

Deacon, H.J. 1995. Two Late Pleistocene-Holocene archaeological depositories. South African Archaeological Bulletin 50:121-131.

Deacon, H.J. in press. Modern human emergence: an African archaeological perspective. In: Proceedings of the Duel Congress held in 1998.

Deacon, H.J. & Deacon, J. 1999. Human beginnings in South Africa. Cape Town: David Philip Publishers.

Deacon H.J. & Geleijnse V.B. 1988. The stratigraphy and sedimentology of the main site sequence, Klasies River. South African Archaeological Bulletin 42:5-14.

Deacon, H.J., Talma, A.S. & Vogel, J.C. 1988. Biological and cultural developments of Pleistocene people in an old world southern continent. In: Prescott, J.R. (ed.) Early man in the southern hemisphere. Supplement to archaeometry: Australian studies 1988. Department of physics and mathematical physics, University of Adelaide, Adelaide.

Deacon, J. & Lancaster, N. 1988. Late Quaternary palaeoenvironments of Southern Africa. Oxford: Clarendon Press.

Efremov, I. A. 1940.Taphonomy: a new branch of paleontology. Pan-American Geologist. 74:81-93.

Frison, G.C. 1974. Archaeology of the Casper Site. In: Frison, G.C. (ed.) The Casper Site: a Hell Gap bison kill on the High Plains. Pp 1-111. New York: Academic Press.

Gifford, D. P. 1981. Taphonomy and paleoecology: a critical review of archaeology's sister disciplines. Advances in Archaeological Method and Theory 4:365-438.

Grayson, D.K. 1981. The effects of sample size on some derived measures in vertebrate faunal analysis. Journal of Archaeological Science 2:199-237.

Grayson, D.K. 1984. Quantitative zooarchaeology. London: Academic Press.

Grün, R., Schacketon, N.J. & Deacon, H.J. 1990. ESR dating of tooth enamel from Klasies River Mouth. Current Anthropology 31(4):427-432.

Hendey, Q.B. 1974. Faunal dating of the Late Cenozoic of southern Africa, with special reference to the Carnivora. Quaternary Research 4 :140-161.

Hendey, Q.B. 1983. Cenozoic geology and palaeogeography of the Fynbos region. In: Deacon, H.J., Hendey, Q.B. & Lambrechts, J.J.N. (eds) Fynbos palaeoecology: a preliminary synthesis. South African National Scientific Programmes Report No. 75.

Henshilwood, C.S. & Sealy, J.C. 1997. Bone artefacts from the Middle Stone Age at Blombos Cave, southern Cape, South Africa. Current Anthropology 38(5):890-895.

Inskeep, R.R. 1987. Nelson Bay Cave. Oxford: British Archaeological Reports International Series 357(i) & (ii).

Klein, R.G. 1975. Ecology of Stone Age man at the southern tip of Africa. Archaeology 28:238-247.

Klein, R.G. 1976. The mammalian fauna of the Klasies River Mouth sites. South African Archaeological Bulletin 31(123+124):75-98.

Klein, R.G. 1978. Stone Age predation on large African bovids. Journal of Archaeological Science 5:195-217.

Klein, R.G. 1979. Stone Age exploitation of animals in Southern Africa. American Scientist 67:151-160.

Klein, R.G. 1980a. The interpretation of mammalian faunas from stone-age archaeological sites, with special reference to sites in the southern Cape Province, South Africa. In: Behrensmeyer, A.K. & Hill, A.P. (eds) Fossils in the making: vertebrate taphonomy and paleoecology. Chicago: University of Chicago Press.

Klein, R.G. 1980b. Environmental and ecological implications of large mammals from Upper Pleistocene and Holocene sites in South Africa. Annals of the South African Museum 81:223-283.

Klein, R.G. 1981. Stone Age predation on small African bovids. South African Archaeological Bulletin 36:55-65.

Klein, R.G. 1982. Age (mortality) profiles as a means of distinguishing hunted species from scavenged one in South African archaeological sites. Paleobiology 8(2):151-158.

Klein, R.G. 1983. Paleoenvironmental implications of Quaternary large mammals in the Fynbos Biome. In: Deacon, H.J. Hendey, Q.B. & Lambrechts, J.J.N. (eds). Fynbos palaeoecology: a preliminary synthesis. South African National Scientific Programmes Report No 75.

Klein, R.G. 1989. Why does skeletal part representation differ between smaller and larger bovids at Klasies River Mouth and other archaeological sites. Journal of Archaeological Science 6:363-381.

Klein, R.G. 1994. The long-horned African buffalo (*Pelorovis antiquus*) is an extinct species. Journal of Archaeological Science 21:725-733.

Klein, R.G. 1995. Anatomy, behaviour and modern human origins. Journal of World Prehistory 9:167-198.

Klein, R.G. & Cruz-Uribe, K. 1984. The analysis of animal bones from archaeological sites. Chicago: University of Chicago Press.

Klein, R.G. & Cruz-Uribe, K. 1996. Exploitation of large bovids and seals at Middle and later Stone Age sites in South Africa. Journal of Human Evolution 31:315-334.

