A PALAEODEMOGRAPHIC, PALAEOPATHOLOGIC AND MORPHOLOGIC STUDY OF THE 20th CENTURY VENDA

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DECLARATION

I declare that this thesis is my own unaided work. It is being submitted for the degree of Doctor of Philosophy at the University of Pretoria, Pretoria. It is has not been submitted before for any degree or examination in any other University.

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Table of Contents

List of Figures iv
List of Tables v
Abstract vii
Acknowledgments ix

Chapter 1. Introduction
1.1. The 20th century Venda 1
1.2. Origins of the Venda 8
1.3. Aim 10

Chapter 2. Materials and Methods
2.1. Origin of the skeletal material 13
2.1.1. Nandoni Dam Project (2001) 14
2.1.2. Approval for skeletal analysis 14
2.1.3. Excavation of graves in Venda 14
2.1.4. Accession numbers for skeletons from Nandoni 15
2.1.5. Mutoti Dam Project (1999) 15
2.2. Skeletal material 16
2.3. Methods for skeletal analysis 16
2.3.1. Metric analysis 16
2.3.2. Sex determination 16
2.3.2.1. Morphology 17
2.3.2.2. Osteometric analysis 18
2.3.2.3. Juveniles 19
2.3.3. Age determination 19
2.3.3.1. Stillborns, Infants and Juveniles 20
2.3.3.2. Adults 22

Chapter 3. Palaeodemography
3.1. Introduction & Literature Review 26
3.1.1. Sampling of the population 28
3.1.2. Estimation of age from skeletal remains 28
3.1.3. Stationary populations 30
3.1.4. Individual heterogeneity 31
3.1.5. Aim 31
3.2. Materials and Methods 31
3.2.1. Comparative South African populations 33
3.3. Results 36
3.4. Discussion 40
3.4.1. Shortcomings 40
3.4.2. Interpretation of the demographic profile 40
3.4.2. General demographic trends from the Iron Age to present 42

Chapter 4. Palaeopathology

4.1. Introduction & Literature Review 52
4.1.1. Aim 54
4.2. Materials and Methods 55
4.3. Results 55
4.3.1. Non-specific signs of infectious disease 56
4.3.1.1. Sub-periosteal lesions 59
4.3.1.2. Cribra orbitalia 62
4.3.2. Specific infectious disease 65
4.3.2.1. Leprosy 65
4.3.2.2. Osteomyelitis 67
4.3.3. Trauma 72
4.3.4. Arthritis – degenerative changes in the skeleton 75
4.3.4.1. Osteoarthritis 75
4.3.4.2. Spinal degeneration 77
4.3.5. Stature 79

Chapter 5. Dental Health

5.1. Introduction & Literature Review 93
5.1.1. Aim 94
5.2. Materials and Methods 94
5.3. Results 94
5.4. Dental caries 95
5.5. Periapical abscess 103
5.6. Antemortem tooth loss (AMTL) 105
5.7. Enamel hypoplasia 109

Chapter 6. Population Affinity

6.1. Craniometry 121
6.1.1. Theories regarding the origin of the Venda 121
6.1.2. Cranial variation among humans 123
6.1.3. Aim 124
6.1.4. Materials and methods 125
6.1.4.1. Comparative populations 125
6.1.4.2. Metric variables and statistical analysis 128
6.1.4.3. Univariate statistics 129
6.1.4.4. Multivariate statistics 129
6.1.5. Results 132
6.1.5.1. ANOVA 132
6.1.5.2. Discriminant function (canonical analysis) 133
6.1.5.3. Factor analysis 135
6.1.6. Discussion 137
6.1.6.1. Relationship between the Venda and other African groups 138
6.1.6.2. Relationship between K2 and the Venda 140

6.2. Odontometry
6.2.1. Introduction 163
6.2.2. Materials and methods 166
6.2.2.1. Comparative populations 167
6.2.2.2. Penrose analysis 171
6.2.3. Results 171
6.2.4. Discussion 173

Chapter 7. Discussion
7.1. Introduction 180
7.2. Sample representation 181
7.2.1. Exhumation of graves in Venda 181
7.2.2. Preservation of skeletal remains 183
7.3. General health status of the Venda 184
7.3.1. Demography 184
7.3.2. Infectious disease 186
7.3.3. Dental health 191
7.4. Population affinity 193

Chapter 8. Conclusion 197

References 200

Appendix A
Legend 227
Individual skeletal reports 228
Appendix B
Descriptive statistics of cranial measurements for males and females 362
Appendix C
Descriptive statistics of post cranial measurements for males and females 363

List of Figures

Figure 1.1. Map of Africa showing the location of South African and Venda **12**
Figure 1.2. Skeletons used in this study came from: Budeli, Dididi, Mpego, Mulenzhe, and Mutoti. Tshilangoma and the Machivandihala are not shown. **12**
Figure 4.1. Destruction of the hard palate and loss of the maxilla, possibly leprosy (NANMUL267) **85**
Figure 4.2. Possible case of leprosy: destruction of the hard palate of NANMUL267 **86**
Figure 4.3. Atrophy of the maxilla and nasal margin, possible case of leprosy (NANMUL267) **87**
Figure 4.4. Compound fracture with visible cloacae (NANMUL375) **88**
Figure 4.5. Possible case of osteomyelitis (NANMUL766) **88**
Figure 4.6. Osteomyelitis: upper humerus (NANMUL267) **89**
Figure 4.7. Osteomyelitis: left femur (NANMUL267) **90**
Figure 4.8. Healed fracture: left femur (NANMUL375) **91**
Figure 4.9. Surgical wire on the mandible (NANMUL261) **91**
Figure 4.10. Compressed fracture of T8 (NANMUL337) **92**
Figure 6.1.1. Map of comparative populations **153**
Figure 6.1.2. Scatterplot of analysis I of MDA **154**
Figure 6.1.3. Scatterplot of analysis II of MDA **155**
Figure 6.1.4. Scatterplot of analysis IV of MDA **156**
Figure 6.1.5. Scatterplot of factor analysis I: Vault (Face) **157**
Figure 6.1.6. Scatterplot of factor analysis II: Vault (Face) **158**
Figure 6.1.7. Scatterplot of factor analysis III: Vault (Face) **159**
Figure 6.1.8: Scatterplot of factor analysis IV: Face (Vault) **160**
Figure 6.1.9. Scatterplot of factor analysis V: Face (Vault) **161**
Figure 6.1.10. Scatterplot of factor analysis VI: Face (Vault) **162**

List of Tables

Table 2.1. Summary of skeletal material from seven villages in Venda **25**

Table 3.1. Life tables for the Venda not adjusted for growth rate **44**

Table 3.2. Life tables for the Venda adjusted for a growth rate of 2.3% **45**

Table 3.3. Life table for black South Africans from the Rebecca Street Cemetery not adjusted for growth rate **46**

Table 3.4. Life table for black South Africans from the Rebecca Street Cemetery adjusted for a growth rate of 2.3% **47**

Table 3.5. Life table for white South Africans from the Rebecca Street Cemetery not adjusted for growth rate. **48**

Table 3.6. Life table for white South Africans from the Rebecca Street Cemetery adjusted for growth rate of 1.85%. **49**

Table 3.7. Comparison of life expectancy at birth and adulthood among various populations in Southern Africa. **50**

Table 3.8. Life expectancy at birth and adulthood for whites and blacks in South Africa by decade from the burial registers at the Rebecca Street and Mamelodi cemeteries adjusted for a growth rate of r = .0185 (whites) and .023 (blacks). **51**

Table 3.9. Comparison of mortality rates for children less than 5 years of age with life expectancy at birth for South African blacks and whites for the years 1935-1970. **51**

Table 4.1. Frequency of skeletal pathology in the Venda **82**

Table 4.2. Comparison of sub-periosteal growth on the long bones **82**

Table 4.3. Frequency of cribra orbitalia in South African populations **83**

Table 4.4. A summary of stature of the Venda and other South African populations. **84**

Table 5.1. Summary of the incidence of dental caries in the Venda. **113**

Table 5.2. Caries intensity for the Venda sorted by age and sex. **113**

Table 5.3. Caries intensity for the Venda sorted by sex and tooth type. **114**

Table 5.4. Incidence of dental caries in various South African populations. **115**

Table 5.5. Summary of the incidence of AMTL in the Venda. **116**

Table 5.6. AMTL intensity for the Venda sorted by sex and age.
116
Table 5.7. AMTL per tooth type for the Venda sorted by sex and age.
117
Table 5.8. Summary of the incidence of enamel hypoplasia in the Venda.
118
Table 5.9. Enamel hypoplasia in the Venda sorted by sex and tooth type.
119
Table 5.10. Incidence of enamel hypoplasia in various South African populations.
120
Table 6.1.1. Summary of categorical variables for population 1 & population 2.
142
Table 6.1.2 Metric variables used from the cranium and mandible.
143
Table 6.1.3. Descriptive statistics of metric variables from the cranium and mandible.
144
Table 6.1.4a. One way analysis of variance for testing group differences on individual variables (POP1)
145
Table 6.1.4b. One way analysis of variance for testing group differences on individual variables (POP2)
146
Table 6.1.5. Eigenvalues for analysis I, III & IV for the discriminant axes for population 2.
147
Table 6.1.6. Classification results: predicted group membership for MDA 1.
147
Table 6.1.7. Classification results: predicted group membership for MDA 3.
148
Table 6.1.8. Classification results: predicted group membership for MDA 4.
148
Table 6.1.9. Summary of eigenvalues for factor analysis I-VI for population 2.
149-150
Table 6.1.10. One way analysis of variance: testing group differences on the regression factor scores.
151
Table 6.1.11. Independent sample t-tests on regression factor scores between Venda and each other group.
152
Table 6.2.1. Descriptive statistics of the mesiodistal and buccolingual dimensions in the maxilla and mandible and a t-test between the sexes.
176
Table 6.2.2. Penrose shape distances for pooled (male and female) South African & North American groups for the maxilla and mandible.
177
Table 6.2.3. Penrose shape distance for the maxilla and mandible in females.
178
Table 6.2.4. Penrose shape distance for the maxilla and mandible in males.
179

Abstract

In 1999, the Department of Water Affairs and Forestry (DWAF) initiated the development of the Nandoni Dam. A component of this project was the relocation of seven rural villages, which include Mulenzhe, Budeli, Dididi, Mpego, Machivandihala Agricultural College, Mutoti and Tshilangoma. Upon request from the community, DWAF had to provide for the exhumation of approximately 1,000 graves dating to the 20th century. A comprehensive analysis of the 160 skeletons (118 adults and 42 juveniles) found in association with these graves was performed, and a description of the health and disease patterns of these rural communities was provided. A secondary objective of this study was to assess the biological affinity of the Venda by examining both craniometric and odontometric traits.

A demographic profile of these communities revealed a high incidence of death in children less than 5 years of age and medium ranged adult mortality that peaked between 45 and 55 years of age. This profile is similar to other contemporary black South African communities, and has been associated with poverty, poor living conditions and poor sanitation. When compared to Iron Age populations, it was noted that a dramatic decline in child mortality and a slight increase in adult longevity has occurred in black South African populations within the past 800 years. This may be associated with a reduction in the number of children born per mother and general improvements in lifestyle and living conditions.

Medical researchers suggest that infectious disease and parasite infestation were high in rural Venda communities during the 20th century. Despite the high pathogen load in the environment, skeletal markers of non-specific diseases in this study were found to be minimal. This may be attributed to the administering of medication at both hospitals and local clinics, which would have arrested the development of diseases caused by bacteria and parasites. Overall, it appears that medicine improved health for the individual, but it was relatively ineffective on reducing the number of pathogens in the general environment.

Dental health was relatively good for these communities. Tooth decay was more common in Venda than other agricultural based populations and may be related to the increased consumption of western foods such as refined maize and sugar.

The results of uni- and multivariate statistical analyses on the craniometric and odontometric traits are indicative of a stronger relationship between the Venda and South African Negroid populations than the East Africa groups. This supports the idea of local development of the Venda people in the Soutpansberg region. These results are also in agreement with other studies that have shown similarities in cranial and dental morphology of South African Negroids with the Venda. Due to the small sample size from K2, it was not possible to establish a direct relationship between this group and the Venda. However, it is prudent to say that both groups can be classified as South African Negroids.

Abstrak

Die Departement van Waterwese en Bosbou (DWAF) het gedurende 1999 begin met die ontwikkeling van die Nandoni Dam. 'n Gedeelte van die projek het die verskuiwing van sewe gemeenskappe, naamlik Mulenzhe, Budeli, Dididi, Mpego, Machivandihala Landbou Kollege , Mutoti en Tshilangoma behels. Op versoek van die gemeenskap moes die departement voorsiening maak vir die verskuiwing van ongeveer 1,000 grafte wat dateer uit die 20ste eeu. Honderd-en-sestig skelette (118 volwassenes en 42 kinders) afkomstig uit hierdie grafte is uitgebreid ontleed en 'n beskrywing van die gesondheid en siektepatrone van hierdie landelike gemeenskappe is gedoen. 'n Bykomende doelwit van hierdie studie was om die biologiese verwantskap van die Venda aan die hand van kraniometriese en odontometriese kenmerke te ondersoek.

Die demografiese profiel van die gemeenskappe toon 'n hoë voorkoms van sterftes in kinders jonger as 5 jaar en 'n medium reeks volwasse mortaliteit wat piek tussen 45 en 55 jarige ouderdom. Hierdie profiel is soortgelyk aan ander gelyktydige swart Suid-Afrikaanse groepe en word geassosieer met armoede, swak lewensomstandighede en onvoldoende sanitasie. Oor die afgelope 800 jaar het daar by hierdie bevolkings, in vergelyking met bevolkings uit die Ystertydperk, 'n dramatiese afname in kindersterftes en 'n effense toename in volwasse lewensverwagting plaasgevind. Dit kan toegeskryf word aan 'n afname in die aantal kinders per moeder en algemene verbeterings in lewenstyl en lewensomstandighede.

Mediese navorsing dui daarop dat infektiewe siektes en parasitiese lading in plattelandse Venda gemeenskappe gedurende die 20ste eeu hoog was. Ten spyte van die hoë patogeen lading in die omgewing, is min skeletale merkers vir nie-spesifieke siektes in hierdie studie gevind. Dit kan toegeskryf word aan die toediening van medikasie by beide hospitale en klinieke, wat die ontwikkeling van siektes veroorsaak deur bakterieë en parasiete sou vertraag. Oorsigtelik wil dit voorkom asof medisyne algemene gesondheid vir die individu verbeter het, maar dit was relatief oneffektief om die aantal patogene in die wyer omgewing te verminder.

Tandheelkundige gesondheid was relatief goed in hierdie gemeenskappe. Tandbederf was meer algemeen in Venda as in ander landbou gebaseerde bevolkings en kan toegeskryf word aan die verhoogde inname van westerse voedsels soos verfynde mieliemeel en suiker.

Die resultaat van uni- en multivariant statistiese ontledings op kraniometriese en odontometriese kenmerke dui op 'n sterker verhouding tussen die Venda en Suid-Afrikaanse Negroïede bevolkings as die groepe uit OosAfrika. Dit ondersteun die hipotese vir 'n plaaslike ontwikkeling van die Venda in die Soutpansberg gebied. Hierdie resultate stem ook ooreen met ander studies van skedel- en tandmorfologie wat akkoorde toon tussen die Suid-Afrikaanse Negroïede en die Venda. Weens die klein steekproef van K2, was dit nie moontlik om 'n direkte verband tussen K2 en die Venda vas te stel nie, maar dit is waarskynlik veilig om beide groepe as Suid-Afrikaanse Negroïede geklassifiseer kan word.

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Chapter 1 – Introduction

1.1. The 20th century Venda

Due to geographic isolation of the Venda in the Soutpansberg Mountains, they had little contact with Europeans until the late 19th and early 20th century. In 1872, the Berlin Lutheran missionaries were the first to settle in the region of Venda and to introduce western ideology, mannerisms and lifestyle to the people. Other missionary groups such as the Dutch Reformed Protestants followed the Germans with similar ideas of converting, educating, healing, and nourishing the local inhabitants (Blacking, 1964b). These various missionaries built clinics, small shops and churches in the area, but the cultural impact these earlier settlers had on the local inhabitants is not known. After the second Anglo-Boer War (1899 – 1902), the area of Venda was incorporated into the Union of South Africa, which had a tremendous effect on the lifestyle and culture of the population (Stayt, 1931).

Approximately 60 years after the arrival of the Berlin Lutheran missionaries, Stayt (1931) published a comprehensive ethnography on the people of Venda. This monograph supplied information on cultural behavior such as family life, religion, music, and kinship as well as their health, economy, industry, law, and subsistence patterns. He describes the culture of the Venda people as being in a period of transition in which indigenous traditions and economic systems were slowly being replaced by European values and beliefs. Due to the rapid disintegration of traditional ideologies, early ethnographers felt obliged to record these behaviors for posterity. Following Stayt (1931), several books on Venda law, which include betrothal, marriage, divorce, property and inheritance, music and folklore were written (Van Warmelo and Phophi, 1948a,b,c,d,e; Blacking, 1964b). In the last 100 years, at least 360 books and articles have been published on the Venda, which have explored the history, language, culture, government, subsistence economy and health of these people (Poulos, 1981). As was expected, most of the traditions and behaviors observed by these early researchers are either no longer practiced or have been greatly modified by the present day inhabitants of the area.

By 1960, European influence was visibly apparent such that the Venda wore western style clothes, gave birth in hospitals, were given Western names, attended Christian churches and bought processed maize and sugar from European trading shops (Stayt, 1931; Blacking, 1964b). However, there was no change in the physical appearance of the rural communities such that living conditions and access to basic resources remained poor. On account of both strict Apartheid laws regarding business ownership and the unavailability of work in the area, many Venda (mostly males) entered the work force as migrant labourers in large cities such as Johannesburg and Pretoria. The massive shift of manual labour out of Venda and into the cities also hindered local development.

In 1979, the area of Venda became an independent homeland. However, this new Republic was not economically stable such that it relied on the South African government for approximately 80% of its revenue (Moody and Golino, 1984). With these funds, various government buildings, hospitals and a University were built in the district of Thohoyandhou (Wilson, 1999). By 1985, there were two general hospitals and one maternity clinic in this district, which included the Tshilidzini, Donald Fraser and William Eadie maternity clinic. A third general hospital, Silam was located in the Dzanani district. At the same time, it was recorded that 49 clinics, 2 health centers and 20 visiting points were available in the rural areas around Thohoyhandou. The visiting points were interspersed throughout the rural communities and supplied them with basic medical aid, feeding schemes, and immunization. In 1984 and 1985, people were immunized for tuberculosis, polio, diphtheria, whooping cough, measles and tetanus (Grové and Pieterse, 1987). The period of construction for these clinics and visiting points is not known, but it can be suggested that they were built after 1960.