Lyman, R.L. 1984. Bone density and differential survivorship of fossil classes. Journal of Anthropological Archaeology 3:259-299.

Lyman, R.L. 1994. Vertebrate taphonomy. Cambridge: Cambridge University Press.

Marean, C.W. 1998. A critique of the evidence for scavenging by Neandertals and early modern humans: new data from Kobeh Cave (Zagros Mountains, Iran) and Die Kelders Cave 1 layer 10 (South Africa). Journal of Human Evolution 35:111-136.

Marean, C.W. & Kim, S.Y. 1998. Mousterian large-mammal remains from Kobeh Cave. Current Anthropology 39 (supplement June).

Marshall, F.B. & Pilgram. A. 1991. Meat versus within-bone nutrients: another look at the meaning of body-part representation in archaeological sites. Journal of Archaeological Science 18:149-163.

Miller, G.H., Beaumont, P.B., Deacon, H.J., Brooks, A.S., Hare, P.E. & Jull, A.J.T. 1999. Earliest modern humans in southern Africa dated by isoleucone epimerization in ostrich eggshell. Quaternary Geochronology (Quaternary Science Reviews) 18:1573-1548.

Miller, G.H., Beaumont, P.B., Jull, A.J.T. & Johnson, B. 1992. Pleistocene geochronology and palaeothermometry from protein diagenesis in ostrich eggshells: implications for the evolution of modern humans. Philosophical Transactions of the Royal Society, London B 337:149-158.

Milo, R.G. 1994. Human-animal interactions in South African prehistory: a microscopic study of bone damage signatures. University of Chicago, PhD Thesis

Milo, R.G. 1998. Evidence for hominid predation at Klasies River Mouth, South Africa and its implications for the behaviour of early modern humans. Journal of Archaeological Science 25:99-135.

Noë-Nygaard, N. 1987. Taphonomy in archaeology with special emphasis on man as a biasing factor. Journal of Danish Archaeology 6:7-52.

O'Connell, J.F., Hawkes, K. & Blurton Jones, N. 1988. Hadza hunting, butchering and bone transportation and the archaeological implications. Journal of Anthropological Research 44:113-161.

O'Connell, J.F., Hawkes, K. & Blurton Jones, N. 1990. Reanalysis of large mammal body part transport among Hadza. Journal of Archaeological Science 17:301-316.

Payne, S. 1972. Partial recovery and sample bias: the results of some sieving experiments. In Higgs, E.S. (ed). Papers in Economic Prehistory. pp. 49-64. London: Cambridge University Press.

Payne, S. 1975. Partial recovery and sample bias. In Clason, A.T. (ed) Archaeozoological Studies. pp. 7-17. New York: American Elsevier.

Plug, C. & Plug, I. 1990. MNI counts as estimates of species abundance. South African Archaeological Bulletin 43:53-57.

Price, T.D., Blitz, J. & Ezzo, J.A. 1992. Diagenesis in prehistoric bone: problems and solutions. Journal of Archaeological Science 19:513-529.

Ringrose, T. J. 1993. Bone counts and statistics: a critique. Journal of Archaeological Science 20:121-157.

Rightmire, G.P. & Deacon, H.J. 1991. Comparative studies of Late Pleistocene human remains from Klasies River Mouth, South Africa. Journal of Human Evolution 20:131-156.

Shaffer, B.S. 1992. Quarter-inch screening: understanding biases in recovery of vertebrate faunal remains. American Antiquity 57:129-136.

Singer, R. & Wymer, J. 1982. The Middle Stone Age at Klasies River Mouth in South Africa. Chicago: University of Chicago Press.

Smithers, R.H.N. 1983. The mammals of the southern African subregion. Pretoria: University of Pretoria.

Stallibrass, S. 1982. The use of cement layers for absolute ageing of mammalian teeth: a selective review of the literature, with suggestions for further studies and alternative applications. In: Wilson, W., Grigson, C. & Payne, S. (eds) Ageing and sexing animal bones from archaeological sites. British Archaeological Research, British Series 109.

Stiner, M.C. 1990. The use of mortality pattern in archaeological studies. Journal of Anthropological Archaeology 9:305-351.

Thackery, A.I. 1990. Carnivore activity at Klasies River Mouth: a response to Binford. Palaeontologia Africana 27:101-109.

Todd, L.C. & Rapson, D.J. 1988. Long bone fragmentation and interpretation of faunal assemblages: approaches to comparative analysis. Journal of Archaeological Science 15:307-325.

Turner, A. 1989. Sample selection schlepp effects and scavenging: the implications of partial recovery for the interpretations of the terrestrial mammal assemblages from Klasies River Mouth. Journal of Archaeological Science 16:1-12.

Van Andel, T.H. 1989. Late Pleistocene sea levels and the human exploitation of the shore and shelf of southern South Africa. Journal of Field Archaeology 16:133-55.

Vogel, J.C. In press. Radiometric dates for the Middle Stone Age in South Africa. In: Proceedings of the Duel Congress held in 1998.