Unfortunately, the new government did not make plans to improve the physical infrastructure of the rural communities. According to Moody (1984:7) only 12% of government expenditure was geared towards investing in infrastructure, which effectively "kept the region frozen in a state of physical underdevelopment". The majority of the funds were spent on social services, but it did not appear to be enough to cover basic necessities such as water, electricity, and proper schooling for the rural communities. After the collapse of the Apartheid government in 1994, Venda was reunited with South Africa. At this time, it was observed that the infrastructure of the rural villages lagged significantly behind the rest of country (Wilson, 1999). The area remains one of the poorest regions in South Africa up to the present day.

High rates of fertility and subsequently high rates of infant mortality, poverty, malnutrition, poor sanitation, poor living conditions, ignorance and infestations from parasites and bacteria are considered to be characteristics of a developing nation (McKeown, 1979; Foster, 1992). In the past 100 years, all of these features have been observed in rural Venda communities (e.g., Stayt, 1931; Brighton, 1983; Teichler et al., 1986; Nembudani, 1999). Even though modern health care has greatly improved the livelihood of the individual, more development in physical infrastructure is needed to improve standards in rural Venda areas such that they are comparable with the rest of the country.

In the 1980's, the Hans Snyckers Institute conducted research on the demography, health and disease profiles of a rural Venda village, known as Tshikundamalema. This village is situated North of the projected area of the Nandoni Dam and is considered to have a similar lifestyle, living conditions and access to resources (such as clinics and medical care) as the seven villages used in this study. The findings from Tshikundamalema are invaluable, because they provide a background by which to evaluate the results obtained from the skeletal remains.

Over a 10-year period, these researchers noted that the infrastructure of Tshikundamalema was poor but they considered the population to be relatively healthy since no cases of malnutrition, obesity, hypertension or rheumatoid arthritis were observed and dental disease was minimal (Van Nieuwenhuizen and Oosthuizen, 1984; Brighton et al., 1985; Van Staden, 1988). However, incidences of infectious disease and parasite infestation (bilharzia and malaria) were high (Brighton, 1983). These results are to be expected of a developing community that had irregular contact with a western diet and lifestyle. In Venda, malnutrition was most problematic during periods of severe drought such that the number of malnourished individuals in a community could vary considerably from one year to the next (Van Staden, 1982). Thus it is not possible to say that malnutrition did not exist in Venda, only that it did not occur at Tshikundamalema during the period of their study. The continual infestation of this community with bacteria and parasites can be attributed to poor living conditions and poor sanitation. Similar problems have been observed in other rural communities in Venda and are clearly attributable to poverty and inadequate infrastructure.

The most serious problems that affect development and health in the rural areas are deforestation and a lack of sanitation. Since most of these communities are without electricity, firewood is their primary source of fuel. A recent increase in population growth in Venda has increased the demand for firewood (Mphaphuli, 1999). This demand has led to the stripping of ecologically sensitive montane forests without the re-planting of new trees. The environmental repercussions of deforestation are changes in temperature, rainfall and soil erosion; all of which effect the agricultural sustainability of the land. If fewer crops can be grown annually, it will have a significant affect on both income and nutrition for many families in these rural villages. Several recommendations that have been made to alleviate this problem include education and improvement in basic services to rural areas (Mphaphuli, 1999).

Poor sanitation in rural communities is primarily responsible for the contamination of streams and underground water supplies. The origin of this pollution is improper disposal of garbage, pit latrines near water sources, cattle, and graveyards (Nembudani, 1999). Since Venda has a tropical climate, stagnant and polluted water acts as a breeding ground for mosquitoes and a catalyst for malaria, which is already endemic to the region.

Polluted water is also a primary cause of infectious diseases such as typhoid, cholera and gastro-enteritis and parasitic infestation (McKeown, 1979). Between 1984 and 1985 there were approximately 707 typhoid cases and 172 malaria cases per 100,000 people, which is above average when compared to other regions in the country (Grové and Pieterse, 1987). Education and sanitation services to rural areas are two possible means by which this problem can be resolved.

It is logical to believe that education and access to basic resources such as electricity, water and sanitation would improve the living and health conditions in the rural Venda communities. However, the main problem with any plans for rural development is the scarcity of water in the region, when compared to the population density (Nembudani, 1999). As a whole, South Africa is a semi-arid country with the primary sources of water coming from rivers and streams. In Venda, the main source of water is the Limpopo River and its smaller tributary rivers, which are the Crocodile, Matlabas, Mogalakwena, Sand, Nzhelele, Nwanedzi, Luvuvhu and Mutale (Stayt, 1931). Two major dams, the Vondo and Damani, provide water to many but not all of the rural areas (Nembudani, 1999). The main reason rural villages do not have water is because there is not enough water available in these dams. In areas without a direct water source, inhabitants have to rely on water from nearby streams, which increase their exposure to bacteria and parasites.

The annual rainfall in the Venda region varies considerably such that some areas are relatively dry while others receive up to 1200 mm of rainfall per year. Based on rainfall and topography, the area can be divided into three geographic zones. These include the Limpopo valley, the Pietersburg highland and the Soutpansberg Mountain range (Saidi, 1999). The Limpopo valley and Pietersburg highland are situated on the north and south of the Soutpansberg Mountains, respectively. On the northern side of the mountain, it is hot (31 C) and dry with only 300– 600 mm of rainfall each year (Bergh, 1999). Since the area receives little rain, it is not suitable for subsistence agriculture and is thus sparsely inhabited. The vegetation includes scrub savanna, baobab, and mopane trees (Saidi, 1999). On the east and southern side of the mountain, the region is sub-tropical (27 C– 4 C) and has an annual rainfall of 400 mm to 1000 mm (Bergh, 1999). Vegetation includes tropical montane forests at the high altitudes, mixed savannas at middle altitudes and scrub savannas at lower altitudes and in the foothills (Saidi 1999:31). This area contains the most fertile soils in region, but it is primarily owned by commercial farmers such that few people inhabit the region.

The rural villages used in this study are situated in the lush, tropical region around the Soutpansberg Mountains, which is also the most densely inhabited region in Venda. With regard to vegetation, the top of the mountain is tropical montane forest that shifts to savanna woodland and savanna scrubland towards the foothills (Saidi, 1999). The area has a relatively constant temperature in summer (21 – 24 C) and winter (14 – 16 C), with the summer rainfall being between 400 to 1200 mm (Bergh, 1999). The soil is fertile and is able to sustain cultivation of vegetable crops, citrus and commercial plantations such as coffee and tea (Grové and Pieterse, 1987). However, droughts are common and can be devastating to local inhabitants who depend on subsistence agriculture as a form of income and nutrition.

Since the town of Thohoyandhou and its surrounds are the most populated areas in Venda, they are also the most in need of water (Pullen, 2001). However, it has been shown that there is not enough water in the Vondo Dam to supply all the rural communities within the district of Thohoyandou (Nembudani, 1999). In response to this dilemma, the Department of Water Affairs and Forestry (DWAF) decided to construct an additional reservoir dam (the Nandoni Dam) in the Luvuvhu River, which is only 20 km downstream from Thohoyandhou, and will be able to adequately supply water to these rural villages.

Due to the immense size of the Nandoni dam, seven rural villages had to be relocated and include Mulenzhe, Budeli, Dididi, Mpego, Machivandihala, Mutoti, and Tshilangoma (Figure 1.1 & 1.2). With regard to this study, the most important aspect of the relocation program was the exhumation of approximately 1000 graves. From an analysis of the skeletal remains found within these burials, it was possible to interpret the effects that living conditions, disease, health care, physical activity and diet may have had on the mortality and health of the population (e.g., Angel, 1971; Kennedy, 1989; Kelley, 1989; Larsen, 1997). This research also provided an invaluable opportunity to shed light on the health status of a rural African community during the emergence of westernisation.

In most populations, a period of transition is usually followed by a change in the general health of the community. For example, the shift from a hunter and gatherer to an agricultural economy brought about a distinct decline in mortality and health for many populations (e.g., Angel, 1984; Goodman, 1993; Larsen, 1997). With the emergence of intensified agricultural came an increase in fertility and population density, both of which contributed to a decline in the quality of living conditions and sanitation. Poor sanitation led to the exposure of these groups to new pathogens such as parasites, salmonella, typhi and staphylococci bacteria (Armelagos, 1990). The saturation of these groups with infectious microbes had a detrimental effect on both their social and biological health. An increase in skeletal pathology such as sub-periosteal lesions, cribra orbitalia, osteomyelitis, and enamel hypoplasia have been observed in these groups and is clearly indicative of an adaptation to the increased pathogen load that they had encountered in their new environment (e.g., Larsen, 1984; Armelagos, 1990; Wood et al., 1992). Aside from general skeletal pathology, other indicators of population stress include a high incidence of infant and young adult mortality and a reduction in adult stature.

In developing countries, rural communities experienced similar problems such as overcrowding, poor sanitation, high incidence of parasites and environmental degradation. Therefore, it can be expected that skeletal remains from these areas would demonstrate stress markers similar to those found in the early transitional agricultural groups. This is clearly shown at the site of Maroelabult, a 20th century rural farming community in South Africa, in which a relatively high percentage of sub-periosteal infections, cribra orbitalia and a high number of infant deaths were attributed to possible intestinal parasites, malnutrition and other chronic diseases

(Steyn et al., 2002). In rural African communities that do not have access to basic services such as water and sanitation, parasitic infestations and malnutrition are common health problems (Hunponu-Wusu, 1976; Department of International Economic and Social Affairs, 1982; Department of International Economic and Social Affairs, 1988).

Within the past 200 years, chronic disease and/or poor nutrition plagued many rural and urban communities throughout the world. For example, overcrowded living conditions and improper disposal of human waste were held responsible for the increase in "skeletal and dental markers of stress" in both poor and wealthy urban communities in 19th century industrial England (Lewis, 2002:212). Likewise, dietary deficiencies, parasites and harsh work conditions are likely the causes of high rates of mortality (infant and adult) and high incidences of sub-periosteal lesions, enamel hypoplasia and cribra orbitalia found among 19th century North American slave groups (e.g., Kelley and Angel, 1983; Kelley and Angel, 1985; Rathbun, 1987). Therefore high population density, poor education with regard to health and sanitation, inadequate environmental conditions and poverty can be considered primary contributors to poor health in developing nations.

In the mid - 20th century, improvements in the quality of health education, living conditions and developments in medicine and medical technology were observed in America and many European countries. These social, economic and technological changes caused a decrease in mortality, fertility, infectious disease and increases in stature (Stewart, 1980; Alfonso Sanchez et al., 2002). For a variety of reasons, many African countries have not experienced this economic transition and thus many rural areas in Africa remain plagued with problems of overcrowding, high fertility, inadequate nutrition and poor environmental conditions.

The country of South Africa is considered a developed nation, but the majority of the inhabitants reside in undeveloped areas which are overcrowded, overrun with infectious disease and do not have access to running water or electricity. The cause of death for individuals in these communities is usually from parasitic infections, respiratory disease and violence (Van Tonder and Van Eeden, 1975; Hunponu-Wusu, 1976). Even though the living conditions in rural Venda remained unchanged, health care facilities were built and medicines (such as antibiotics and vaccines) were administered to these people in the late 20th century. The appearance of medicine and preventive medicine (such as vaccinations) would have had an effect on individual and possibly community health. As far as is known, there is relatively little information available on the health and mortality status of rural South African communities in the post-antibiotic era. Since poverty, inadequate living conditions and infectious diseases are not unique to the rural Venda; the results from this study establish a precedent for other skeletal samples from developing communities in South Africa that date to the post-antibiotic era.

1.2. Origins of the Venda

The analysis of a large number of skeletons exhumed from the seven rural villages in Venda also provided an opportunity to further investigate the origins of this relatively enigmatic group. Currently, there are two opposing hypotheses pertaining to the origin of the Venda people. The first hypothesis is based on an external migration from East Africa, and the second is focused on internal development in the Soutpansberg region.

The theory of external migration states that between AD 1200 - 1500 the Venda, known then as the Vhangona, migrated from the Great Lakes region in East Africa to the Soutpansberg area (e.g., Stayt, 1931; Van Warmelo, 1932;Wilson, 1969; Stayt, 1971). This migrant population easily subjugated the local inhabitants of the Soutpansberg area, because they were more advanced in both knowledge and weaponry. This theory was formulated from ethnographic accounts and oral traditions given by numerous Venda informants in the 1930's (Stayt, 1931). At this time, there was no other evidence by which to doubt the East African ancestry of the Venda. The oral traditions and the theory focus on physically separating the Venda people from other groups such that they would appear unique and relatively mysterious.

However, it should be noted that some aspects of the theory reflected on the similarities between the Venda and the Shona, their neighbours north of the Limpopo River (Stayt, 1931). Traits that were shared between these two groups included language, belief in the divine rule of the chief, stonewall construction of the chief's compound at both Dzata (Venda) and Great Zimbabwe (Shona), the use of divining dice by shaman, and copper metallurgy (Stayt, 1971; Huffman, 1996). Based on these similarities, Stayt (1971) concluded that the Vhangona must have spent a considerable amount of time with the Shona before migrating across the Limpopo River and into the Soutpansberg region. According to this theory, the predecessors of the Venda chiefs were indirectly associated with the construction of the stone palaces at Great Zimbabwe.

The greatest weakness in the migration theory is that it was based solely on oral traditions, which are possibly biased towards the ruling dynasty, distorted over time and mix factual occurrences with myth (Loubser, 1988). Recently, it has been suggested that these oral traditions were based on the dynasty of the Singo, a group of Shona chiefs who conquered the Soutpansberg area in the 17th and 18th century and thus is biased with regard to understanding the origin of the people of Venda (Loubser, 1989; Loubser, 1990).

Recently, Loubser (1988) devised a theory of local development for the Venda that was based on archaeological evidence, linguistics and ethnography. This theory states that the distinct culture, language and traditions of the Venda are explainable through several hundred years of alliances and trade networks between Sotho-Tswana and Shona groups in Southern Africa. The earliest evidence of trade in this area has been found at Mapungubwe Hill (AD 1250 – 1290). At the decline of Mapungubwe in the 13th century, this population (or parts of it) are believed to have moved east and closer to the Soutpansberg mountains; evidence for this migration was noted at the sites of Princess Hill and Tshitaka-tsha-Makoleni in which later phases of Mapungubwe style pottery have been found (Loubser, 1989). It has been suggested that the descendants of these early trade groups later amalgamated and formed trade alliances with Sotho-Tswana populations, who only arrived in Southern Africa after AD 1400 (Loubser, 1989).

In AD 1500, several Shona chiefs migrated into the Soutpansberg region and settled in the Nzhelele Valley (Loubser, 1988). This was the first attempt by the Shona to settle in the Soutpansberg area and has been associated with an initial decline in trade at Great Zimbabwe (Mitchell, 2002). The reason for this settlement was most likely to establish smaller and more lucrative trade networks in ivory, gold and copper with the east coast. The Shona chiefs initiated alliances with the local Sotho-Tswana inhabitants regarding trade and inter-marriage among the ruling class (Loubser, 1988). However, unlike previous alliances in which both groups maintained their separate identities, this coalition resulted in an amalgamation of language, tradition and culture such that later generations referred to themselves as a single ethnic group - the *BaVenda* (Stayt, 1931). It has been shown that Shona and Sotho-

Tswana practices had a considerable influence on cultural traditions and language of the Venda (e.g., Huffman and Hanisch, 1987; Loubser, 1989; Loubser, 1990; Huffman, 1996). In summary, this theory implies that the Venda identity developed out of continuous interaction between Shona and Sotho-Tswana communities and not a foreign migration from East Africa. It also suggests a relationship, albeit quite removed, between the Venda and the prehistoric samples of K2 and Mapungubwe.

Since cranial and dental morphology have been shown to have a strong relationship with genetics (Dempsey and Townsend, 2001; Relethford, 2002), it was possible to examine the above-mentioned hypothesis regarding the origins of the Venda by comparing the cranial and dental measurements obtained from the Venda skulls to both East African and South African skeletal samples. Therefore, the exhumation of the skeletal remains from the seven rural Venda villages offered a unique opportunity to explore these relationships.

1.3. Aim

The primary objective of this study was to describe the health and disease pattern of a rural 20th century Venda population. In order to achieve this goal, it was necessary to comprehensively examine the skeletal remains with regard to age, sex, dental and skeletal pathology and adult stature. When these various features are combined, the longevity and incidence of disease in the group can be described. Since this study is focused on a modern population, the information obtained from the skeletal remains was also compared to studies conducted on general health in the rural communities by ethnographers, medical researchers and census groups during the 20th century. The written accounts provide a clearer understanding of the effects medication, health care and western diets had on the well being of this modern, albeit rural, population.

The secondary objective of this study was to provide evidence regarding the biological affinity of the Venda. This is accomplished by using uni- and multivariate statistics to compare both craniometric and odontometric traits among various East and South African samples. Several questions are explored such as the relationship of the Venda to East African groups; relationship of the Venda to South African groups; and the relationship of the Venda to the prehistoric skeletal samples from K2 and

Mapungubwe. Both the migration and local development theories were used to interpret the results.