Voigt 1982. The molluscan fauna. In: Singer, R. & Wymer, J. (eds) The Middle Stone Age at Klasies River Mouth in South Africa. Chicago: University of Chicago Press.

White, T.D. 1987. Cannibalism at Klasies? Sagittarius 2:6-9.

Woodborne, S., Hart, K. & Parkington, J. 1995. Seal bones as indicators of the timing and duration of hunter-gatherer coastal visits. Journal of Archaeological Science 22:727-740.

Yellen, J.E. 1991a. Small mammals: !Kung San utilization and the production of faunal assemblages. Journal of Anthropological Archaeological 10:1-26.

Yellen, J.E. 1991b. Small mammals: postdiscard patterning of the !Kung San faunal remains. Journal of Anthropological Archaeological 10:152-192.

# Appendix 1

## Bovid NISP data

### ABBREVIATIONS:

| | |
|---|---|
| dentes sup | (dentes superiores) upper teeth |
| dentes inf | (dentes inferiores) lower teeth |
| dentes indet | indeterminate teeth |
| other vert | vertebrae other than atlas and axis |
| hum P | proximal humerus |
| hum D | distal humerus |
| hum S | humerus shaft |
| hum C | complete humerus |
| rad P | proximal radius |
| rad D | distal radius |
| rad S | radius shaft |
| rad C | complete radius |
| ulna P | proximal ulna |
| ulna D | distal ulna |
| ulna S | ulna shaft |
| unla C | complete ulna |

| | |
|---|---|
| mtc P | proximal metacarpal |
| mtc D | distal metacarpal |
| mtc S | metacarpal shaft |
| mtc C | complete metacarpal |
| fem P | proximal femur |
| fem D | distal femur |
| fem S | femur shaft |
| fem C | complete femur |
| tib P | proximal tibia |
| tib D | distal tibia |
| tib S | tibia shaft |
| tib C | complete tibia |
| other tars. | other tarsals |
| mtt P | proximal metatarsal |
| mtt D | distal metatarsal |
| mtt S | metatarsal shaft |
| mtt C | complete metatarsal |
| mtp P | proximal metapodial |
| mtp D | distal metapodial |
| mtp S | metapodial shaft |
| indet shaft | indeterminate shaft |

| | |
|---|---|
| phal 1 P | proximal first phalange |
| phal 1 D | distal first phalange |
| phal 1 C | complete first phalange |
| phal 2 P | proximal second phalange |
| phal 2 D | distal second phalange |
| phal 2 C | complete second phalange |
| phal 3 P | proximal third phalange |
| phal 3 C | complete third phalange |

## Table 14: Large and large medium bovid NISP data

**LARGE BOVIDS**

| **Elelments** | **Upper** | **SAS t** | **SAS m** | **SAS b** | **LBS** | **TOTAL** |
|---|---|---|---|---|---|---|
| horn core | - | 1 | 2 | 16 | 1 | **20** |
| skull | - | - | - | 2 | 2 | **4** |
| maxilla | 2 | - | 2 |  |  | **4** |
| dentes sup | 2 | - | 7 | 15 | 5 | **29** |
| mandible | 3 | 1 | 3 | 12 | 4 | **23** |
| dentes inf | 22 | - | 6 | 33 | 8 | **69** |
| dentes indet | 20 | 7 | 6 | 13 | 4 | **50** |
| hyoid | 1 | - | - |  |  | **1** |
| atlas | - | - | - | 1 | 1 | **2** |
| axis | 1 | - | - | 2 | 1 | **4** |
| other vert | 12 | 5 | 5 | 26 | 6 | **54** |
| rib fragments | 10 | 2 | 7 | 26 | 7 | **52** |
| scapula | 1 | 1 | - | 3 | - | **5** |
| hum P | - | - | - | 3 | - | **3** |
| hum D | - | - | - | 4 | - | **4** |
| hum S | - | - | - | 2 | 1 | **3** |
| hum C | - | - | - | - | - | - |
| rad P | - | - | - | - | - | - |
| rad D | 1 | - | - | 1 | 1 | **3** |
| rad S | - | - | - | 1 | - | **1** |
| rad C | - | - | - | - | - | - |
| ulna P | - | - | - | 1 | - | **1** |
| ulna D | - | - | - | - | 1 | **1** |
| ulna S | - | - | - | - | - | - |
| ulna C | - | - | - | - | - | - |
| carpalla | 1 | 3 | - | 19 | 2 | **25** |
| mtc P | 3 | 2 | - | 5 | 7 | **17** |
| mtc D | 2 | - | - | - | - | **2** |
| mtc S | - | 1 | - | 2 | - | **3** |
| mtc C | - | - | - | - | - | - |
| pelvis | - | - | - | 2 | 1 | **3** |
| patella | - | - | - | 1 | 2 | **3** |
| fem P | - | - | - | 1 | - | **1** |
| fem D | - | 1 | - | 1 | - | **2** |
| fem S | - | - | - | 3 | - | **3** |
| fem C | - | - | - | - | - | - |
| tib P | - | - | - | - | 1 | **1** |
| tib D | 1 | - | - | 4 | 3 | **8** |
| tib S | 2 | - | 1 | 8 | 2 | **13** |
| tib C | - | - | - | - | - | - |
| fibula | - | - | - | - | - | - |
| astragalus | 1 | - | - | - | - | **1** |
| calcaneus | - | 1 | 1 | 2 | 2 | **6** |
| other tars | 5 | 1 | 1 | 3 | 1 | **11** |
| mtt P | - | - | 2 | 2 | 2 | **6** |
| mtt D | - | - | - | 1 | - | **1** |
| mtt S | - | - | - | 1 | 2 | **3** |
| mtt C | - | - | - | 1 | - | **1** |
| mtp P | - | - | - | 1 | 2 | **3** |
| mtp D | 2 | 1 | 2 | 4 | 3 | **12** |
| mtp S | - | - | - | 4 | - | **4** |
| indet shaft | - | - | 5 | 31 | 1 | **37** |
| phal 1 P | - | 2 | 3 | 7 | 2 | **14** |
| phal 1 D | 9 | 3 | 4 | 7 | 1 | **24** |
| phal 1 C | 1 | 1 | 2 | 2 | - | **6** |
| phal 2 P | 2 | - | 3 | 4 | - | **9** |
| phal 2 D | 6 | 1 | - | 5 | 2 | **14** |
| phal 2 C | 1 | 2 | 2 | 6 | 1 | **12** |
| phal 3 P | 2 | - | - | 5 | - | **7** |
| phal 3 C | 3 | 2 | 3 | 6 | - | **14** |
| sesamoid | 19 | 7 | 4 | 16 | 5 | **51** |
| **NISP** | **135** | **45** | **71** | **315** | **84** | **650** |

**LARGE MEDIUM BOVIDS**

| **Elelments** | **Upper** | **SAS t** | **SAS m** | **SAS b** | **LBS** | **TOTAL** |
|---|---|---|---|---|---|---|
| horn core | 4 | 1 | - | 6 | 7 | **18** |
| skull | 2 | - | - | 6 |  | **8** |
| maxilla | 2 | - | - | 1 | 1 | **4** |
| dentes sup | 4 | - | - | 19 | 5 | **28** |
| mandible | 2 | - | 5 | 8 | 2 | **17** |
| dentes inf | 9 | 1 | 11 | 29 | 1 | **51** |
| dentes indet | 34 | 2 | 8 | 6 | 8 | **58** |
| hyoid | - | - | - | - | - | - |
| atlas | - | - | 1 | 1 | 1 | **3** |
| axis | - | - | - | 1 | 1 | **2** |
| other vert | 13 | 1 | 11 | 77 | 21 | **123** |
| rib fragments | 13 | 1 | 13 | 51 | 24 | **102** |
| scapula | 1 | - | 1 | 10 | 2 | **14** |
| hum P | - | - | - | 7 | 2 | **9** |
| hum D | - | - | 1 | 4 | - | **5** |
| hum S | - | - | 1 | 2 | - | **3** |
| hum C | - | - | - | - | - | - |
| rad P | 1 | - | - | - | 2 | **3** |
| rad D | - | - | - | 1 | - | **1** |
| rad S | 1 | - | - | - | 2 | **3** |
| rad C | - | - | - | - | - | - |
| ulna P | 1 | 1 | - | 1 | 3 | **6** |
| ulna D | - | - | - | - | - | - |
| ulna S | - | - | - | - | - | - |
| ulna C | - | - | - | 1 | - | **1** |
| carpalla | 5 | - | 4 | 9 | 1 | **19** |
| mtc P | 1 | - | 1 | 3 | 2 | **7** |
| mtc D | - | - | - | 1 | - | **1** |
| mtc S | - | - | 1 | 3 | 4 | **8** |
| mtc C | - | - | - | - | 1 | **1** |
| pelvis | 1 | 1 | - | 2 | 4 | **8** |
| patella | 1 | - | 1 | 6 | 2 | **10** |
| fem P | - | - | - | 1 | - | **1** |
| fem D | 2 | 1 | - | 1 | - | **4** |
| fem S | - | - | 1 | - | 1 | **2** |
| fem C | - | - | - | - | - | - |
| tib P | 3 | - | - | 1 | - | **4** |
| tib D | - | - | - | 1 | 1 | **2** |
| tib S | 1 | - | 2 | 3 | 2 | **8** |
| tib C | - | - | - | - | - | - |
| fibula | - | - | - | - | - | - |
| astragalus | 2 | - | - | - | - | **2** |
| calcaneus | 5 | - | 1 | - | 3 | **9** |
| other tars | 8 | - | 2 | 5 | - | **15** |
| mtt P | - | - | - | 2 | 1 | **3** |
| mtt D | - | 1 | 1 | 2 | - | **4** |
| mtt S | 3 | 1 | 3 | 3 | 5 | **15** |
| mtt C | - | - | - | - | - | - |
| mtp P | 1 | - | - | 1 | - | **2** |
| mtp D | 4 | 1 | 8 | 12 | 4 | **29** |
| mtp S | - | - | - | 8 | - | **8** |
| indet shaft | - | - | 4 | 8 | - | **12** |
| phal 1 P | 3 | - | 2 | 5 | 4 | **14** |
| phal 1 D | 17 | 1 | 5 | 7 | 4 | **34** |
| phal 1 C | 1 | 2 | - | 1 | - | **4** |
| phal 2 P | 3 | 1 | - | 5 | 1 | **10** |
| phal 2 D | 6 | - | 3 | 8 | 3 | **20** |
| phal 2 C | 1 | 1 | 1 | 2 | 3 | **8** |
| phal 3 P | 1 |  | 2 | 2 | 1 | **6** |
| phal 3 C | 6 | 1 | 4 | 9 | 2 | **22** |
| sesamoid | 32 | 1 | 5 | 19 | 4 | **61** |
| **NISP** | **194** | **19** | **103** | **361** | **135** | **812** |