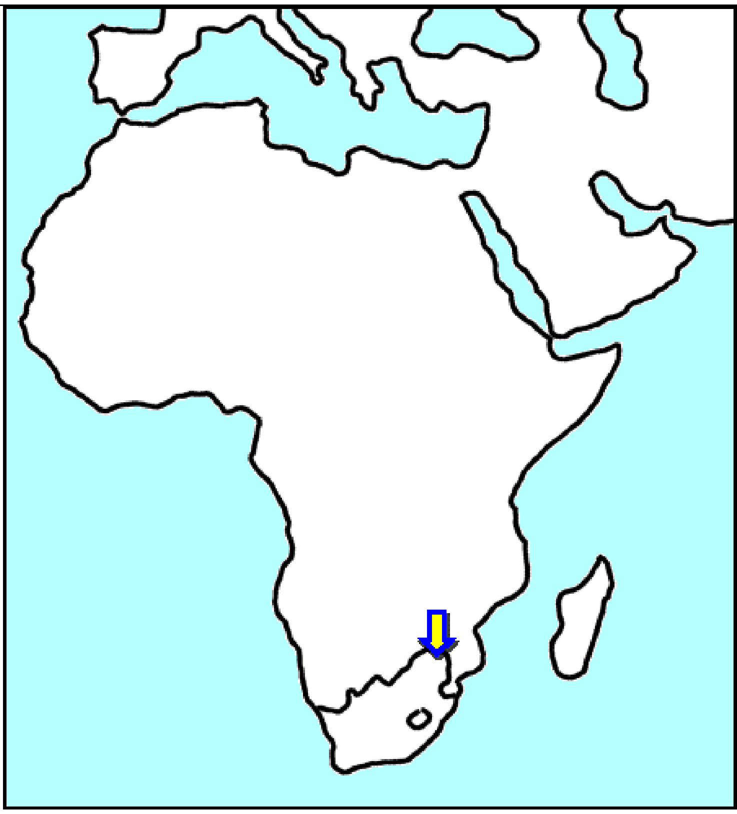


Figure 1.1. Map of Africa showing the location of South Africa and Venda.

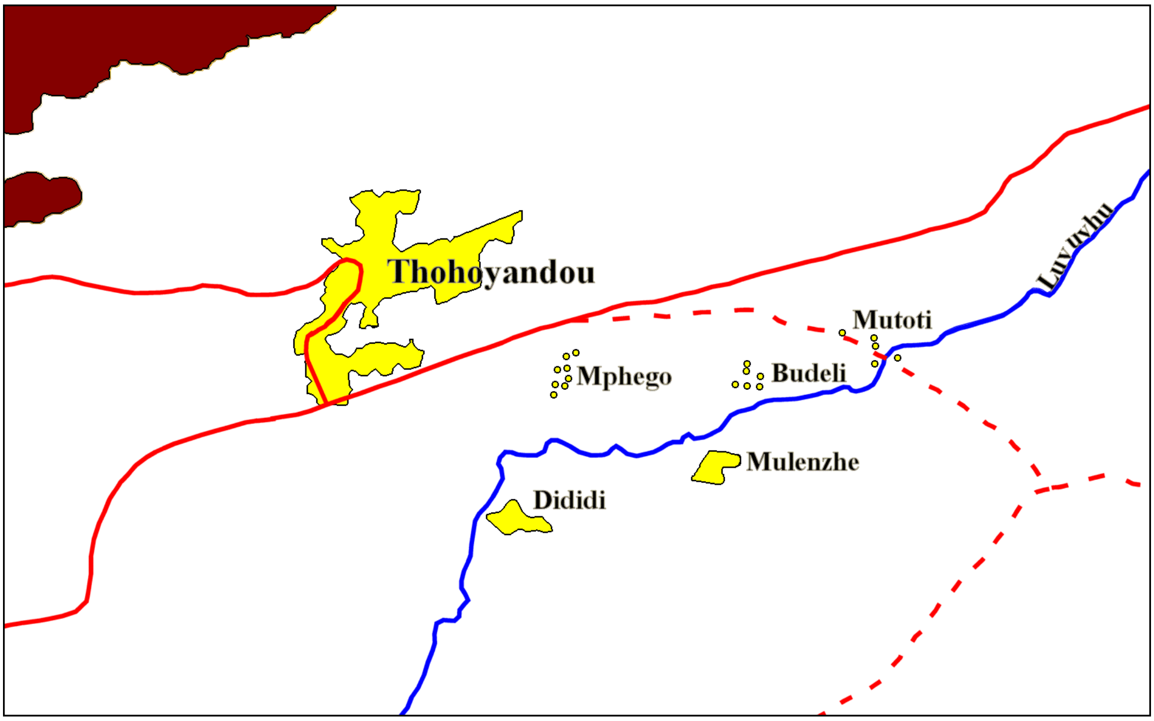


Figure 1.2. Skeletons used in this study came from Budeli, Dididi, Mphego, Mulenzhe, and Mutoti. Tshilangoma and Machivandiza are not shown.

Chapter 2. Materials and Methods

2.1. Origin of the skeletal material

2.1.1. Nandoni Dam Project (2001)

During the 20th century, exponential population growth and successive droughts left the people of Venda in need of a larger and more reliable water source. It has been estimated that by 2020 another 150 million cubic meters of water will be required to supply heavily populated areas such as those at Louis Trichardt and Thohoyandhou (Pullen, 2001). In response to this problem, the Department of Water Affairs and Forestry (DWAF) decided to build a reservoir dam in the Luvuvhu River approximately 20 km downstream from Thohoyandhou, which coincidentally is the city in greatest need of water. The construction of the Nandoni Dam began in 1999 and should be completed by 2005.

Due to the immense size of the Nandoni dam, seven villages in the Venda area which include Mulenzhe, Budeli, Dididi, Mpego, Machivandihala Agricultural College, Mutoti, and Tshilangoma were affected and the people within these communities had to relocate their homes, garden plots, shops and graveyards outside of the estimated 50 year floodline. The exhumation of human remains from these settlements was of particular importance to this study. Within the various communities, more than 1,000 graves had been identified in which the date of death ranged from 1910 to 1999. Exhumation of these individuals began as early as February 1999. The company responsible for relocating these communities was BKS Ltd. Pty. For the specific exhumation of the graves, this company sub - contracted Anthropology Private Practice (APP), which is affiliated with the Department of Anatomy at the University of Pretoria. Mr. W.C. Nienaber was the project leader and organized the exhumation of the graves, monitored the completion of the project, and wrote a final report that provides technical details with regard to the relocation of the graves and any archaeological finds. He sub-contracted the task of excavating the graves to Archaeo-Info Northern Province, an archaeology company that was run by Polke Birkholtz, Marko Hutten, Stefan Gaigher, and Henk Steyn.

2.1.2. Approval for skeletal analysis

In October 2000, a proposal to study the skeletal remains that were to be exhumed from the villages was submitted to the Department of Water Affairs and a council representing the family members of the deceased. It was approved in January of 2001, with the condition that the researcher must obtain consent from the head of the family prior to analysis of the skeletal remains. A consent form was formulated by the researcher and translated into Venda and Shangaan. With the assistance of a social consultant from the grave relocation project (Zacharia Munyae) details of the study were explained to family members before or on the day of exhumation. The families of the deceased responded positively to the project.

2.1.3. Excavation of graves in Venda

The bulk of the excavations began in April 2001 and ended in February 2002. A maximum of 7 graves were excavated per day. Once the body was exhumed, a 45-minute period was allocated for analysis before the remains were given to an undertaker. Since many of the graves were excavated simultaneously in the different villages, it was not always possible to reach each gravesite before the body was removed. Sometimes the reburial ceremony was fortuitously postponed to the next morning and under such circumstances the skeletal analysis was done at the mortuary that evening or early the next day. All the mortuaries were located in the Thoyhoyandou area and included Ligaraba, Malamuele, Tshitshitse and Saffas.

Of the 1,021 identified graves, 130 were symbolic inhumations. These burials were performed when the person had either died and had been buried in another area or had left the village and was presumed to be dead. Bone fragments from a goat or sheep, blankets, broken pottery, beads and occasionally seeds were associated with these graves (L. Hutten pers. communication).

Eight hundred and ninety one graves were presumed to contain human remains. However, skeletal material was not found in 536 of these graves. Possible explanations for this phenomenon included the family forgetting the exact location of the grave, poor preservation of the skeleton, or person (s) desiring monetary compensation from the Department of Water Affairs for a pile of stones that appeared to be a grave.

The condition of the bones was highly dependent on the manner and location of the burial. Burials from the early 20th century (pre – 1960's) were simple and no formal cemeteries existed. Graves from this period were quite difficult to find and the condition of the skeletal remains was usually poor. According to Stayt (1931), miscarriages, stillborns and infants were buried beneath the clay floor of the mothers' cooking hut. Children, teenagers and adults were wrapped in cowhide and buried in the veldt with a few funerary goods and several stones to mark the burial plot (Stayt, 1931).

In the later half of the 20th century, burial practices changed due to the adoption of Christianity and the availability of medical care. During this period, the body of the deceased was wrapped in a white plastic bag at the hospital. This bag was then covered by several blankets, placed in a supine position in a coffin, and buried at least 1m below the surface. These inhumations were usually located within the boundaries of the family's living huts. These new practices regarding the handling of human remains inadvertently led to better preservation of both juveniles and adults.

From the 355 graves that contained human remains, it was possible to analyze 136 skeletons. A skeleton was not assessed when soft tissue was present, preservation was extremely poor, or the family had requested an immediate reburial.

2.1.4. Accession numbers for skeletons from Nandoni

Each grave was assigned an accession number, for example NANMUL222. NAN identified it as part of the Nandoni project, MUL meant that it had been excavated in the Mulenzhe village and 222 was used to mark the position of the grave on the survey map. The abbreviations for the other villages are Mutoti (MUT), Dididi (DID), Mphego (MPEG), Machivandihala Agricultural College (MAC), Budeli (BUD), and Tshilangoma (TSHIL).

2.1.5. Initial excavations: Mutoti burials (1999)

In February of 1999 the Department of Anatomy at the University of Pretoria excavated 37 graves in the village of Mutoti. Since the initial sections of the dam wall were to be constructed in this village, these graves were exhumed first. Twenty-four skeletons were excavated, analyzed in the field by Maryna Steyn and interred the following day. Data obtained from these skeletons were included in this study. The accession number refers to Mutoti (MUT) and a three-digit catalogue number that was assigned to the remains during the 1999 excavations. The abbreviation NAN (Nandoni) was excluded because they were excavated prior to April 2001.

2.2. Skeletal material

A summary of the skeletal material is presented in Table 2.1. A total of 160 skeletons were analysed and included 118 adults (55 males, 51 females and 12 unknown sex) and 42 juveniles. Twenty-four of these skeletons were excavated in 1999, while the remaining 136 skeletons were excavated from April 2001 – April 2002. Twenty-nine of the juveniles had been either stillborn babies or infants under the age of 2 years. A description of the burial position, preservation/condition of the remains, sex, age, stature and pathology of each skeleton can be found in the Appendix A (pg. 228-362).

2.3. Methods of skeletal analysis

This section explains the method used to determine sex and age during analysis of the skeletal remains. Methods pertaining to palaeodemography, pathology, dental health and population affinity are presented in those chapters respectively.

2.3.1. Metric analysis

The cranial and postcranial remains of the adult skeletons were measured according to anthropometric standards proposed by Buikstra and Ubelaker (1994). In order to obtain these measurements, standard equipment including a mandibulometer, sliding caliper (to the nearest tenth of a millimeter), spreading caliper, and osteometric board were used.

2.3.2. Sex determination

A combination of skeletal morphology and multiple discriminant functions derived from modern South African populations were used to estimate sex from adult skeletal remains in this study. This multi-factorial approach to the determination of sex has been shown to be more reliable than a single trait or method used alone (e.g., Ýþcan, 1989; Ýþcan and Steyn, 1999; Patriquin et al., 2003). The reason for the combination of these methods is that the accuracy of distinguishing between characteristics based on morphology diminishes when the skeleton is poorly preserved, whereas osteometric analysis is a more reliable method for poorly preserved and/or fragmentary remains (Krogman and Ýþcan, 1986; Loth and Ýþcan, 2000b). It should be noted that metric analysis is only benefical when the state of preservation is such that measurements can be taken from the remains.

2.3.2.1. Morphology

The degree of sexual dimorphism in a population dictates the accuracy by which morphological indicators can be used to estimate sex from skeletal remains. In most human populations, shapes of the cranium and pelvis are visibly distinct between males and females. Differences between the sexes should be viewed as a continuum with each end of the spectrum representing ultra feminine and ultra masculine characteristics, with the middle containing variations of these features (Krogman and Ýþcan, 1986). Since variation is a norm and not an exception, it is unlikely to find crania or pelves that will represent a true feminine or masculine form. For this reason, accuracy in sex estimation is improved when more than one morphological indicator can be observed.

According to De Villiers (1968), there are several characteristics in the crania of South African Negroids that are significantly different in appearance between males and females. These features include the shape of the forehead, shape of the cranial vault, size of the mastoid processes, shape of the supra-orbital torus, appearance of the superior orbital margins, shape of the nuchal crest, shape of the mental eminence, and gonial eversion. Males tend to be larger and more robust than females for the above-mentioned features, while in the orbital margins of females orbit are sharper and of males more blunt. These cranial features have been observed with varying degrees in most human populations and are thus considered standard morphological indicators of sex (e.g., Ferembach et al., 1980; Krogman and Ýþcan, 1986; Buikstra and Ubelaker, 1994).

Recently, Loth and Henneberg (1996) proposed that flexure in the mandibular ramus is a male characteristic whereas a straight ramus is a female characteristic. However, Kemkes-Frottenthaler et al. (2002) have shown that the accuracy of this morphological indicator for sex is drastically reduced by factors such as age and excessive antemortem tooth loss. In this study, this technique was used in conjunction with other morphological characteristics but only when the mandible was well preserved.

Another reliable morphological indicator of sex from the skeleton is the pelvis. In females, the pelvis has a dual function (locomotion and parturition) and thus tends to be shorter and wider than the male pelvis (e.g., Krogman andÝþan, 1986; Scheuer, 2002). In this study, the morphological indicators that were examined on the pelvis were the shape of the greater sciatic notch, sub-pubic angle, body of the sacrum, obturator foramen, acetabulum and presence or absence of the pre-auricular sulcus. In the female pelvis, the sub-pubic angle and sciatic notch are wider, the sacrum broader, the obturator foramen more triangular in shape, and the acetabulum smaller and placed more laterally than in the male pelvis. A pre-auricular sulcus may be observed on a female pelvis but it is not likely to be seen on a male pelvis (Loth andÝþan, 2000b).

The pelvis was rarely recovered during excavations since the preservation of the thorax and pelvic regions was poor. Therefore, this bone was not a very useful morphologic indicator by which to determine sex in this study.

2.3.2.2. Osteometric analysis

In the past 10 years, several studies have been published regarding metric determination of sex from the humerus, femur, tibia and pelvis of South African Negroids (Kieser et al., 1992; Steyn andÝþan, 1999; Asala, 2001; Patriquin et al., 2003; Steyn et al., 2004). These studies provide additional resources by which sex can be determined in South African Negroid groups, and is especially useful when morphological indicators are ambiguous or the skeleton is poorly preserved (Steyn andÝþan , 1997).

The most commonly used statistical method to determine sex from the skeleton is through discriminant function formulae (Krogman andÝþan, 1986). These formulae are designed to separate the sexes with regard to single or multiple (e.g., skull, pelvis or long bone) skeletal measurements.

For South African Negroids, the most diagnostic single bone measurements are the diameter of the humeral and femoral head, which have an accuracy of approximately 90%. An accuracy of 87 - 89% can be achieved from other single bone measurements that include the humeral epicondylar breadth, femoral midshaft circumference, femoral distal breadth, tibial proximal breadth, tibial circumference at the nutrient foramen and tibial distal breadth (Loth andÝþan, 2000b). The single bone measurements were quite useful in determining sex when only portions of the long bones were recovered.

When multiple measurements are used, a combination of dimensions from the pelvis is the most diagnostic and provides an accuracy of 91 – 97%. The dimensions used in this multiple discriminant function formula are the acetabulum diameter, sciatic notch width, pubic bone width, pubic bone length and ischial length (Patriquin et al., 2003). However, it was not always possible to use this formula due to poor preservation of the pelvic region.

2.3.2.3. Juveniles

The determination of sex from juvenile remains is a difficult task. Both morphologic and metric techniques have been created but tend to be highly unreliable, (e.g., Schutkowski, 1987; Schutkowski, 1993; Scheuer and Black, 2000). Loth and Henneberg (2001) suggested that the shape of the inferior symphyseal border of the mandible could be used to estimate sex in juvenile skeletons with an accuracy of 81%. Similar to other morphologic techniques the results are most accurate when the mandible is well preserved and relatively complete; a requirement that is not always possible with archaeological remains. Recently, Coussens et al. (2002) metrically assessed sexual dimorphism in the long bones of infants and young children. The authors found that robusticity indices could be reliably used to determine the sex of juvenile remains.

No attempts were made to determine sex from juvenile skeletons in this study. However during exhumation, the mother would provide information regarding the age and sex of her child to the researcher. On occasion, the style and colour of clothing buried with the child was also used as an indicator of sex.

2.3.3. Age determination

The average lifespan can be divided into three general age phases, which are growth and development, equilibrium, and senescence (Scheuer, 2002). Growth and development refer to stages of foetal development, infancy, and adolescence, which occur at relatively constant rates such that age can be determined from skeletal remains of juveniles with greater accuracy than from adult remains. Age determination from adults is more difficult because skeletal degeneration is highly variable and may be affected by factors such as the environment, genetics and physical activity (e.g., Ferembach et al., 1980; Krogman and Ýþcan, 1986; Ubelaker, 1989). Maples (1989:323) described age determination as "ultimately an art and not a precise science", which becomes more accurate with experience of the various techniques and knowledge of a particular population. It should be mentioned that multiple techniques were used in this study to estimate age in both immature and adult remains as a means to improve accuracy (e.g., Lovejoy et al., 1985; Meindl et al., 1985b; Ýþcan, 1989).

2.3.3.1. Stillborns, Infants and Juveniles

Foetal/ Stillborn remains

A considerable portion of the juvenile remains excavated in this study was either foetal skeletons from miscarriages or full term infants who had died shortly after birth. The age at death of foetal remains can be determined from the diaphyseal length of the long bones with relative accuracy (e.g., Olivier and Pineau, 1960; Olivier, 1974; Fazekas and Kosa, 1978; Scheuer et al., 1980). The seminal study by Fazekas and Kosa (1978) is considered standard with regard to the estimation of age from foetal remains and was used in this study.

Infants and juveniles

Cranium

Fusion times for the anterior and posterior fontanelles, mandibular symphysis and base of the occipital bone are relatively constant and are useful for estimating the age at death for infants and juveniles skeletons. The fontanelles at the pterion and asterion close shortly after birth with the posterior fontanelle and the mandibular symphysis closing around 6 months of age (Loth and Ýþcan, 2000a). The anterior fontanelle begins to close 6 months after birth and is obliterated between 1 and 2 years of age. Fusion of the metopic suture occurs between 2 and 6 years of age, but it can remain open in the adult. At the base of the occipital, the pars squama and pars lateralis sutures fuse between 1 and 3 years, and the suture between pars basilaris and pars lateralis closes around 3 to 7 years (Scheuer and Black, 2000). If all of these fusion sites are closed, then the child was at least 7 years of age.