# Table 15: Small medium and small bovid NISP data

SMALL MEDIUM BOVIDS

| Elelments | Upper | SAS t | SAS m | SAS b | LBS | TOTAL |
|---|---|---|---|---|---|---|
| horn core | 1 | - | - | 1 | - | **2** |
| skull | 2 | - | - | - | 2 | **4** |
| maxilla | - | - | 2 | - | - | **2** |
| dentes sup | - | - | 6 | 16 | 1 | **23** |
| mandible | - | 1 | 2 | 12 | 2 | **17** |
| dentes inf | 9 | 2 | 1 | 4 | 1 | **17** |
| dentes indet | 3 | - | 1 | 1 | 2 | **7** |
| hyoid | - | - | - | - | - | - |
| atlas | - | - | 1 | - | - | **1** |
| axis | - | - | - | 3 | - | **3** |
| other vert | 6 | 2 | 21 | 72 | 4 | **105** |
| rib fragments | 12 | 3 | 15 | 30 | 15 | **75** |
| scapula | 1 | - | 3 | 9 | 1 | **14** |
| hum P | - | - | 1 | 3 | - | **4** |
| hum D | 1 | - | 2 | 3 | 2 | **8** |
| hum S | - | - | - | 5 | - | **5** |
| hum C | - | - | - | - | - | - |
| rad P | - | - | - | 3 | - | **3** |
| rad D | - | - | 1 | 1 | - | **2** |
| rad S | - | - | - | - | - | - |
| rad C | - | - | - | - | - | - |
| ulna P | 1 | - | 1 | 2 | 1 | **5** |
| ulna D | - | - | - | - | - | - |
| ulna S | - | - | - | - | - | - |
| ulna C | - | - | - | - | - | - |
| carpalla | 3 | 1 | 4 | 11 | 3 | **22** |
| mtc P | 1 | - | 2 | - | - | **3** |
| mtc D | - | - | 1 | - | - | **1** |
| mtc S | - | - | - | - | - | - |
| mtc C | - | - | - | - | - | - |
| pelvis | - | 1 | 1 | 6 | 1 | **9** |
| patella | - | - | 5 | 7 | 1 | **13** |
| fem P | - | - | - | 4 | 1 | **5** |
| fem D | 2 | 1 | 1 | 2 | - | **6** |
| fem S | - | - | - | - | - | - |
| fem C | - | - | - | - | 1 | **1** |
| tib P | - | - | - | 5 | - | **5** |
| tib D | - | - | 1 | - | - | **1** |
| tib S | - | - | - | 2 | - | **2** |
| tib C | - | - | - | - | - | - |
| fibula | - | - | - | - | - | - |
| astragalus | 1 | - | - | 4 | 1 | **6** |
| calcaneus | 2 | 1 | 2 | 1 | 2 | **8** |
| other tars | 3 | 1 | 2 | 1 | 1 | **8** |
| mtt P | 1 | - | 3 | 1 | 3 | **8** |
| mtt D | 2 | - | - | - | - | **2** |
| mtt S | - | - | - | 1 | 1 | **2** |
| mtt C | - | - | - | - | - | - |
| mtp P | 1 | - | 1 | 1 | 1 | **4** |
| mtp D | 11 | 1 | 2 | 12 | 1 | **27** |
| mtp S | - | - | 3 | 4 | - | **7** |
| indet shaft | - | - | - | 5 | - | **5** |
| phal 1 P | 9 | 1 | 10 | 10 | 3 | **33** |
| phal 1 D | 9 | - | 5 | 4 | 4 | **22** |
| phal 1 C | 1 | - | 3 | 2 | 1 | **7** |
| phal 2 P | 2 | - | 1 | 5 | 5 | **13** |
| phal 2 D | 13 | - | 3 | 3 | 3 | **22** |
| phal 2 C | 4 | - | 2 | 6 | 3 | **15** |
| phal 3 P | 5 | 1 | 2 | 3 | - | **11** |
| phal 3 C | 10 | 1 | 11 | 10 | - | **32** |
| sesamoid | 14 |  | 7 | 18 | 2 | **41** |
| **NISP** | **130** | **17** | **129** | **293** | **69** | **638** |

SMALL BOVIDS

| Elelments | Upper | SAS t | SAS m | SAS b | LBS | TOTAL |
|---|---|---|---|---|---|---|
| horn core | - | - | 1 | 1 | 1 | **3** |
| skull | - | - | - | 1 | - | **1** |
| maxilla | - | - | 5 | 12 | 1 | **18** |
| dentes sup | 5 | 1 | 17 | 20 | 1 | **44** |
| mandible | 3 |  | 12 | 34 | 3 | **52** |
| dentes inf | 10 | 1 | 7 | 21 | 6 | **45** |
| dentes indet | 2 | 1 | - | 1 | - | **4** |
| hyoid | - | - | - | - | - | - |
| atlas | - | - | - | 4 | - | **4** |
| axis | - | - | 2 | 1 | 1 | **4** |
| other vert | 24 | 11 | 56 | 95 | 3 | **189** |
| rib fragments | 7 | 5 | 29 | 13 | 3 | **57** |
| scapula | 1 | 1 | 7 | 27 | 3 | **39** |
| hum P | 1 | - | 4 | 8 | - | **13** |
| hum D | 2 | - | 10 | 20 | 2 | **34** |
| hum S | 1 | - | - | - | - | **1** |
| hum C | - | - | - | - | - | - |
| rad P | 5 | 1 | 2 | 4 | - | **12** |
| rad D | 5 | - | 2 | 4 | - | **11** |
| rad S | - | - | - | - | - | - |
| rad C | - | - | - | - | - | - |
| ulna P | 1 | 1 | 1 | 2 | - | **5** |
| ulna D | - | - | - | - | - | - |
| ulna S | - | - | - | - | - | - |
| ulna C | - | - | - | - | 1 | **1** |
| carpalla | 14 | 1 | 30 | 14 | - | **59** |
| mtc P | 4 | - | 3 | 3 | 1 | **11** |
| mtc D | - | - | - | - | - | - |
| mtc S | - | - | 1 | - | - | **1** |
| mtc C | - | - | - | - | - | - |
| pelvis | 3 | - | 6 | 7 | 1 | **17** |
| patella | 7 | 1 | 7 | 5 | 2 | **22** |
| fem P | 6 | - | 5 | 16 | - | **27** |
| fem D | 2 | 1 | 8 | 11 | 2 | **24** |
| fem S | - | - | 1 | - | - | **1** |
| fem C | - | - | 1 | 1 | 3 | **5** |
| tib P | 2 | - | 2 | 1 | - | **5** |
| tib D | 6 | - | 5 | 6 | - | **17** |
| tib S | 1 | - | - | - | - | **1** |
| tib C | - | - | - | - | - | - |
| fibula | - | - | - | - | - | - |
| astragalus | 7 | 2 | 3 | 11 | - | **23** |
| calcaneus | 11 | 1 | 12 | 4 | - | **28** |
| other tars | 14 | 1 | 6 | 2 | 1 | **24** |
| mtt P | 6 | - | 2 | 1 | 1 | **10** |
| mtt D | 1 | 1 | 5 | - | 1 | **8** |
| mtt S | 1 | - | - | - | - | **1** |
| mtt C | - | - | - | 1 | - | **1** |
| mtp P | - | 1 | 1 | 1 | - | **3** |
| mtp D | 21 | 4 | 17 | 21 | - | **63** |
| mtp S | - | - | 4 | 1 | - | **5** |
| indet shaft | - | - | - | - | - | - |
| phal 1 P | 28 | 2 | 13 | 14 | 2 | **59** |
| phal 1 D | 15 | 2 | 14 | 6 | 2 | **39** |
| phal 1 C | 2 | 4 | 12 | 17 | 1 | **36** |
| phal 2 P | 3 | 1 | 6 | 6 | 1 | **17** |
| phal 2 D | 11 | 1 | 6 | 8 | - | **26** |
| phal 2 C | 15 | 4 | 17 | 22 | 3 | **61** |
| phal 3 P | - | - | 6 | 2 | - | **8** |
| phal 3 C | 49 | 5 | 37 | 29 | - | **120** |
| sesamoid | 8 | - | 10 | 12 | 1 | **31** |
| **NISP** | **304** | **54** | **395** | **490** | **47** | **1290** |