Vertebral column

Fusion of the vertebrae can also be used to estimate age between birth and five years. Each vertebra has three primary centres of ossification, the centrum and two neural arches. At birth all the vertebrae have centra with two associated neural arches, none of which are fused. Between 12 and 16 months, the neural arches of the lower thoracic to the upper lumbar (T6-L2) fuse at the hemi neural arch. The process then goes cranially and caudally such that by 2 years all the neural arches have fused in C1, C3-C7, T1-T12, L1-L5, S1-S5 (Buikstra and Ubelaker, 1994; Scheuer and Black, 2000). The neural arches of C2 do not fuse until 3 to 4 years of age.

Fusion of the neural arch to the centrum (known as neurocentral fusion) occurs between 2 and 6 years of age. The first bones to fuse are the lumbar and sacral vertebrae, the second are the cervical vertebra and the last are the thoracic vertebrae (Scheuer and Black, 2000).

Dental eruption and development

The time and sequence of eruption of both the deciduous and permanent dentition is a reliable method by which to estimate age in juveniles from 6 months to 15 years (e.g., Ubelaker, 1989; Scheuer and Black, 2000; Scheuer, 2002). A dental eruption chart provides the mean eruption time (in years) from birth to 30 years of age (Krogman and Ýþcan, 1986; Scheuer and Black, 2000). This method requires that the dental eruption sequence observed in the maxilla and mandible is visually matched to a corresponding eruption sequence on the chart. The dental eruption chart created by Ubelaker (1989) on Native Americans is considered the most reliable and was used in this study (Buikstra and Ubelaker, 1994; Scheuer and Black, 2000). No dental eruption chart has been created for modern African juveniles, while interpopulational differences may exist.

Secondary ossification centers

The appearance and fusion times of secondary ossification centres are good indicators for determining age in the juvenile skeleton. Most of the available standards on skeletal growth are based on Caucasoid populations. However, it has been accepted that these standards can be used on both Negroid and Mongoloid groups (Krogman and Ýþcan, 1986).

Union of primary and secondary ossification centres takes places in four stages, which are identified as no union, beginning union, recent union, and complete union. Complete union appears in the elbow (12-14 years), the hip (13-15 years), the ankle (14-16 years), the knee (15-17 years), the wrist (16-18 years), and lastly the shoulder (17-19 years) (Krogman and Ýþcan, 1986; Loth and Ýþcan, 2000a).
The linear length of the long bones has been accepted as a reliable estimator of age at death for up to 12 years with the femoral length being the most reliable indicator (Krogman and Ýþcan, 1986). However, it is strongly advised that other methods of age determination such as dental eruption and fusion of ossification sites are used in conjunction with the diaphyseal length.

2.3.3.2. Adults

Since the skeleton does not degenerate at a constant rate, age estimation from adult remains is difficult. Attempts to determine age from skeletal remains are further confounded when preservation is poor. Therefore, it has been suggested that a combination of age at death indicators should be used to estimate age from the skeleton (e.g., Ascádi and Nemeskéri, 1970; Krogman and Ýþcan, 1986). The age estimation techniques used in this study include the closure of cranial sutures, dental wear, changes in the sternal end of the 4th rib and degeneration of the pubic symphysis. Other standard techniques such as measuring the cortical bone thickness with radiographs, cemental anulation, and bone histology are available, but due to time, finance, and ethical considerations were beyond the scope of this study. On account of the various errors involved in determining age at death in adult skeletal remains, none of the skeletons were assigned an age range of less than 10 years.

From the 16th century to present, researchers have attempted to determine age from the cranial sutures with limited success (Masset, 1989). Several problems with the technique include poor reproducibility, a lack of consistency regarding closure times for the cranial sutures and wide age ranges. On account of these problems, some researchers have abandoned the technique altogether. Other researchers suggest that the cranial sutures can be used but only in conjunction with other age indicator techniques (e.g., Krogman and Ýþcan, 1986; Buikstra and Ubelaker, 1994).

In this study, the composite method developed by Meindl and Lovejoy (1985) was used for scoring the cranial sutures. Using this method, the degree of ectocranial suture closure is quantified from 0 to 3 such that 0 is no closure and 3 is complete obliteration with 1 and 2 representing minimal and significant closure, respectively (Meindle and Lovejoy, 1985). The scoring system is applied to 10 sites on the cranium which include the midlamboid, lambda, obelion, anterior sagittal, bregma, pterion, midcoronal, sphenofrontal, inferior sphenotemporal, and the superior sphenotemporal. The score was then combined and compared with a composite score from which a 20 or 30-year age estimate was obtained. From scoring the cranial sutures, it was possible to place an individual into one of three categories which are young adult (20 – 40 years), middle age adult (30 - 50 years), or old adult (over 50 years of age).

The rate of dental wear on the occlusal surface of the teeth has been shown to be a good indicator of age at death in a population (e.g., Krogman and Ýþcan, 1986, Brothwell, 1989). However, the reliability of this technique is drastically reduced when the diet of the sample population differs from that of the comparative population (Walker et al., 1991; Maat, 2001). Even though dental wear is highly population specific, it does not appear to differ significantly between the sexes (Brothwell, 1989).

The dental wear method developed by Miles (1963) was used in this study. This method has been tested on other populations and was shown to be a reliable estimator of age at death (Nowell, 1978; Kieser et al., 1983). A problem with the Miles dental wear technique is that it is based on earlier populations that had a coarser diet than modern 20th century groups like the Venda. Therefore, it is possible that younger and older individuals would be over aged and under aged respectively.

Dental wear on the occlusal surface of M1, M2 and M3 is observed and scored based on the amount of exposed dentine (Miles, 1963). Since M1 erupts approximately 12 years before M3, it is assumed that the wear pattern will not be equal among the molars. Therefore each molar is scored separately with the amount of dental wear being dependent on the period of time in which the tooth has been in occlusion. Similar to the cranial suture technique, it was possible to place the skeletal remains into three broad age categories which include young adult (20-40 years), middle aged adult (30-50 years) and old adult (over 50 years of age).

The sternal end of the 4th rib has been shown to be a highly reliable technique by which to determine age at death. The age range for this technique is ± 5 years (e.g., Ýþcan and Loth, 1986a,b; Loth and Ýþcan, 1994). Since the sternal end of the true ribs and associated costal cartilages are generally unaffected by physical activity or environmental conditions, the ossification of costal cartilage occurs at a relatively constant rate as age increases (Loth and Ýþcan, 1994). This technique is also sex and race specific. Therefore, it is only accurate when standards are developed for the population in question. Recently, Oettlé and Steyn (2000) developed standards for estimating age at death from the sternal end of the 4th rib in a population of South African Negroids, and obtained a level of accuracy similar to the North American studies.

This technique is quite useful in the forensic context but not in an archaeological setting where the sternal ends of the ribs are usually not preserved (Buikstra and Konigsberg, 1985). Therefore, it was only valuable in estimating age at death when preservation of the skeletal remains was good or excellent.

The most commonly used skeletal indicator of age at death is the pubic symphysis (Meindl and Lovejoy, 1989). Generally, it is considered more reliable than the cranial sutures or dental wear but less reliable than the sternal end of the rib. The method used in this study was from Meindl et al. (1985b), which is a modified version of Todd's 10 phase approach (e.g., Krogman and Ýþcan, 1986; Buikstra and Ubelaker, 1994). When estimating age from the pubic symphysis, one assesses degenerative changes that occur to the symphyseal face of the pubic bone. In the early phases (I – III), the symphyseal face has a billowy wave-like appearance with a poor definition at the extremities. As the person ages, this is replaced with bony nodules on the superior aspect of the bone, a smooth surface with micro-porosities, and defintion of a dorsal and ventral rampart (phases IV – VIII). In last two phases (IX and X), the bone has an erratic appearance, poorly defined ventral rampart and occassionally osteophytic growth. As can be expected, degenerative changes in the pubic symphysis were only useful in estimating age at death when preservation of the pubic bones was good or excellent.

In summary, when the cranial sutures, dental wear, sternal end of the 4th rib and pubic symphysis were combined, it was possible to assign a ± 10-year age range to an adult skeleton. However, when preservation of the remains was poor, a ± 20 or 30-year age range was given.

Table 2.1. Summary of skeletal material from seven villages in Venda

	Budeli	Dididi	Machivandihala	Mpego	Mulenzhe	Mutoti	Tshilangoma	Total
	n	n	n	n	n	n	n	n
Males	12	1	6	1	25	10	-	55
Females	5	1	3	-	23	18	-	50
Unknown	3	-	-	-	6	4	-	13
Juveniles	5	-	1	-	19	7	10	42
Total	**25**	**2**	**10**	**1**	**73**	**39**	**10**	**160**

Chapter 3: Demography

3.1 Introduction and Literature Review

In southern Africa, palaeodemographic studies have only been done on prehistoric populations such as those at Oakhurst (10,000 – 4,000 BP) (Patrick, 1989), K2/Mapungubwe (A.D. 1000 - 1300) (Steyn, 1994), and Toutswe (A.D. 700-1250) (Mosothwane, 2004). These studies showed that child mortality, which refers to death of children less than 5 years of age, and young adult mortality were quite high such that life expectancy at birth was less than 20 years of age, and if an individual survived to adulthood they were then expected to live only until the 3rd or 4th decade of life. The cause of death for many prehistoric individuals has been attributed to parasites (such as malaria), acute and chronic infectious diseases, and accidents (Henneberg and Steyn, 1994). Within the past 1,000 years, mortality has decreased for black South Africans in general (Henneberg and Steyn, 1995). This decline in mortality was most significant among infants and children, and may be attributed to improvements in living conditions, improvements in socio-economic conditions, and the administration of medicine such as antibiotics and vaccinations.

For most of the 20th century, the life expectancy, mortality, and fertility rates for rural black South Africans, such as the Venda, were not recorded by demographers. The reasons for this include the facts that the rural areas were not accessible, information from the informants was, perhaps, not reliable, and there was no organized group to deal with the collection of these data (Sadie, 1951; Sadie, 1970). This study is the first to apply palaeodemographic techniques to a large skeletal sample from a modern rural community in Southern Africa. The term palaeodemography is used to describe the method of applying demographic techniques to the ancient dead. Since this thesis is based on a modern population, the term demography was used in lieu of palaeodemography.

It is assumed that rural communities, such as the Venda, live in a manner comparable to their prehistoric predecessors, with a similar environment, diet, and traditional lifestyle. With a presumed absence of large environmental changes from prehistoric to modern times, it has been suggested that trends in mortality and health also remained unchanged for these rural communities. When black South African populations began to migrate from rural to urban communities in the mid-20th century, it was initially considered to be beneficial to their health, nutrition, and longevity (Sadie, 1951). However, within a few years, an increase in obesity, physiological stress, diabetes mellitus, and hypertension were noted among urban, black South Africans (Edington et al., 1971; Gelfand, 1972; Crous and Borchardt, 1984). These new diseases were the consequence of an urbanized diet, which was high in refined foods such as sugar, maize, flour, and wheat.

Although differences in obesity, diseases caused by obesity, and physiological stress existed between rural and urban communities in South Africa, other diseases including respiratory disease, such as tuberculosis, digestive disorders and cardiac disorders were common in both rural and urban areas and were attributed to "unsatisfactory socio-economic circumstances" (Edington et al. 1971:78).

No studies were conducted on differences, if any, in mortality rates between urban and rural communities. However, it may be tentatively suggested that if the socio-economic circumstances and standards of living were similar between urban and rural groups, then the mortality rates for these two communities would also be similar. Therefore, health and longevity of a community is not determined by whether it is urban or rural; rather it is dependent on the access of that community to basic necessities such as water, nutrition, health care, and proper living conditions.

The rural Moravian missionary community of Mamre (Western Cape Province) for example had excellent health, low frequency of disease and longevity into their 4th or 5th decade of life (Katzenellenbogen et al., 1993). However, other contemporary communities such as the "bush dwellers", who were general nomads in the town of East London during the 1950's, had excessively high infant mortality rate (818 per 1000 births) and poor health due to a lack of housing and unemployment (Reader, 1961). In this chapter, an attempt is made to flesh out the general mortality rates of the rural Venda. The results of this study are compared with other aspects of health such as pathology and dental health as a means to provide a more meaningful synthesis of general health for this rural population.

In palaeodemography, the estimations of life expectancy, mortality, and fertility rates are used as standards by which improvement, or decline, in the general health of a population can be measured and compared with other populations (Owsley and Bass, 1979; Ubelaker, 1989). Since the biological mechanisms of reproduction are the same in all human populations, it is assumed that cultural and environmental factors such as infanticide, high or low pathogen loads, access to medical care, and war (to name a few) are the cause for differential rates of life expectancy, mortality, and fertility between populations (Howell, 1976). However, there are several inherent biases within palaeodemography such as sampling bias, age estimation error, non-stationary populations, and hidden heterogeneity that limit the interpretative powers of this technique.

3.1.1. Sampling of the population

Sampling bias occurs when the sample does not represent the living, or once living, population. Errors in sampling result from differential burial practices, warfare, or poor preservation of female, infant and elderly remains (Buikstra and Konigsberg, 1985; Ubelaker, 1989; Larsen, 1997).

3.1.2. Estimation of age from skeletal remains

The inconsistent degeneration of skeletal tissue has an effect on the accuracy of standards techniques developed to estimate age at death from unknown remains and is a paramount problem in physical anthropology in general, and palaeodemography in particular. Other factors, which make estimation of age at death a difficult task, are population specificity with regard to skeletal degeneration, different skeletal elements degenerating at different rates, and poor preservation of the archaeological material (Buikstra and Konigsberg, 1985; Jackes, 1992).

As mentioned before, standard morphological techniques used to estimate age from the adult skeleton include the cranial sutures, dental attrition, sternal end of the fourth rib, auricular surface, and pubic symphysis (Meindl et al., 1985a; Krogman and Ýþan, 1986; Oettlé and Steyn, 2000). Several subjective observations, which can be used to separate young adults from old adults, include vertebral osteophytes and general osteoarthritis at the joints (Stewart, 1979). , Although the exact relationship between vertebral osteophytes and age is not well defined in the literature, it is generally accepted that the development of vertebral osteophytes increases with age.

Three general criticisms were raised concerning the above-mentioned techniques. Firstly, it was suggested that younger individuals were over-aged and older individuals were under-aged when these age at death techniques were used alone (Masset, 1990). Secondly, Bocquet-Appel and Masset (1982) implied that the results of palaeodemographic studies were merely a reflection of the demographic profile of the population from which the age at death techniques were derived. Lastly, the methods used to generate age at death were highly subjective and thus inter-observer error was considered to be too high for any meaningful results to be obtained (Bocquet-Appel and Masset, 1982; Masset, 1990).

Due to these criticisms, a revision of the age at death techniques became a paramount focus for palaeodemographic and physical anthropological research within the past 20 years (e.g., Meindl and Lovejoy, 1985; Meindl et al., 1985a; Meindl et al., 1985b; Ýþcan, 1989; Meindl and Russell, 1998; Oettlé and Steyn, 2000). Amidst the effort of physical anthropologists to improve the accuracy of age at death techniques on skeletal remains, Meindl and Lovejoy (1985:57) quite philosophically pointed out that more reliable morphological age-indicators for skeletal remains " are not forthcoming". The realistic cynicism of these researchers encouraged others to abandon the modification of the age at death techniques in lieu of statistical adjustment of the raw age at death data obtained from skeletal populations. These adjustments involved complex statistical analyses such as the Bayesian method, maximum likelihood estimates, or hazard models (Konigsberg and Frankenberg, 1992; Aykroyd et al., 1999). However, in addition to requiring knowledge of advanced statistics, some of these analyses also require a large reference bank of skeletal data, which is not available in South Africa. Furthermore, there is little knowledge with regard to the robustness of these statistical calculations such that it is not clear whether these mathematical formulae are accurately adjusting the estimated age at death or just manipulating them into another demographic pattern (Milner et al., 1989).

During the analysis of the skeletons from Venda, it was determined that a multi-factorial approach would be used to reduce error in age at death estimation. This technique, simply enough, uses more than one morphological based age-indicator as a means for estimating age at death from skeletal remains and has become standard among researchers in physical anthropology (Ferembach et al., 1980; Scheuer, 2002). However, the multi-factorial approach is not always applicable if the preservation of the remains is poor, which tends to be the case in many archaeological samples, such that age at death estimations are usually based on less accurate techniques. Loth and Ýþcan (1994:417) pointed out that "despite the fact that cranial sutures are notoriously unreliable, in many cases this site becomes the primary source of age assessment simply because of the hardiness of the cranium."

3.1.3. Stationary populations

The biometric functions used to calculate life expectancy are based on the premise that populations are stationary (Buikstra and Konigsberg, 1985; Ubelaker, 1989). A stationary population is one in which environmental and behavioural factors are held constant such that immigration and migration do not occur, the growth rate is zero, an equal number of individuals are present in each cohort, the probability of dying in each cohort is the same, and reproductive activity begins at menarche and ends at menopause.

However, the functions are usually applied to stable rather than stationary populations. A stable population is one in which the rates of age specific mortality and fertility are constant for a particular period of time. When a stationary model is used on a stable population, the predicted life expectancy is more a measure of fertility than mortality. This is because stationary models cannot compensate for the rate of natural increase in a stable population (Wood, 1990).

For example, the composition of two populations (A and B) may be identical, except that population A has a growth rate of zero and population B has a growth rate of 2.5%. Several hundreds of years later, the skeletal remains from these two populations are excavated from separate cemeteries and biometric functions from the life table are used to assess the population structure. From the result of the life tables, population A will appear to have a lower infant mortality and a higher life expectancy than population B because they had less children and more adults within the living population; whereas population A had more children and less adults within the living population. A general interpretation from these results would be that population A was less healthy than population B; even though this was not the case.

In excavations from the prehistoric populations of K2 and Mapungubwe, the large number of juvenile remains found suggests that the population was not stationary and perhaps had a rate of natural increase as high as 2.5% per annum (Steyn, 1994). As a means to compensate for this rate of natural increase in a stable population, Henneberg and Steyn (1995) developed a non-stationary demographic model which could be used when either the growth rate of the population was known or had been estimated. This model is based on the premise that the total possible number of individuals within each age at death class varies based on the rate of natural increase (or growth rate) of the population. For example, in a living population with a positive rate of increase, the number of individuals within the juvenile class (0-4 and 5-10) would be higher than the number of individuals within the adult classes (20 and over) such that if a census was taken of the population, it would contain a relatively higher number of children. The same theory can be applied to the number of individuals dying within the population; statistically a higher number of children than adults will die on account of the fact that there are proportionally more juveniles than adults within the population.

3.1.4. Individual heterogeneity

Individual heterogeneity refers to the internal make-up of an individual such as deleterious genetic disorders, congenital defects, and the overall strength of the immune system. In a population without proper medical care or treatment, natural selection dictates mortality such that the weaker individual succumbs to disease, dies and enters the skeletal sample at a younger age than the more robust individual who survives various diseases and lives to be an old adult. Since one cannot know the frail from the robust individual when analysing a skeletal sample, it is difficult to ascertain the overall health of the population from the life expectancy or pathology alone. The question in regard to individual heterogeneity and palaeodemography is whether the younger individuals in a skeletal sample represent the heterogeneity of the population (both frail and robust) or just the frailer aspects of it (Wood et al., 1992). These problems are inherent to skeletal samples and cannot be easily solved.

3.1.5 Aim

The purpose of this chapter is to compare the estimated life expectancy of the rural Venda with prehistoric and contemporary populations from South Africa. From this comparison, general inferences will be made with regard to the longevity and general health of the rural Venda during the 20th century.

3.2 Material and Methods

The first step in any demographic analysis is to construct a life table. Since age at death was estimated from the skeletal remains, abridged life tables were calculated by means of the Halleys' method. An abridged life table is divided into five-year groups as a way to compensate for errors in age at death estimations

(Ubelaker, 1989). In this study 14 five-year classes were created (e.g., 0-4, 5-9, 10-14) and age at death ranged from 0 to 70 years. If an individual had an age at death that was larger than a single five-year age class, then equal proportions of that individual were placed into each subsequent age class (Ascádi and Nemeskéri, 1970). For example, if the age range was 25 to 35 years, then ½ of the individual was placed in the 25 to 29 year age class and the other ½ into the 30 to 34 year age class. Due to the poor preservation of the remains, only 26% of the individuals could be placed into the direct age classes with the other 74% being fractioned and distributed into other age classes.

Once the individuals are sorted into five year age classes, it is possible to calculate the six biometric functions associated with life tables which include the total number of deaths in each age class (Dx); the percentage of deaths in each age class (dx); the number of survivors entering each age class (lx); the probability of dying in a particular age class (qx); the total number of years lived by the entire population (Lx); the total number of years remaining for all individuals (Tx); and life expectancy (ex).

The first two functions Dx and dx represent the *total* number of individuals and the *percentage* of individuals who died in the age class, respectively. The number of survivors entering an age class is recorded as lx. This function is calculated by subtracting the percentage of individuals who died in the age class from the percentage of individuals who died in the preceding age class. As can be expected, the percentage of survivorship decreases in succeeding age classes. The probability of dying in a particular age class (qx) is determined by dividing the percentage of deaths (dx) by the percentage of survivors (lx) in a particular age class. Lx is calculated by adding the percentage of survivors (lx) in a single age class to the percentage of surviving in the following age class. The sum of these two age classes is then multiplied by five and divided by two. From these two calculations, it is possible to obtain the average number of years lived in each age class by the entire population. Tx is calculated by adding the value in the Lx column to all succeeding age classes. Life expectancy is the average number of years an individual is expected to live at the beginning of each age class. It is calculated by dividing the total number of years remaining for all individuals (Tx) by survivorship (lx) in that age class. In this chapter, only e_0, the average number of years an individual is expected to live at birth and e_{20} the average number of years an individual is expected to live from adulthood was used for comparison with other populations. Adulthood was thus deemed to start at 20 years of age.

Both stationary and non-stationary demographic models were used to estimate life expectancy. A stationary model, known as Halleys' method, calculates life expectancy directly from the frequency of individuals who have died in each age class (Coale and Demeny, 1966). However, as mentioned earlier, stationary models tend to underestimate life expectancy in stable populations, because the model cannot compensate for a rate of natural increase. For this reason, the non-stationary demographic model, as developed by Henneberg and Steyn (1995), was used to adjust the life table for a rate of natural increase.

The non-stationary demographic model is based on a correction factor that is added to the biometric function dx, which is the number of individuals who died within a particular cohort. With this correction factor, it is possible to estimate the number of individuals who should have been within a particular cohort given the rate of natural increase of the population. The correction factor is $(1 + r)^x$ with r being the rate of natural increase and x being the midpoint in years for the respected age class (Henneberg and Steyn, 1995). The rate of natural increase used for the non-stationary demographic model was selected from the Central Statistical Services (1982). From 1911 to 1970, the population of black South Africans was estimated to have been growing at a rate of 2.3% and white South Africans at 1.85%.

3.2.1. Comparative South African samples

The estimated life expectancy and mortality rates calculated for the Venda were compared with several prehistoric, rural and urban populations from South Africa. The aim of these comparisons was to assess changes in life expectancy from the prehistoric period to present and to show similarities or differences in the estimated life expectancy from Venda with other modern populations.

The prehistoric populations that were used include K2, Oakhurst and Toutswe. Modern demographic data on black and white South Africans were obtained from Katzenellenbogen et al. (1993), Sadie (1970), Van Tonder and Van Eeden (1975), and Henneberg and Steyn (1995). Institute of Developments Studies at the Rands Afrikaans University (RAU) (1979) and Van Nieuwenhuizen and Oosthuizen (1984) provided demographic data on the rural Venda during the 1970's and 1980's. The burial registers from the Rebecca Street Cemetery were also recorded and supply additional data on modern urban black and white South African populations.

K2

Occupied between A.D. 1000 and 1300, the K2 site represents a turning point in social structure for the early Iron Age 'Bantu'speaking agricultural populations of South Africa. It is at K2 that the reorganization of social space from the 'egalitarian' central cattle pattern to a more socially stratified society with ruling elite has been noted (Huffman, 1996; Mitchell, 2002). The health status of the individuals from K2 was relatively good, such that low incidences of sub-periosteal lesions, cribra orbitalia, and other chronic infectious diseases were observed (Steyn, 1994). However, parasitic diseases may have been common due to possible overcrowding, poor sanitation, and inconsistent access to a water supply (Dittmar and Steyn, 2004). On account of the relatively good health of the K2 population, it was suggested that the population was expanding (Henneberg and Steyn, 1994).

Oakhurst

The skeletal remains from the Oakhurst Rockshelter have been dated between 10,000 and 6,000 B.P. Unlike the prehistoric population of Mapungubwe/K2 who had relatively good health, these individuals were suggested to have experienced generalized nutritional stress (Patrick 1989). According to Sealy et al. (1992), poor health of this group can be attributed to their dependence a marine diet that lacked many vital nutrients such as iron. Cribra orbitalia were ubiquitous among the skeletal remains from Oakhurst and have been associated with iron deficiency anaemia.

Toutswe

This is an early Iron Age population from Botswana that dates between AD 700 and 1250 (Mosothwane, 2004). The skeletal sample contains remains of 84 individuals (58 juveniles and 26 adults) from various sites within east central Botswana. According to Mosothwane (2004), the population had high infant mortality but generally good adult health. The primary cause of death was attributed to acute infectious diseases.

Modern populations

A paucity of data exists with regard to the mortality rates for urban black South African populations during the 20th century and little to no information exists with regard to rural populations. Katzenellenbogen et al. (1993) assessed infant and adult mortality for three time periods, 1837-1846, 1870-1879, 1900-1909, from missionary records at a rural, coloured farming community, known as the Moravian Mission at Mamre in the Western Cape. The labourers at this mission had superior health and longevity, when compared to their contemporaries. This discrepancy has been attributed to a better diet and living conditions. In a modern rural farming community at Maroelabult, the life expectancy was low and health was poor; conditions which have been related to either food shortages or infectious disease (Steyn et al., 2002). These articles comprise the only published life expectancy data available for modern non-white South Africans before 1935.

For the period 1935-1970, Sadie (1970) compiled data on the rates of fertility, mortality and longevity for urban black South Africans; most of the demographic information was taken from censuses for the period 1936, 1946, 1951, and 1960. Mortality and longevity rates for the decades 1980 and 1990 for urban black and white South Africans were acquired from Henneberg and Steyn (1995). The only demographic data available on rural Venda communities were recorded in the 1970's by the Institute of Development at RAU (1979) and is cited in Teichler et al. (1985).

Additional demographic data for urban white and black South Africans were obtained from the burial registers at the Rebecca Street and Mamelodi cemeteries for the period 1904-2000 by the author. The Rebecca Street Cemetery was established in 1904 and is the largest cemetery in the city of Pretoria, the capital of South Africa. Black South Africans, juveniles and adults, were buried in this cemetery from 1904 to approximately 1965. With the implementation of the Apartheid system in the 1960's, black South Africans were moved into homelands outside the city where they established their own burial grounds known as the Mamelodi cemetery. Therefore, burial registers from both cemeteries were used to obtain information for the life table statistics of black South Africans. Abridged model life tables for white South Africans are available from 1926 to present; information obtained for white South Africans from the Rebecca Street cemetery was used as an additional comparative population only (Van Tonder and Van Eeden, 1975).

A random sample of 1,364 black and 1,286 white South Africans were taken from the burial registers at the above-mentioned cemeteries. The register was divided into ten year intervals such as 1901-1910, 1911-1920, 1921-1930 etc. In each interval (i.e. 1901-1910), the first twenty entries were selected from every second page (10 for white and 10 for black South Africans). This process was repeated until 100 entries were obtained for each race group. The criterion for selection was that age at death, sex, and racial affinity of the individual had to be complete. The mortality and longevity rates for the cemetery samples were calculated using both a stationary and non-stationary demographic model.

Several inherent biases are present in cemetery burial registers and include misreporting the age of an individual, under-reporting of stillborn babies, and the absence of individuals who had not practiced religions such as Christianity, Judaism or Islam (Katzenellenbogen et al., 1993). The last criterion is an important consideration with regard to the representation of black South Africans in the cemetery. Urban migration may also have affected the composition of the Rebecca Street cemetery, and thus it may not reflect the demographic profile of the whole country (Coale and Demeny, 1966). However, due to the paucity of demographic data on both urban and rural populations in South Africa, the information obtained from the Rebecca Street Cemetery is a valuable addition to the mortality and longevity rates of South Africans during the 20th century.

3.3 Results

Abridged life tables for the Venda, calculated for both stationary and non-stationary demographic models, are shown in Tables 3.1 and 3.2 respectively. In the stationary model (Table 3.1), the mortality rate ($q_{0\text{-}4}$:0.24) for individuals less than five years of age. After 5 years of age, the mortality rate decreases and remains low until 30 years of age. Once an individual is over 30 years of age, the mortality rate rises steadily and eventually by the age of 45 years, is similar to the mortality rate found during the first five years of life.

Therefore, it can be suggested that the Venda had a high rate of child mortality (0-4 years), low juvenile and young adult mortality (5 - 29 years), and a steady increase in mortality after the age of 30 years with the highest mortality rate occurring after 45 years of age. The calculated life expectancy at birth (e_0) for the Venda was approximately 35 years. If an individual reached adulthood (age 20), then s/he was estimated to live another 25 years or to reach 45 years of age.

According to the stationary model life table, most individuals died during middle adulthood (roughly between 30 and 40 years of age), which is younger than other contemporary rural and urban South African populations where the average life expectancy at birth was between 35 and 55 years (Brighton, 1983; Katzenellenbogen et al., 1993; Henneberg and Steyn, 1995). The lower life expectancy at birth calculated for the Venda may be attributed to errors in estimating age at death, sampling techniques, or in the stationary model which was used to calculate life expectancy from a non-stationary population. The first two errors are inherent to the sample and cannot be modified. However, the stationary model life table can be adjusted. This model was recalibrated by adjusting the growth rate of the population to 2.3%.

In the non-stationary demographic model (Table 3.2), adjusted for a growth rate of 2.3%, the pattern of mortality is similar to that found in the stationary model, but with a reduction in the mortality rate of children less than 5 years of age (from $q_{0\text{-}4} = .24$ to $q_{0\text{-}4} = .10$). Once the individual passes the five-year mark, the mortality rate drops and remains low ($qx < .10$) until 35 years of age. After 35 years of age, the mortality rate begins to steadily increase with a peak at 50 years of age and older. Similar to the stationary population, infant mortality is high, juvenile and young adult mortality (5-29 years) is low, and mortality increases after 35 years with the highest rate of mortality occurring after 50 years of age. In this model, the overall life expectancy at birth and adulthood is at least ten years longer than with the stationary model. At birth, an individual is expected to live 44 years, and if s/he reaches adulthood (age 20), then they can be estimated to live another 25 years or to reach approximately 49 years of age. The results of the non-stationary demographic model are similar to other contemporary South African populations, which have high infant mortality and middle-aged adult mortality. For the remainder of the results section, only these adjusted life tables are used to represent mortality and longevity for the Venda. Although not discussed in this section, abridged life tables for modern black and white South Africans from the Rebecca Street and Mamelodi cemeteries can be found in Tables 3.3 – 3.6.

A comparison of life expectancy at birth (e_0) and at adulthood (e_{20}) among various prehistoric and modern (rural and urban) populations in Southern Africa is given in Table 3.7. The estimated life expectancy at birth and adulthood for the three prehistoric populations, Toutswe, K2/Mapungubwe, and Oakhurst, is below 20 years of age. The poor longevity rates for these populations have been attributed to high mortality rates for individuals less than five years of age and high young adult mortality between 25 and 35 years of age (Steyn, 1994; Mosothwane, 2004).

The life expectancy at birth for all the various rural and urban black South African populations for the period from 1837 to 1955 was between 35 and 45 years of age and is most similar to the life expectancy for whites approximately a century earlier (pre – 1820) (Table 3.7). Therefore, a discrepancy in mortality rates between white and black South Africans was already visible in the late nineteenth century. This continued into the twentieth century in which the mortality rates for blacks lagged those of whites by ten years or more. For the period 1955-1960, a distinct increase in life expectancy at birth is observed for black South Africans (e_0: 47.9 male; e_0 : 53.7 female) and has been attributed to improvements in living conditions for urban, black South Africans (Sadie, 1970).

In Table 3.8, the longevity data calculated from the Rebecca Street cemetery were divided into decades for the entire 20th century. In the first decade of the century (1901-1910), estimated life expectancy at birth for black South Africans was 24.5 years and by 1930 it had risen to 37.5 years; an increase of more than ten years. As a whole, life expectancy at birth for black South Africans rose steadily throughout the 20th century from 24.4 years in 1910 to 63.1 years in 2000. This supports the demographic data presented by Sadie (1970) and Van Tonder and Van Eeden (1975), where a steady increase in life expectancy for other urban, black South Africans was also observed. However, for the period of 1950-1970, an increase in *mortality* at the Rebecca Street cemetery was noted. This increase in mortality does not correspond with other black South African life tables for this period and may be specific to the Pretoria area. It may also be the result of sample bias.

The life expectancy at birth for the Venda (e_0: 44.5 years) is most similar to urban black South Africans from the period 1950-1960, which may be due to the fact that the date of death of most of the skeletal remains from Venda are within this time frame. These results are also in agreement with the recorded life expectancy for the living Venda during 1970, which was proposed to be 48 years of age for males and 54 years of age for females (Teichler et al., 1985). The close relationship between the calculated life expectancy data for the Venda and the demographic life tables of Van

Tonder and Van Eeden (1975) implies a similar rate of longevity for the rural Venda and other contemporary South African communities.

In addition to life expectancy, the rate of mortality for children less than 5 years of age is an important demographic criterion when interpreting improvements in health for any population. In Table 3.9, the probability of dying (qx) is summarized with the expectancy of life at birth (e_0) and at adulthood (e_{20}) for black and white South Africans. The information was modified from Van Tonder and Van Eeden, (1975), who created the first abridged life tables for all population groups in South Africa for the period between 1921-1970.

In both white and black South African populations, a decrease in child mortality ($q_{0\text{-}4}$) and an increase in life expectancy at birth (e_0) throughout the century are clearly observable. However, the decline in child mortality occurs more slowly for black than white South Africans. For example, for the period 1935-1940, the mortality rate for children under five years is three times higher for black South Africans ($q_{0\text{-}4}$ = 0.306) than for white South Africans ($q_{0\text{-}4}$ = 0.094). This discrepancy in child mortality may be attributed to differential access to resources, diet, the number of children born per mother and a difference in the general standards of living between black and white South Africans. Although child mortality does decline for black South Africans during the 20th century, it remained quite high in 1970 ($q_{0\text{-}4}$ = 0.14 females; 0.16 males) when compared to white South Africans from the same period ($q_{0\text{-}4}$ = 0.02). The estimated child mortality rate for the Venda ($q_{0\text{-}4}$ = 0.10) fits well with the estimated rates for the later half of the 20th century.

In summary, a steady increase in life expectancy at birth was observed for urban black South Africans during the 20th century. It can be assumed that this decrease in mortality also occurred among some of the rural Venda communities. Many of these communities had access to comparable resources such as food and health care as their urban contemporaries (Van Nieuwenhuizen and Oosthuizen, 1984). The estimated adult average at at death for the Venda was roughly 49 years and is within the range of life expectancy (37-55 years) for black South Africans during the period 1935-1990 (Van Tonder and Van Eeden, 1975; Henneberg and Steyn, 1995). In the 20th century, adult mortality (e_{20}) remained relatively constant for both black and white South Africans. Black South Africans had an average adult age at death between 55 and 65 years, whereas the average adult mortality for white South Africans was between 65 and 75 years.

3.4 Discussion

3.4.1. Shortcomings

In this study, poor preservation was the primary obstacle for estimating age at death. The bones least likely to be recovered during excavations were the upper limbs, ribs, vertebrae, pelvis, hands and feet. On account of this, the more accurate age at death techniques such as the sternal end of the 4^{th} rib and the pubic symphysis had to be excluded in lieu of less accurate techniques like cranial suture closure and dental attrition. Out of the 97 adult individuals, the sternal end of the fourth rib was present in only 4.1% (n = 4) and the pubic symphysis in 8.2% (n = 8). Therefore, it can be said that the poor preservation of the skeletal material strongly affected the estimation of age at death such that the age range given to most adult individuals was large (more than 20 years). Thus skeletal remains of adults could often only be placed into general categories of young adult, young to middle aged adult and older adult.