## Table 16: Indeterminate bovid NISP data

| | Indeterminate bovids | | | | | |
|---|---|---|---|---|---|---|
| | **Upper** | **SAS t** | **SAS m** | **SAS b** | **LBS** | **TOTAL** |
| horn core | - | - | 22 | 27 | 14 | 63 |
| skull | - | - | - | 20 | - | 20 |
| maxilla | - | - | - | 3 | - | 3 |
| dentes sup | - | - | 2 | 6 | 1 | 9 |
| mandible | - | - | 1 | 9 | - | 10 |
| dentes inf | 1 | - | - | 3 | 3 | 7 |
| dentes indet | - | - | 19 | 62 | - | 81 |
| other vert | - | - | - | 11 | 2 | 13 |
| scapula | - | - | - | 3 | - | 3 |
| hum P | - | - | - | 1 | - | 1 |
| carpalla | - | - | 1 | - | - | 1 |
| mtt P | - | - | - | - | 1 | 1 |
| mtt S | - | - | - | - | 1 | 1 |
| mtp S | - | - | - | - | 1 | 1 |
| indet shaft | - | - | 3 | 1 | - | 4 |
| phal 3 C | - | - | 1 | - | - | 1 |
| sesamoid | - | - | 1 | 1 | - | 2 |
| NISP | 1 | - | 50 | 147 | 23 | 221 |

# Appendix 2

## Comparison of the 1967-68 and 1984-WB excavations

### Table 17: Comparison of the 1967-68 and 1984-WB bovid NISP values

| **Cave 1** | **LB** | | **LMB** | | **SMB** | | **SB** | | **Total** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1967-68 | 1984-WB | 1967-68 | 1984-WB | 1967-68 | 1984-WB | 1967-68 | 1984-WB | 1967-68 | 1984-WB |
| maxilla | 13 | 2 | 14 | 1 | 6 | 2 | 13 | 0 | 46 | 5 |
| mandible | 46 | 11 | 55 | 18 | 31 | 12 | 65 | 18 | 197 | 59 |
| atlas | 22 | 1 | 22 | 1 | 7 | 0 | 12 | 4 | 63 | 6 |
| axis | 16 | 2 | 9 | 1 | 9 | 3 | 12 | 2 | 46 | 8 |
| other vert | 139 | 28 | 150 | 82 | 151 | 83 | 136 | 128 | 576 | 321 |
| rib fragments | 42 | 25 | 65 | 36 | 22 | 29 | 10 | 23 | 139 | 113 |
| scapula | 43 | 3 | 96 | 9 | 75 | 10 | 110 | 29 | 324 | 51 |
| hum P | 12 | 3 | 6 | 7 | 8 | 3 | 6 | 12 | 32 | 25 |
| hum D | 67 | 4 | 33 | 4 | 29 | 4 | 37 | 23 | 166 | 35 |
| rad P | 79 | 0 | 13 | 0 | 10 | 2 | 7 | 5 | 109 | 7 |
| rad D | 43 | 1 | 18 | 1 | 7 | 1 | 6 | 4 | 74 | 7 |
| ulna P | 78 | 0 | 14 | 1 | 12 | 3 | 17 | 0 | 121 | 4 |
| ulna D | 23 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 29 | 0 |
| carpalla | 309 | 19 | 35 | 10 | 2 | 11 | 0 | 37 | 346 | 77 |
| mtc P | 197 | 3 | 43 | 3 | 8 | 2 | 4 | 4 | 252 | 12 |
| mtc D | 102 | 0 | 31 | 1 | 14 | 1 | 4 | 0 | 151 | 2 |
| pelvis | 73 | 2 | 80 | 1 | 42 | 2 | 68 | 7 | 263 | 12 |
| patella | 31 | 1 | 7 | 7 | 7 | 11 | 1 | 10 | 46 | 29 |
| fem P | 32 | 1 | 19 | 1 | 14 | 4 | 19 | 19 | 84 | 25 |
| fem D | 27 | 1 | 12 | 1 | 19 | 2 | 25 | 15 | 83 | 19 |
| tib P | 11 | 0 | 16 | 1 | 11 | 5 | 15 | 2 | 53 | 8 |
| tib D | 73 | 4 | 48 | 1 | 16 | 1 | 22 | 6 | 159 | 12 |
| astragalus | 116 | 0 | 46 | 0 | 19 | 4 | 18 | 11 | 199 | 15 |
| calcaneus | 102 | 2 | 46 | 0 | 25 | 1 | 26 | 7 | 199 | 10 |
| other tars | 100 | 2 | 20 | 3 | 3 | 0 | 5 | 2 | 128 | 7 |
| mtt P | 135 | 2 | 51 | 0 | 18 | 2 | 8 | 0 | 212 | 4 |
| mtt D | 73 | 0 | 24 | 2 | 18 | 0 | 13 | 1 | 128 | 3 |
| phal 1 C | 312 | 15 | 75 | 12 | 10 | 25 | 9 | 55 | 406 | 107 |
| phal 2 C | 203 | 14 | 34 | 16 | 3 | 13 | 1 | 56 | 241 | 99 |
| phal 3 C | 170 | 12 | 42 | 15 | 4 | 16 | 0 | 59 | 216 | 102 |
| sesamoid | 135 | 9 | 3 | 16 | 0 | 19 | 0 | 20 | 138 | 64 |
| total | 2824 | 167 | 1132 | 251 | 601 | 271 | 669 | 559 | 5226 | 1248 |