One method used to check age at death estimates was to compare the estimated age results with the ages provided by family members. However, these age estimations also had a certain degree of bias. For example, if the mother was present during the excavation of her young child, then she could recall his/her age with a fair degree of accuracy. On the other hand, other relatives such as grandchildren had great difficultly in remembering the age of their grandparents or great grandparents. In such cases, they were more prone to over-age than under-age. More than one set of family members attested that their relative had been 106, or 110 years of age when they died! A tendency to over-estimate the age of an adult was also observed in urban, black South African communities (Sadie, 1970).

Inadvertent sample bias may have also contributed to errors in demographic calculations. Several aspects of the excavations conducted in the Venda villages that may have caused sample bias include poor preservation of juvenile remains, poor preservation of the early 20th century (pre-1960), inadequate recollection of family members with regard to the location of a grave and selective sampling of graves from areas affected by construction of the Nandoni Dam.

3.4.2. Interpretation of the demographic profile

In the abridged life tables from both stationary and non-stationary models, a classic mortality pattern was noted in that child mortality was high, juvenile and young adult mortality low, and mortality began to increase in middle adulthood (around 30-35 years) (Katzenellenbogen et al., 1993). The main difference between the stationary and non-stationary models is that child mortality was much higher and the increase in adult mortality occurred at a younger age in the former. This is due to the fact that when a stationary model is applied to a stable population with a rate of natural increase (such as the Venda), the result is an "overestimation of juvenile mortality and an underestimation of adult mortality (Henneberg and Steyn 1994:111).

As previously mentioned, the Venda population can be described as having a high mortality rate for children less than 5 years of age and a medium range adult mortality rate with most adult deaths occurring between 45 and 55 years of age (Department of International Economic and Social Affairs, 1982). This mortality trend is most similar to that seen in the West model life table Level 17 from Coale and Demeny (1966). In this model life table, the average age of the population is 25 years, which suggests that children and young adolescents comprised the bulk of the population. Child mortality is high such that the average age at death is 39 years; but if an individual lives past the age of five years then this average rises to 53 years of age.

In a study by Henneberg and Steyn (1995) on the mortality trends of black South Africans in the 1980's and 1990's, the Level 17 West model life table was also used as a model population for this group due to the high rates of infant mortality and medium range adult longevity. Therefore, the mortality trends for the Venda and urban black South African populations in general were not different during the 20th century. In fact, a high rate of child mortality has been observed in many African countries (Department of International Economic and Social Affairs, 1988).

In order to elucidate further the general health status of the Venda, it is important to examine the possible environmental factors that result in a high level of child mortality in a population. According to the United Nations (Department of International Economic and Social Affairs, 1982), the parasitic diseases, such as malaria and schistosomiasis, and acute infectious diseases appear to be the most common cause of death in Sub-Saharan Africa. In a study from Kaduna, Nigeria, the primary cause of death for adult individuals 15-44 years old was infections and parasitic disease (32%), accidents, poison and violence (14%), and circulatory disease (12%) (Hunponu-Wusu, 1976). Infections, parasitic disease, respiratory disease and congential deformities were also common causes of death among 'Coloured' people in South Africa (Van Tonder and Van Eeden, 1975). Similar to these above-mentioned studies, Edingtonet al. (1971) noted that a high frequency of deaths in rural South African populations was caused by respiratory infections (47%) and abdominal and digestive disorders (11%). Although neither of these studies focused on child mortality, it can be assumed that acute infections and parasitic disease were perhaps the largest contributors to mortality for this age group.

Geographically, the community of Venda is located within a malaria endemic area (Stayt, 1931;Brighton, 1983). Stayt (1931) noted that malaria affected the energy levels and productivity of most adults throughout the year. In addition, he mentioned that infant mortality was high such that between 60 and 70%, of infants died during the summer months. These deaths may be attributed to malaria and other infectious diseases. According to Van Staden (1988), bilharzia (schistosomiasis) had the highest infectious rate in the rural community of Tshikundamelema, with 66% of the community infected. Other diseases found within this community were *tinea capitis* (54%), malaria (5.6%), syphilis (6%), tuberculosis (2%) and fungal infections. Brighton (1983) and Teichler et al. (1985) noted a higher frequency of tuberculosis in the rural Venda area than Van Staden (1988). From these various studies, it can be suggested that the prevalence of parasitic and infectious disease in rural Venda was similar or possibly higher to disease prevalence in other rural communities in South Africa and sub-Saharan Africa.

3.4.3. General demographic trends from the Iron Age to present

An improvement in life expectancy for black South Africans was noted from the prehistoric (K2/Mapungubwe) to the modern era (Venda). At K2/Mapungubwe, infant mortality was high and adult longevity was short. The decline in mortality from prehistoric times to the 20th century may be attributed to a reduction in pathogen loads in the population, immunity to certain pathogens, reduction in infant mortality, reduction in fertility, improvement in living and socio-economic conditions and possible access to medical treatment and vaccinations (Henneberg and Steyn, 1995). Child mortality, which includes the death of all children less than 5 years of age, has a considerable effect on the life expectancy at birth in a population (Van Tonder and Van Eeden, 1975; Whiteside and Sunter, 2000). Therefore, it may be considered that the individuals who benefited most over the past 1,000 years with regard to longevity were children less than five years of age. The death of children under five years of age dropped from 34% at K2/Mapungubwe to approximately 10% in the Venda. The adult mortality rate also improved with more individuals surviving until their 4th of 5th decade of life within the modern Venda community. However, it was the dramatic drop in child mortality, which created a higher life expectancy at birth for the Venda when compared to K2/Mapungubwe.

Infant and child mortality are sensitive to socio-economic and environmental conditions such that a decrease in mortality for this group is a clear indication of improvements in health within the population (Department of International Economic and Social Affairs, 1988). From 1910 to 2000, it has been shown that child mortality steadily declined and life expectancy rose for black South Africans (Table 3.7 and 3.8). It is interesting to note that in 1910 the child mortality rate was 31% ($q_{0\text{-}4}$ = 0.31), which is nearly as high as the child mortality rates seen for K2/Mapungubwe ($q_{0\text{-}4}$ = 0.34). Therefore, improvements in mortality for black South Africans may have only occurred within the past 100 years. Although mortality decreased for South African blacks during the 20th century, it did not decline as rapidly as mortality for white South Africans. This discrepancy may be due to differences in socio-economics and standards of living.

In summary, it can be implied that life expectancy improved for the Venda during the 20th century in a manner similar to that seen in other black South African populations. This improvement in life expectancy was most likely attributed to a decrease in child mortality rather than an increase in adult longevity. It appears that adult longevity remained relatively constant throughout the 20th century for both black and white South Africans. It can be expected that in the future, infant and young adult mortality rates will rise for black South Africans due to widespread HIV infection/AIDS in the country and throughout sub-Saharan Africa (Whiteside and Sunter, 2000). By 2010, the life expectancy at birth may fall below 50 years of age for South African populations (Gregson et al. 1997; Whiteside and Sunter 2000). Thus, the decrease in mortality seen in black South Africans over the last 50 years will most likely be lost within the next 10 years, due to this disease.

Table 3.1. Life table for the Venda not adjusted for growth rate

Age	Dx	dx	lx	qx	Lx	Tx	ex
0-4	37.00	23.57	100.00	0.24	441.08	3465.15	**34.65**
5-9	2.50	1.59	76.43	0.02	378.18	3024.08	39.57
10-14	0.50	0.32	74.84	0.00	373.40	2645.90	35.35
15-19	2.00	1.27	74.52	0.02	369.43	2272.50	30.50
20-24	4.90	3.13	73.25	0.04	358.43	1903.08	**25.98**
25-29	9.50	6.02	70.12	0.09	335.55	1544.65	22.03
30-34	12.60	8.01	64.10	0.13	300.48	1209.10	18.86
35-39	11.90	7.59	56.09	0.14	261.48	908.63	16.20
40-44	14.60	9.32	48.50	0.19	219.20	647.15	13.34
45-49	13.00	8.26	39.18	0.21	175.25	427.95	10.92
50-54	17.80	11.32	30.92	0.37	126.30	252.70	8.17
55-59	13.00	8.26	19.60	0.42	77.35	126.40	6.45
60-64	11.30	7.20	11.34	0.63	38.70	49.05	4.33
65-69	6.50	4.14	4.14	1.00	10.35	10.35	2.50
Total	**157**						

Table 3.2. Life table for the Venda adjusted for a growth rate of 2.3%

Age	Dx	corrected	Dx [r = 2.3]	dx	lx	qx	Lx	Tx	ex
0-4	37.00	2.16	39.16	10.14	100.00	0.10	474.65	4404.25	**44.04**
5-9	2.50	0.46	2.96	0.77	89.86	0.01	447.38	3929.60	43.73
10-14	0.50	0.16	0.66	0.17	89.09	0.00	445.03	3482.23	39.09
15-19	2.00	0.98	2.98	0.77	88.92	0.01	442.68	3037.20	34.16
20-24	4.90	3.30	8.20	2.12	88.15	0.02	435.45	2594.53	**29.43**
25-29	9.50	8.16	17.66	4.57	86.03	0.05	418.73	2159.08	25.10
30-34	12.60	13.75	26.35	6.82	81.46	0.08	390.25	1740.35	21.36
35-39	11.90	15.70	27.96	7.24	74.64	0.10	355.10	1350.10	18.09
40-44	14.60	23.86	38.46	9.96	67.40	0.15	312.10	995.00	14.76
45-49	13.00	25.19	38.19	9.89	57.44	0.17	262.48	682.90	11.89
50-54	17.80	40.82	58.62	15.18	47.55	0.32	199.80	420.43	8.84
55-59	13.00	34.94	47.94	12.42	32.37	0.38	130.80	220.63	6.82
60-64	11.30	35.51	46.81	12.12	19.95	0.61	69.45	89.83	4.50
65-69	6.50	23.57	30.17	7.81	7.83	1.00	19.63	20.38	2.60
Total	**157**		**386.12**						

Table 3.3. Life table for black South Africans from the Rebecca Street cemetery not adjusted for growth rate.

Age	Dx	dx	lx	qx	Lx	Tx	ex
0-4	550	40.32	100.00	0.40	399.20	2967.00	**29.67**
5-9	27	1.98	59.68	0.03	293.45	2567.80	43.03
10-14	19	1.39	57.70	0.02	285.03	2274.35	39.42
15-19	29	2.13	56.31	0.04	276.22	1989.33	35.33
20-24	42	3.08	54.18	0.06	263.20	1713.10	**31.62**
25-29	59	4.33	51.10	0.08	244.68	1449.90	28.37
30-34	67	4.91	46.77	0.11	221.57	1205.23	25.77
35-39	69	5.06	41.86	0.12	196.65	983.65	23.50
40-44	76	5.57	36.80	0.15	170.08	787.00	21.39
45-49	56	4.11	31.23	0.13	145.88	616.93	19.75
50-54	58	4.25	27.12	0.16	124.98	471.05	17.37
55-59	47	3.45	22.87	0.15	105.73	346.08	15.13
60-64	66	4.84	19.42	0.25	85.00	240.35	12.38
65-69	53	3.89	14.58	0.27	63.18	155.35	10.66
70-74	60	4.40	10.69	0.41	42.45	92.18	8.62
75-79	34	2.49	6.29	0.40	25.23	49.72	7.91
80-84	27	1.98	3.80	0.52	14.05	24.50	6.45
85-89	15	1.10	1.82	0.60	6.35	10.45	5.74
90-94	5	0.37	0.72	0.51	2.68	4.10	5.69
95-99	3	0.22	0.35	0.63	1.20	1.43	4.07
100-104	2	0.15	0.13	1.15	0.28	0.23	1.73
105-109	0	0.00	-0.02	0.00	-0.05	-0.05	2.50
Total	**1364**						

Table 3.4. Life table for black South Africans from the Rebecca Street Cemetery adjusted for a growth rate of 2.3%.

Age	Dx	corrected	Dx (r=2.3)	dx	lx	qx	Lx	Tx	ex
0-4	550.00	28.98	578.98	19.47	100.00	0.19	451.33	4636.30	**46.36**
5-9	27.00	45.00	31.50	1.06	80.53	0.01	400.00	4184.98	54.97
10-14	19.00	5.56	24.56	0.83	79.47	0.01	395.28	3784.98	47.63
15-19	29.00	12.54	41.54	1.40	78.64	0.02	389.70	3389.70	43.10
20-24	42.00	24.67	66.67	2.24	77.24	0.03	380.60	3000.00	**38.84**
25-29	59.00	44.79	103.79	3.49	75.00	0.05	366.28	2619.40	34.93
30-34	67.00	63.60	130.60	4.39	71.51	0.06	346.58	2253.13	31.51
35-39	69.00	80.05	149.05	5.01	67.12	0.07	323.08	1906.55	28.41
40-44	76.00	105.96	181.92	6.12	62.11	0.10	295.25	1583.48	25.49
45-49	56.00	92.55	148.55	5.00	55.99	0.09	267.45	1288.23	23.01
50-54	58.00	112.49	170.49	5.73	50.99	0.11	240.63	1020.77	20.02
55-59	47.00	106.10	153.10	5.15	45.26	0.11	213.43	780.15	17.24
60-64	66.00	172.24	238.24	8.01	40.11	0.20	180.53	566.73	14.13
65-69	53.00	159.00	212.00	7.13	32.10	0.22	142.68	386.20	12.03
70-74	60.00	205.95	265.95	8.94	24.97	0.36	102.50	243.53	9.75
75-79	34.00	133.01	167.01	5.62	16.03	0.35	66.10	141.03	8.80
80-84	27.00	119.96	146.96	4.94	10.41	0.47	37.70	74.93	7.20
85-89	15.00	75.48	90.48	3.04	5.47	0.56	19.75	35.23	6.44
90-94	5.00	28.42	33.42	1.12	2.43	0.46	9.35	15.48	6.37
95-99	3.00	19.22	22.22	0.75	1.31	0.57	4.68	6.13	4.68
100-104	2.00	14.42	16.42	0.55	0.56	0.98	1.43	1.45	2.59
105-109	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.03	2.50
Total	**1364.00**		**2973.40**						

Table 3.5. Life table for white South Africans from the Rebecca Street cemetery not adjusted for growth rates

Age	Dx	dx	lx	qx	Lx	Tx	ex
0-4	258	20.06	100.00	0.20	449.85	5101.50	**51.02**
5-9	17	1.32	79.94	0.02	396.40	4651.65	58.19
10-14	7	0.54	78.62	0.01	391.75	4255.25	54.12
15-19	17	1.32	78.08	0.02	387.10	3863.50	49.48
20-24	22	1.71	76.76	0.02	379.53	3476.40	**45.29**
52-29	24	1.87	75.05	0.02	370.58	3096.87	41.26
30-34	27	2.10	73.18	0.03	360.65	2726.30	37.25
35-39	29	2.26	71.08	0.03	349.75	2365.65	33.28
40-44	47	3.65	68.82	0.05	334.98	2015.90	29.29
45-49	48	3.73	65.17	0.06	316.53	1680.93	25.79
50-54	54	4.20	61.44	0.07	296.70	1364.40	22.21
55-59	77	5.99	57.24	0.10	271.23	1067.70	18.65
60-64	88	6.84	51.25	0.13	239.15	796.48	15.54
65-69	108	8.40	44.41	0.19	201.05	557.33	12.55
70-74	139	10.81	36.01	0.30	153.03	356.28	9.89
75-79	114	8.86	25.20	0.35	103.85	203.25	8.07
80-84	98	7.62	16.34	0.47	62.65	99.40	6.08
85-89	78	6.07	8.72	0.70	28.43	36.75	4.21
90-94	30	2.33	2.65	0.88	7.43	8.33	3.14
95-99	4	0.31	0.32	0.97	0.83	0.90	2.81
100-104	0	0.00	0.01	0.00	0.05	0.08	7.50
105-109	0	0.00	0.01	0.00	0.03	0.03	2.50
Total	**1286**						

Table 3.6. Life table for white South Africans from the Rebecca Street Cemetery adjusted for a growth rate of 1.85%

Age	Dx	corrected	Dx (r= 1.85)	dx	lx	qx	Lx	Tx	ex
0-4	258	13.59	271.59	6.28	100.00	0.06	484.30	6578.35	**65.78**
5-9	17	2.83	19.83	0.46	93.72	0.00	467.45	6094.05	65.02
10-14	7	2.05	9.05	0.21	93.26	0.00	465.78	5626.60	60.33
15-19	17	7.35	24.35	0.56	93.05	0.01	463.85	5160.83	55.46
20-24	22	12.92	34.92	0.81	92.49	0.01	460.43	4696.98	**50.78**
25-29	24	18.22	42.22	0.98	91.68	0.01	455.95	4236.55	46.21
30-34	27	25.63	52.63	1.22	90.70	0.01	450.45	3780.60	41.68
35-39	29	33.64	62.64	1.45	89.48	0.02	443.78	3330.15	37.22
40-44	47	65.51	112.51	2.60	88.03	0.03	433.65	2886.38	32.79
45-49	48	79.32	127.32	2.94	85.43	0.03	419.80	2452.73	28.71
50-54	54	104.73	158.73	3.67	82.49	0.04	403.28	2032.93	24.64
55-59	77	173.82	250.82	5.80	78.82	0.07	379.60	1629.65	20.68
60-64	88	229.65	317.65	7.34	73.02	0.10	346.75	1250.05	17.12
65-69	108	324.00	432.00	9.99	65.68	0.15	303.43	903.30	13.75
70-74	139	477.13	616.13	14.24	55.69	0.26	242.85	599.88	10.77
75-79	114	445.96	559.96	12.94	41.45	0.31	174.90	357.03	8.61
80-84	98	435.43	533.43	12.33	28.51	0.43	111.73	182.13	6.39
85-89	78	392.48	470.48	10.87	16.18	0.67	53.73	70.40	4.35
90-94	30	170.52	200.52	4.63	5.31	0.87	14.98	16.68	3.14
95-99	4	25.63	29.63	0.68	0.68	1.00	1.70	1.70	2.50
100-104	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105-109	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**2650**		**4326.4**						

Table 3.7 Comparison of life expectancy at birth and adulthood of the Venda with various populations in Southern Africa

	Year	N Male	N Female	N Combined	e_0 Male	e_0 Female	e_0 Combined	e_{20} Male	e_{20} Female	e_{20} Combined	Source
Prehistoric											
Toutswe		-	-	84	-	-	17.23	-	-	20.44	Mosothwane 2004
K2/Mapungubwe*		-	-	154	-	-	18.91	-	-	19.12	Steyn 1994
Oakhurst		-	-	37	-	-	19.60	-	-	17.40	Patrick 1989
Rural											
SA whites	pre-1820	-	-	110	42.56	46.06	-	40.22	39.37	-	Gouws 1986
Venda*	1910-2000	-	-	386	-	-	44.04			29.43	This study
Venda	1970-1980	-	-	-	48.64	54.64	-	-	-	-	Institute of Development RAU
Mamre	1837-1846	196	160	-	36.02	36.33	-	38.95	37.34	-	Katzenellen-bogen 1993
	1870-1879	182	172	-	34.48	31.92	-	43.32	39.82	-	"
	1900-1909	128	97	-	39.94	45.12	-	39.94	45.25	-	"
Urban											
RBC[1] black*	1904-2000	-	-	2973	-	-	46.36	-	-	38.84	This study
SA - black	1935-40	-	-	-	37.72	38.47	-	37.55	37.96	-	Van Tonder 1975
	1940-45	-	-	-	36.34	36.56	-	37.26	37.65	-	"
	1945-50	-	-	-	39.10	39.23	-	38.67	39.17	-	"
	1950-55	-	-	-	41.74	43.62	-	37.81	40.32	-	"
	1955-60	-	-	-	47.94	53.70	-	39.34	44.72	-	"
	1960-65	-	-	-	48.53	54.68	-	39.40	45.36	-	"
	1965-1970	-	-	-	48.99	55.55	-	39.55	45.76	-	"
	1980	-	-	-	-	-	53.80	-	-	40.80	Henneberg and Steyn 1995
	1990	-	-	-	-	-	59.40	-	-	43.20	"
RBC[1] white*	1904-2000	-	-	4326	-	-	65.78	-	-	50.78	This study
SA - white	1980	-	-	-	-	-	65.60	-	-	47.70	Henneberg and Steyn 1995
SA-white	1990						67.50			49.20	"

*growth rate adjusted for these populations. Unadjusted growth rates for this study can be found in Table 3.1(Venda) and in Table 3.3 & 3.5 (RBC blacks and whites) and for K2/Mapungubwe in Steyn (1994).