## Table 18: Comparison of the 1967-68 and 1984-WB bovid element ratios

| **Cave 1** | **LB** | | **LMB** | | **SMB** | | **SB** | | **total** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1967-68 | 1984-WB | 1967-68 | 1984-WB | 1967-68 | 1984-WB | 1967-68 | 1984-WB | 1967-68 | 1984-WB |
| maxilla | 0.5% | 1.2% | 1.2% | 0.4% | 1.0% | 0.7% | 1.9% | 0.0% | 1% | 0% |
| mandible | 1.6% | 6.6% | 4.9% | 7.2% | 5.2% | 4.4% | 9.7% | 3.2% | 4% | 5% |
| atlas | 0.8% | 0.6% | 1.9% | 0.4% | 1.2% | 0.0% | 1.8% | 0.7% | 1% | 0% |
| axis | 0.6% | 1.2% | 0.8% | 0.4% | 1.5% | 1.1% | 1.8% | 0.4% | 1% | 1% |
| other vert | 4.9% | 16.8% | 13.3% | 32.7% | 25.1% | 30.6% | 20.3% | 22.9% | 11% | 26% |
| rib fragments | 1.5% | 15.0% | 5.7% | 14.3% | 3.7% | 10.7% | 1.5% | 4.1% | 3% | 9% |
| scapula | 1.5% | 1.8% | 8.5% | 3.6% | 12.5% | 3.7% | 16.4% | 5.2% | 6% | 4% |
| hum P | 0.4% | 1.8% | 0.5% | 2.8% | 1.3% | 1.1% | 0.9% | 2.1% | 1% | 2% |
| hum D | 2.4% | 2.4% | 2.9% | 1.6% | 4.8% | 1.5% | 5.5% | 4.1% | 3% | 3% |
| rad P | 2.8% | 0.0% | 1.1% | 0.0% | 1.7% | 0.7% | 1.0% | 0.9% | 2% | 1% |
| rad D | 1.5% | 0.6% | 1.6% | 0.4% | 1.2% | 0.4% | 0.9% | 0.7% | 1% | 1% |
| ulna P | 2.8% | 0.0% | 1.2% | 0.4% | 2.0% | 1.1% | 2.5% | 0.0% | 2% | 0% |
| ulna D | 0.8% | 0.0% | 0.4% | 0.0% | 0.2% | 0.0% | 0.0% | 0.0% | 1% | 0% |
| carpalla | 10.9% | 11.4% | 3.1% | 4.0% | 0.3% | 4.1% | 0.0% | 6.6% | 7% | 6% |
| mtc P | 7.0% | 1.8% | 3.8% | 1.2% | 1.3% | 0.7% | 0.6% | 0.7% | 5% | 1% |
| mtc D | 3.6% | 0.0% | 2.7% | 0.4% | 2.3% | 0.4% | 0.6% | 0.0% | 3% | 0% |
| pelvis | 2.6% | 1.2% | 7.1% | 0.4% | 7.0% | 0.7% | 10.2% | 1.3% | 5% | 1% |
| patella | 1.1% | 0.6% | 0.6% | 2.8% | 1.2% | 4.1% | 0.1% | 1.8% | 1% | 2% |
| fem P | 1.1% | 0.6% | 1.7% | 0.4% | 2.3% | 1.5% | 2.8% | 3.4% | 2% | 2% |
| fem D | 1.0% | 0.6% | 1.1% | 0.4% | 3.2% | 0.7% | 3.7% | 2.7% | 2% | 2% |
| tib P | 0.4% | 0.0% | 1.4% | 0.4% | 1.8% | 1.8% | 2.2% | 0.4% | 1% | 1% |
| tib D | 2.6% | 2.4% | 4.2% | 0.4% | 2.7% | 0.4% | 3.3% | 1.1% | 3% | 1% |
| astragalus | 4.1% | 0.0% | 4.1% | 0.0% | 3.2% | 1.5% | 2.7% | 2.0% | 4% | 1% |
| calcaneus | 3.6% | 1.2% | 4.1% | 0.0% | 4.2% | 0.4% | 3.9% | 1.3% | 4% | 1% |
| other tars | 3.5% | 1.2% | 1.8% | 1.2% | 0.5% | 0.0% | 0.7% | 0.4% | 2% | 1% |
| mtt P | 4.8% | 1.2% | 4.5% | 0.0% | 3.0% | 0.7% | 1.2% | 0.0% | 4% | 0% |
| mtt D | 2.6% | 0.0% | 2.1% | 0.8% | 3.0% | 0.0% | 1.9% | 0.2% | 2% | 0% |
| phal 1 C | 11.0% | 9.0% | 6.6% | 4.8% | 1.7% | 9.2% | 1.3% | 9.8% | 8% | 9% |
| phal 2 C | 7.2% | 8.4% | 3.0% | 6.4% | 0.5% | 4.8% | 0.1% | 10.0% | 5% | 8% |
| phal 3 C | 6.0% | 7.2% | 3.7% | 6.0% | 0.7% | 5.9% | 0.0% | 10.6% | 4% | 8% |
| sesamoid | 4.8% | 5.4% | 0.3% | 6.4% | 0.0% | 7.0% | 0.0% | 3.6% | 3% | 5% |