1 Rebecca Street Cemetery (Pretoria, South Africa)

Table 3.8. Life expectancy at birth and adulthood for whites and blacks in South Africa by decade from the burial registers at the Rebecca Street and Mamelodi cemeteries adjusted for a growth rate of r = .0185 (whites) and .023 (blacks).

Decade	White			Black			Combined		
	N	e_0	e_{20}	N	e_0	e_{20}	N	e_0	e_{20}
1901-10	34.41	34.71	30.72	210.22	24.52	15.92	236.33	25.74	18.24
1911-20	194.40	46.07	39.19	170.40	27.99	19.40	375.98	39.01	31.97
1921-30	207.34	47.63	40.91	194.97	37.35	31.78	410.36	43.40	37.31
1931-40	187.20	53.90	46.42	162.77	42.88	41.25	359.72	49.90	44.47
1941-50	464.47	57.42	44.72	284.33	29.09	30.50	795.09	48.24	41.76
1951-60	441.43	67.06	50.46	279.82	38.11	37.13	770.24	57.30	47.33
1961-70	561.22	66.83	52.77	240.46	41.42	37.78	871.15	60.88	50.10
1971-80	367.07	68.32	52.30	490.27	55.99	42.53	861.25	61.89	47.48
1981-90	677.77	72.46	54.13	548.75	60.06	43.25	1277.10	67.88	50.24
1991-00	611.65	71.83	53.30	717.59	63.09	47.63	1342.70	67.55	50.73

Table 3.9. Comparison of mortality rates and life expectancy for children less than 5 years of age for South African blacks and whites for the years 1935-1970*

	Black				White			
Years	Males		Females		Males		Females	
	q_{0-4}	e_0	q_{0-4}	e_0	q_{0-4}	e_0	q_{0-4}	e_0
1921-26	-	-	-	-	0.13	55.27	0.11	58.66
1935-40	0.31	37.72	0.29	38.47	0.09	58.63	0.08	62.48
1940-45	0.34	36.34	0.32	36.56	-	-	-	-
1945-50	0.31	39.10	0.30	39.23	0.05	63.33	0.04	67.42
1950-55	0.25	41.74	0.24	43.62	0.05	64.07	0.04	69.07
1955-60	0.18	47.94	0.16	53.70	-	-	-	-
1960-65	0.17	48.53	0.15	54.68	0.04	64.27	0.03	70.57
1965-70	0.16	48.99	0.15	55.55	0.03	64.09	0.02	71.13

* Modified from Van Tonder (1970)

Chapter 4 – Pathology

4.1 Introduction and Literature Review

Health is the complete absence of any physical or emotional disease. Physical disease, caused by mechanical stress, microorganisms, inflammation, hormonal imbalance or neoplasia (to name a few), can cause a disruption in the equilibrium of bone tissue (Steyn and Ýþcan, 2000). This can result in abnormal bone formation (osteoblasts) or bone resorption (osteoclasts) or a combination of both. The macroscopic appearance of abnormal bone is described as a bone lesion. In skeletal samples, the presence of bone lesions can provide clues to the physical health conditions of that population.

A symbiotic relationship between humans, disease and the environment is self-evident. Diseases curb population growth, which, in turn, protects environmental resources. Epidemics, natural disasters and rampant population growth are imbalances in this tri-partite relationship. The causes of these imbalances are worthy of note so that they can be understood and avoided in the future. The primary physical ailments of humans can be attributed to microorganisms. Parasites, viruses, fungi, spirochetes and bacteria, are accountable for, e.g., flu, syphilis, leprosy, smallpox, HIV, malaria and Ebola. Aside from war, these microscopic organisms are the largest threat to our survival.

The origin, evolution, and dissemination of these microorganisms and our immunity against them are essential areas of study in epidemiology, palaeoepidemiology, and palaeopathology. Immunity is crucial for survival against microorganisms in a pre-antibiotic environment. Survivors of an epidemic usually develop immunity to that particular disease which helps them cope with either the reappearance of the disease or the appearance of a similar disease. For example, four types of treponemal diseases exist in the world. They are pinta, yaws, bejel and venereal syphilis (e.g., Steinbock, 1976; Ortner and Putschar, 1981; Rothschild and Rothschild, 1995). All of these diseases, except venereal syphilis, only appear in warm tropical environments with poor living conditions and little use of clothing. In such populations, children are most likely to contract a treponemal disease during play with other infected children. If the child survives the disease, then s/he develops immunity to the other treponemal diseases, including venereal syphilis (Ortner and Putschar, 1981; Meyer et al., 2001). In temperate, sanitary, urban environments (such as Europe), children are not exposed to treponemal diseases such as yaws, bejel or pinta. In adulthood, these individuals do not have immunity against treponemes and will become ill if they contract the venereal form. The above explanation is simplistic and does not include factors such as access to medical care, individual health or socioeconomic status but the relationship between humans, environment, and disease is clear.

If the primary predators of humans are microorganisms, then the second enemy to humankind are themselves. Our species is the most inventive of all mammals and has created (to name a few) weapons (for hunting and war), aeroplanes, buses and trains. All these items have increased our mobility (and perhaps success) as a species but they have also increased our risk of injury and untimely death (Angel, 1976). Trauma, which can result from accidents or aggression, is an important component in all populations. The degenerative processes of aging can also affect the physical and emotional well being of a group.

The examination of bone lesions from ancient skeletal remains is known as palaeopathology, which is a necessary component of any study that seeks to understand the general health status of a group. Since the skeletons from Venda are associated with a modern sample, this study will refer to the examination and diagnosis of these lesions as pathology. Two inherent problems exist which can affect the interpretation of pathological data. The first problem is that not all diseases, particularly acute infectious diseases, leave lesions on the skeleton. Bone lesions are an indication of a chronic or advanced form of a disease. With modern medicine, many specific diseases do not advance to the chronic stage and hence are not visible on the skeletal remains. The second problem is that different diseases affect the bone tissue in a similar manner.

Other problems in the interpretation of palaeopathological data are attributed to selective mortality and hidden heterogeneity. Wood et al. (1992) suggest that selective mortality and hidden heterogeneity are inherent characteristics of any skeletal sample and serve to obfuscate the interpretations of palaeopathological data. Selective mortality acts upon the variation of heterogeneity or frailty of a population and, quite logically, the more frail individuals succumb to disease at an earlier age than the stronger individuals. Thus, strong or advantageous individuals survive diseases and develop bone lesions as a response to the disease; whereas the weak individuals die of the disease and thus do not develop lesions. Wood et al. (1992) imply that the interpretation of palaeopathological data reflects these inherent problems. They suggest that the presence of bone lesions on the skeletal remains should not be an indication of poor health, bur rather an indication of successful adaptation to the environment. Hidden heterogeneity cannot be clearly understood from a living population (thus it will be even less understood in a skeletal sample) and can result from genetic, environmental and social factors. For this reason, Wood et al. (1992) suggest that researchers should examine frailty in modern populations as well as the effect of pathology on bone tissue.

Selective mortality, hidden heterogeneity, and differential burial practices are all inherent problems within prehistoric and modern skeletal samples. However, these problems do not negate the general importance of palaeopathological data in supplying important, albeit general, clues to the health status of a population. The interpretation of palaeopathological data is difficult and contributions from demography, historical and ethnographic accounts can assist in the interpretation of the health status of a once living population.

4.1.1. Aim

The objective of this chapter is to describe the frequency of bone lesions in the sample of skeletal remains from Venda. Bone lesions were recorded for non-specific signs of disease (cribra orbitalia and periostitis), specific infections (treponemal, osteomyelitis and leprosy), trauma, and degenerative changes. Since skeletal growth and ultimately adult stature are strongly determined by environmental conditions, the adult stature is a good indicator of the general health of a population (Bogin, 1999). For this reason, the stature of the adult Venda was examined. Historical accounts from Stayt (1931), published works from the Hans Snyckers Institute and comparative skeletal samples from within and outside South Africa are used for the purposes of 'fleshing out' the possible health status of the Venda.

4.2 Methods

Each skeleton was assessed for gross bone pathology. Techniques such as radiographs and histological tests could not be employed due to constraints of time, finances, and ethics. On account of the restrictions on time, digital photographs were taken whenever signs of abnormalities were observed. The photographs were compared with written notes to improve diagnosis.

Each skull was observed for cribra orbitalia and the classification system of Stuart-Macadam (1985, 1987a, 1987b, 1989b, 1992) was used. Enamel hypoplasiae were also observed but will be covered in the chapter on dentition.

All the bones were assessed for gross pathology (when preservation permitted) and published sources including Steinbock (1976), Brothwell (1981), Ortner and Putschar (1981), Ubelaker (1989), Aufderheide and Martin-Rodriguez (1998) were used for comparison. Bone pathology for non-specific infectious disease, infectious disease, trauma and degenerative changes were observed. Individual pathology is briefly described on a case-by-case basis in Appendix A (pg. 228-362), but expanded on here where needed with differential diagnoses. As can be expected, some individuals had more than one pathological lesion.

4.3 Results

A total of 157 individuals were analysed (120 adults and 37 juveniles). Due to poor preservation of the remains, 44 individuals (28.02%) could not be assessed. Of the remaining skeletons (n=113), 35 (22.29%) had signs of visible bone pathology. Only adults had visible bone pathology and included 22 males (mean age of 42.04 years) and 14 females (mean age 45.7 years). A summary of the types of pathology that were observed on the skeletal remains from Venda is presented in Table 4.1. Approximately 50% of the individuals had no visible bone pathology.

4.3.1 Non-specific signs of infectious disease

Human beings, unlike our animal counterparts, survive within a particular cultural design. Cultural practices, such as a sedentary lifestyle, subsistence farming and medical treatment (to name a few), can affect the type of pathogens to which individuals in a community are exposed to and very often, die from (Kelley, 1989). Every population has a particular pathogen load, which is the "total number of micro-organisms in the local environment, including viruses, bacteria and parasites" (Stuart-Macadam 1992:42). Pathogen loads can depend on the climate, population density, living conditions, hygiene, and food resources of a population (Angel, 1984; Cohen and Armelagos, 1984; Stuart-Macadam, 1992). Several researchers have suggested that health declined during the early transitions to agriculture due to sedentary living, high population density and poor sanitation (e.g., Angel, 1984; Armelagos, 1990; Larsen, 1997). According to Angel (1984:62) this cultural change created an avenue for the introduction of new diseases such as "hookworm, dysenteries, and malaria."

In all, the observation of infectious disease within a skeletal sample is a relative indicator of the overall health of a population as well as its adaptations to the environment. The following section on non-specific pathologies includes a discussion on both periosteal lesions and cribra orbitalia. The incidences of sub-periosteal lesions and cribra orbitalia from other prehistoric and modern groups were used for comparison with the Venda. Brief descriptions of these samples with regard to their general health status and lifestyle are provided. Since the prehistoric samples of K2 and Oakhurst have been described in Chapter 3 (pg. 26-42), they will not be mentioned here again.

Koffiefontein

In 1870, diamonds were discovered on the Koffiefontein farm in the Free State South Africa. The farm quickly became the Koffiefontein Diamond Mine Ltd. and employed labour from the surrounding regions to excavate the kimberlite pipe (L'Abbé et al., 2003). In 1896, a typhoid epidemic broke out among the mineworkers and at least thirty deaths per day were recorded at the height of the epidemic. Since there was no place to dispose of such a large number of bodies per day, the owners of the mine buried them in shallow graves which were later covered by the mine tailings.

In 2002, a total of 36 individuals were excavated from these informal graves and were analysed by L'Abbé et al. (2003). The results of the study showed a high percentage of degenerative diseases of the spine such as intervertebral osteochondrosis, Schmorl's nodes, and vertebral osteophytosis which are indicative of intense physical labour. Evidence of chronic infectious diseases, such as sub-periosteal lesions and cribra orbitalia, was minimal. The absence of visible bony lesions on the skeletal remains is possibly related to the fact that these individuals died prematurely in an epidemic.

Maroelabult

The skeletons excavated at Maroelabult date between the late 19th and early 20th century and were most likely local farm labourers (Steyn et al., 2002). The general health status of these individuals was poor. According to Steyn et al. (2002:143) "high mortality, low life expectancy and high frequency of infectious and other disease indicate that this population was under stress and may have suffered from food shortages/ shortcomings or other stressors." A total of 47 individuals were excavated from the Maroelabult cemetery of which the majority was less than one year old.

Riet River

The Riet River burials are associated with a KhoiSan hunting and gathering lifestyle that had slowly evolved into a herding lifestyle due to cultural and behavioural influences from neighbouring Bantu-speaking agriculturists. The relationship between hunting and gathering and agricultural economies has been well documented in Sub-Saharan Africa (Morris, 1992; Mitchell, 2002). However, the process by which this agricultural transition took place is not fully understood. Eighty-three Riet River skeletons were excavated in the early 20th century and have been analysed by Morris (1984). The incidence of cribra orbitalia was low and is indicative of a relatively well-nourished population. However, dental health was poor for this group, with dental caries being the most common dental disease. Low concentrations of fluoride and other trace minerals in the groundwater are considered to have contributed more than diet to the poor dental health of this group (Morris, 1984)

Kakamas

The graves found in Kakamas near the Augrabies Falls in the Orange Free State have been attributed to a Khoi group known as the Einiqua (Morris, 1992). According to historical accounts, the Einiqua were a hunter and gatherer community who had occupied the Kakamas region in the middle to late 18th century. In 1936, a total of 56 skeletons were excavated from this region by archaeologists Dreyer and Meiring and were analysed in 1980 by Morris (1984).

The incidence of cribra orbitalia was low in this group and is suggestive of a well-nourished population. Dental attrition was severe but dental caries and antemortem tooth loss (AMTL) were uncommon. The pattern of dental health for this group is typical of a hunter and gatherer economy.

Griqua

The Griqua skeletal material was obtained from a cemetery near Campbell, which dates from the period 1815 -1862 (Morris, 1992). From 1961 to 1971 the University of Witwatersrand exhumed 41 individuals (17 males, 11 females and 13 juveniles). Genetic studies have shown that the Griqua are a highly heterogeneous population with genetic admixture from Khoisan, Bantu-speaking agriculturists, and European populations. The dental health of the Griqua was relatively poor such that the frequency of dental caries and AMTL were high. The high frequency of dental disease has been attributed to an agricultural diet of soft and refined foods such as flour and sugar (Morris, 1984). Overall, the individuals appeared to be well nourished with a low incidence of cribra orbitalia.

Catoctin Furnace

The Catoctin furnace complex was a North American iron-working industry that was operational during the late 18th and early 19th century. A portion of the excavation site was an Afro-American slave cemetery that dated from 1790-1840. A total of 35 graves were exhumed from the cemetery and analysed by Kelley and Angel (1983). Similar to other slave cemeteries, the health status of these individuals was relatively poor such that dental and chronic infectious diseases were common (e.g., Kelley and

Angel, 1985; Rathbun, 1987). It can be assumed that acute infectious diseases were also present (i.e. gastroenteritis) and may have been a large contributor to infant deaths. A high frequency of vertebral osteophytes, Schmorl's nodes and advanced osteoarthritis was noted on the skeletal remains and is indicative of intensive physical labour.

19th century cemetery in South Carolina

This cemetery contained the skeletal remains of Afro-American slaves and dated from the period 1840-1870. A total of 36 graves were removed and analysed by Rathbun (1987). The health status of these individuals was poor such that a high prevalences of linear enamel hypoplasia, cribra orbitalia, and Harris lines were observed. The various types of pathology are suggestive of anaemia, possibly genetic and acquired, during childhood. A high frequency of sub-periosteal lesions was also noted and is indicative of chronic, non-specific infectious disease. Signs of intensive physical labour were also observed with the appearance of Schmorl's nodes and advanced degeneration of the shoulder, hip, and cervical vertebrae.

4.3.1.1. Periosteal Lesions

Introduction

Periosteal lesions, also known as sub-periosteal reactions, result from an inflammatory response of the periosteum to traumatic injury, infection, and poor nutrition (e.g., Steinbock, 1976; Kloppers and Van Staden, 1982; Walker et al., 1997). Sub-periosteal lesions caused by injury usually result from "tissue damage or bleeding due to localized compressive forces, " and are commonly observed in battered children and victims of chronic violence (Walker et al. 1997:204). Infection can reach the periosteum in three ways: 1) from adjacent soft tissue, 2) via the blood supply (systemic), and 3) from the bone marrow (Ortner and Putschar, 1981; Aufderheide and Rodriguez-Martin, 1998). Inflammation of the periosteum can occur in response to a variety of diseases both non-specific and specific, such as rheumatoid arthritis, Reiter's syndrome, psoriatic arthritis, thermal injuries, widespread osteomyelitis, rubella, tuberculois, leprosy, scurvy, syphillis, healing rickets and infantile cortical hyperostosis (to name a few) (Mensforth et al. 1978:8).

The periosteum is a fibrous layer of connective tissue that covers (and hence protects) all the bones in the skeleton. The inner layer of the periosteum (the layer closest to the bone) contains osteo-progenitor cells, which contribute to continual remodelling of bone tissue (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998). When inflammation occurs in the periosteum, the osteo-progenitor cells are induced to resume osteoblastic activity and produce new sub-periosteal bone (Mensforth et al. 1978). The result is an elevated layer of bone that looks like a 'scab' or 'band-aid' over the normal bony cortex (Mensforth et al. 1978:9). This elevated bony layer may be irregular or smooth with variable thickness and uneven hypervascularity (Brothwell, 1981; Larsen, 1997). Unhealed periosteal reactions tend to be made up of "loosely organized woven bone" above the cortical bone, whereas healed periosteal reactions are smoother and appear to blend with the cortical bone beneath it (Larsen 1997:85). According to Ortner and Putschar (1985), the most common bone affected by periostitis is the tibia. The reason is that the anterior aspect of the tibia lies closer to the surface of the skin than any of the other bones in the skeleton and thus is at a greater risk of injury and infection.

Results & Discussion

Sub-periosteal lesions were observed in 6.2% (n=7) of the skeletons. All lesions were observed in adults and all on the distal aspects of the femora, tibiae, and fibulae. A comparison of the frequency of sub-periosteal lesions of the Venda with five skeletal samples (four contemporary and one prehistoric) is shown in Table 4.2.

The samples with the highest frequency of sub-periosteal lesions are those from Maroelabult (17%), Catoctin Furnace (26.3%), and the 19th century Afro-American slave cemetery from South Carolina (60.6%). The groups with the lowest sub-periosteal lesions are Koffiefontein (11.1%), Venda (6.2%), and K2 (5.7%).

The difference in the frequency of sub-periosteal lesions between the Venda and Afro-American slaves may be attributed to the superior health and living conditions experienced by the former over the latter. The living and working conditions of early 18th century slaves were highly inadequate such that the possible exposure to bacteria, parasites and malnutrition was greater for these groups than for the Venda, who had a relatively adequate diet, better living conditions and did not experience the psychological stresses of slavery.

However, the discrepancy in sub-periosteal lesion frequencies between the Venda and Maroelabult was not expected, since both groups are contemporary South African populations with similar dietary habits and living conditions. It may be proposed that the people from Venda had less dietary and/or populational stress than their Maroelabult contemporaries.

The mineworkers from the Koffiefontein diamond mine are a unique group of migrant workers from rural communities in the Free State and Eastern Cape and date to the late 19th century. The low frequency of sub-periosteal lesions among these individuals may be ascribed to their premature death in a typhoid epidemic at the mine.

For the Venda, the low incidence of sub-periosteal lesions can be attributed to either poor preservation of the long bones or a relatively low prevalence of non-specific infections within the community; both scenarios are equally tenable. However, the notion of a low prevalence of infectious disease within the Venda community is even more probable if one examines the intensity of sub-periosteal lesions (which is the total number of sub-periosteal lesions observed on a specific bone, such as the tibia, divided by the total number of tibiae in the sample) in K2 and the Venda. For the Venda, it should be mentioned that all these lesions were observed in adults and no sub-periosteal lesions were observed on juvenile remains.

The intensity of sub-periosteal lesions for K2 is 7.2% (tibia), 11.4% (fibula) and 9.1% (femur). For the Venda, the frequency of sub-periosteal lesions per bone is 7.0% (tibia), 0.1% (fibula) and 1.1% (femur). For K2, the pattern of intensity of the sub-periosteal lesions has been attributed to chronic infectious disease; due to the fact that a single individual had more than one long bone affected (Steyn, 1994). The intensity of sub-periosteal lesions observed in the Venda is dissimilar to this pattern. Rather it appears that a single bone, the tibia, is affected more than the other bones; this is more suggestive of traumatic injury to the tibia than chronic infectious disease. If the sub-periosteal lesions were caused by chronic infections, both tibiae would have been affected.

4.3.1.2. Cribra orbitalia

Introduction

Anaemiae are regarded as the cause for both cribra orbitalia and porotic hyperostosis (Brothwell, 1981; Angel, 1984; Stuart-Macadam, 1989a, 1992). Cribra orbitalia are observed on the superior roof of the orbits, whereas porotic hyperostosis is observed on the skull vault particularly the frontal, parietal, and occipital bones.

Anaemia may result when either the red blood cell count is low or the quality of the red blood cells is poor (i.e. sickle cell anaemia). Both conditions result in a decrease of available oxygen in the body. In response, the body increases red blood cells production. The manufacturing of red blood cells (and all blood cells) occurs in the red bone marrow of spongy bone. Due to increased production of these blood cells, the spongy bone begins to expand and press against the compact bone (or the outer cortical bone layer). In juveniles, the outer cortical bone layer is usually thin and plastic in nature and thus yields to the expanding spongy bone. The macroscopic result is a "sieve-like" appearance in the outer bone table. In severe cases, the outer table of bone is obliterated and the hypertrophy of spongy bone is visible (Mensforth et al. 1978:4). This response to anaemic reactions is most often located in the skull because the orbits and skull vaults have a thin outer cortical bone layer that is easily reabsorbed by hypertrophy of the inner spongy bone.

Stuart-Macadam (1985) demonstrated that both porotic hyperostosis and cribra orbitalia are a response to the same pathology. Thus, for the purpose of this chapter, only cribra orbitalia are discussed. Cribra orbitalia was first observed in skeletal samples from the Neolithic, a cultural period that has been characterized by the emergence of agriculture and a sedentary lifestyle (Angel, 1984; Cohen and Armelagos, 1984; Larsen, 1997). Crowded living areas and a change in diet caused 'stress' on the early Neolithic farmers such that their life expectancy, stature and skeletal dimensions were less than those of their Palaeolithic predecessors (Angel, 1984). According to Angel (1984), cribra orbitalia indicated iron deficiency anaemia in the Neolithic groups, which may have resulted from inadequate nutrition and/or infectious diseases. Angel (1971) also noted a high frequency of cribra orbitalia in areas in which malaria was endemic and suggested a relationship between cribra orbitalia and genetic anaemia such as sickle cell anaemia and thalassemia.

The first hypothesis created to explain cribra orbitalia was the dietary hypothesis. Under this theory, it was suggested that iron poor diets (such as maize based diets), malnutrition and infections were responsible for iron deficiency anaemia and the appearance of cribra orbitalia (Mensforth et al., 1978; Larsen, 1997). Challenging this theory, Stuart-Macadam (1992:40) has proposed that the pathogen load of the environment may contribute more to the presence of cribra orbitalia than dietary factors.

All populations have a 'pathogen load'. A 'pathogen load' refers to the total number of microorganisms such as fungi, virsues, bacteria, and parasites that are present in the environment (Stuart-Macadam, 1987a; Stuart-Macadam, 1987b; Stuart-Macadam, 1989b). Many of these microorganisms require iron for replication but lack iron production stores. Therefore, they use the iron stores of their host, which in this case is a human. According to Stuart-Macadam (1992:41) the human body can fight the replication of these microorganisms by "decreasing serum iron and the absorption of dietary iron by the intestinal mucosa." The 'with-holding' of iron stores is thus considered an adaptative response to the invading microorganisms (Kent et al. 1994).

Iron deficiency anaemia has been attributed to genetics, diet and infectious disease. As with any pathological condition, not every individual who is afflicted with the disease will develop skeletal lesions. "At most 50-75% of clinical patients with anaemia" exhibit lesions and children under 5 years of age are more likely to develop skeletal lesions than adults (Stuart-Macadam 1985:397). Children are also more susceptible to iron deficiency anaemia because of changes in diet (weaning) and infectious disease. Although uncommon, Palkovich (1987) demonstrated porotic lesions on crania from individuals as young as 6 weeks of age.

Anaemia does not usually affect the postcranial skeleton of an adult because the bones are no longer malleable (Stuart-Macadam, 1985; Stuart-Macadam, 1987a). Through radiographic analysis, Stuart-Macadam (1987) demonstrated that children past the age of puberty did not exhibit a bony response to iron deficiency anaemia.

In summary, cribra orbitalia are a response to iron deficiency anaemia and are more likely to be caused by environmental conditions (infectious disease) than genetics or nutrition (e.g., Stuart-Macadam, 1992, Kent et al., 1994). Juveniles show signs of cribra orbitalia more often than adults and most of these juveniles with cribra orbitalia are under 5 years of age. In an adult, cribra orbitalia are an indication of an anaemic episode in childhood.

In contrast to the dietary hypothesis that considered cribra orbitalia to be indicative of poor adaptation to the environment, the new hypothesis considers cribra orbitalia to reflect a successful adaptive response to a heavy pathogen load in the environment (Kent et al., 1994). Recently, Wapler et al. (2004) suggested that anaemia is not the only factor that can cause cribra orbitalia. In a histological examination of cribra orbitalia lesions, they noted that only half of these cases could be directly associated with anaemia. Other ailments that may cause cribra orbitalia lesions include sinusitis, tooth abscesses, oral infections, and nasopharyngeal infections (Wapler et al., 2004).

Methods

The superior roof of the orbits, the frontal bone, the parietal bone and the occipital bone were visually examined on each skeleton. Cribra orbitalia and porotic hyperostosis were scored as being present or absent. If the skull vault or orbits were damaged or were not present then a score of 'not observed' was given.

In the Venda sample, 86.1% (n=31) of the juvenile remains were under the age of 2 years. Six skeletons between the ages of 2 and 18 years were analysed. From the juvenile remains, only one skull was suitable for visual analysis of cribra orbitalia and porotic hyperostosis. This skull belonged to a male infant, ± 7 months of age. For the adult material, a total of 78 orbits or 42 skulls were observed.

Results & Discussion

Comparisons of the frequency of cribra orbitalia in South African skeletal samples are shown in Table 4.3. Out of a total of 43 skulls from Venda, there were no incidences of cribra orbitalia. This sharply contrasts other sites such as K2/Mapungubwe and Oakhurst who had incidences of cribra orbitalia as high as 37.8% and 61%, respectively; in these groups, cribra orbitalia have been attributed to a large pathogen load, presumably parasites, in the environment. The samples from Kakamas (5.2%), Riet

River (9.5%) and Griqua (10%) had much lower rates of cribra orbitalia than either K2/Mapungubwe or Oakhurst. Therefore, it can be logically assumed that the pathogen load was lower for these three skeletal samples.

The complete absence of cribra orbitalia in the Venda sample is unusual and was not expected in a community where malaria is endemic and intestinal worms are common (Brighton et al., 1985). The possible reasons for these results can be either poor preservation of the juvenile crania, adequate intake of iron in the diet and/or the use of antibiotics, which could have prevented bacterial diseases from becoming chronic.

4.3.2 Specific infectious diseases

In this study, two specific diseases, leprosy and osteomyelitis, were observed among the skeletal remains from rural Venda. The diagnosis of specific diseases from macroscopic evidence is not a simple task and requires both knowledge of the pathogenesis of the disease and its bony manifestation. Infectious disease affects bone remodelling and can result in either an increase in bone (osteoblastic activity) or a decrease in bone (osteoclastic activity) (e.g., Steinbock, 1976; Brothwell, 1981; Ortner and Putschar, 1981; Aufderheide and Rodriguez-Martin, 1998). The problem is that different infectious diseases produce similar bone responses (either osteoclastic, osteoblastic or both) that also produce similar macroscopic lesions.

4.3.2.1. Leprosy

Leprosy has been observed in both non-tropical and tropical environments with overcrowding and poor sanitation. This disease is endemic to sub-Saharan Africa and most of the African countries. The Venda considered the disease to be incurable and any individual diagnosed with leprosy was isolated "in a small hut on the side of a mountain. Food was taken to him but he was not permitted to interact with the community"(Stayt 1968:272). Isolation of lepers or a suspected leper has been practiced for thousands of years. During the Middle Ages in Europe, over 19,000 leprosaria were recorded to have been in use (Mays et al., 2003).

Leprosy is a chronic granulomatous infection caused by *Mycobacterium leprae*. The bacterium causes neurotrophic changes to the skin and peripheral nervous tissues

(Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998; Haas et al., 2000). Mutilations of the tissues of the face (rhinomaxillary region), hands and feet are most commonly observed. Although the disease is communicable, it is not highly contagious (Steinbock, 1976). In an area endemic for leprosy, only 1% of individuals in the population will contract the disease and within this 1%, only 15% will be severe enough to cause destruction of the face, hands and feet (Ortner and Putschar, 1981).

Leprosy can range from mild to severe and depends on the resistance of the host to the microbe. If the host has a strong resistance then the disease forms the tuberculoid variation. In the tuberculoid version of leprosy, damage to the skin and peripheral nerves is noted but damage to the face is rarely seen (e.g., Moller-Christensen et al., 1952; Steinbock, 1976). If the host has a poor resistance to the microbe, the lepromatous variation of the disease develops. This type is associated with destruction of the face, nasal and maxillary regions known as *facies leprosa*.

Facies leprosa is characterized either by bone atrophy of the anterior nasal spine, maxilla and/or destructive type lesions of the bony palate. The bone of the palate may be thin, pitted or perforated (Haas et al., 2000). Destruction of the hard palate is the most distinctive feature of *facies leprosa.* Moller-Christensen et al. (1952) noted that atrophy of the nasal spine and maxillary bone was associated with neurotrophy and antemortem tooth loss in the affected area.

The leprosy bacilli can also cause non-specific bone absorption. Since leprosy affects the peripheral nervous system, neurotrophy in the hands and feet is common. Neurotrophy can lead to atrophy of the phalanges and possible secondary infections. Destruction of the phalanges and secondary infections are only observed in association with *facies leprosa* (Moller-Christensen et al., 1952). However, *facies leprosa* can occur alone.

Results & Discussion

One individual (NANMUL267) had bony signs that were possibly related to *facies leprosa.* The person was male and had been over 40 years of age. A complete description of this case can be found in the Appendix A (pg. 263). Destructive lesions were observed on the hard palate (Figure 4.1) with associated destruction of the nasal cavity, maxilla and atrophy of the margin of the nasal bone (Figure 4.2 & 4.3). In the 20th century, leprosy was considered endemic in the Venda area but was not commonly observed (Stayt, 1931). Ross (1966) noted three cases of leprosy during two visits to various clinics and villages, which included the Donald Fraser hospital, the outpatient clinic in Sibasa, the Tshilidizini Mission hospital and three surrounding villages which included Thengwe, Rambuda and Mukula.

A possible differential diagnosis could be gangosa, an advanced stage of yaws that affects the skull. Gangosa causes destruction of the nasal cavity, maxillary bone, and posterior bony palate with minimal bone regeneration (Aufderheide and Rodriguez-Martin, 1998). No caries sicca lesions are observed in cases of gangosa but the tibiae usually develop a sabre-shin appearance. Yaws is most common in juveniles and adolescents and bone lesions occur in about 1% of infected individuals (Ortner and Putschar, 1981). Hands, feet, and crania are affected most often in the later stages of yaws. In this case, no sub-periosteal bone deposition was observed on the tibiae or other long bones and the palatal lesion was located anteriorly. On account of these two characteristics, this is more likely a case of leprosy than treponemal disease.

4.3.2.2. Osteomyelitis

Staphylococcus is the primary organism responsible for osteomyelitis, which is an infection of the bone marrow. Research is not clear on the exact invasive mechanism of the *Staphylococcus aureus* bacterium but it has been related to traumatic injury (such as compound fractures), surgery, and poor health conditions (Shandling, 1960; Steinbock, 1976; Kloppers and Van Staden, 1982; Mader and Calhoun, 1989; Aufderheide and Rodriguez-Martin, 1998). The disease has been most problematic in developing countries with tropical environments (such as Africa) and poor living conditions. From 1952 to 1959, over 300 children were treated for osteomyelitis in Cape Town, which "appeared to represent the highest incidence of osteomyelitis in the world"(Shandling, 1960). Acute haematogenous osteomyelitis is the most common in children but can develop into the chronic form (Shandling, 1960; Mader and Calhoun, 1989).

In the majority of cases, osteomyelitis enters the blood stream via lesions in the skin or mucous membrane. The bacterium travels via the haematogenous route throughout the body until it reaches an area conducive to multiplication – usually the haemopoietic tissue (red bone marrow) (Anderson, 1985). The multiplication of these bacteria causes an inflammatory response in the tissue, which results in the production of pus (a mixture of neutrophils, proteins and fibrin). The pus fills the marrow cavity of the bone and can spread to the periosteum (Ortner and Putschar, 1981). As the pus fills the marrow cavity, the pressure inside the cavity increases. At a certain pressure threshold, the pus bursts out of the marrow cavity and drains externally. The channel through which the pus drains to the external environment is known as a cloaca.

Children have an increased susceptibility to osteomyelitis, "because of the anatomy of growing bones" (Mader and Calhoun 1989:476). There are three centres of growth in the long bones - the diaphysis and two epiphyses (Krogman andÝþcan, 1986). Between the diaphysis in which the primary ossification centre is situated and the epiphyses which are secondary ossification centres are plates of hyaline cartilage known as epiphyseal plates. These plates share a rich capillary network with the diaphyses but not the epiphyses. This rich vascular blood supply permits easy dissemination of the bacterium through the medullary cavity of the diaphyses and into the periosteum, which is loosely attached to the developing bone. In the periosteum, the infection may cause a sub-periosteal abscess that may burst and infect the surrounding muscle and tissue and, if left untreated, may drain externally (Ortner and Putschar, 1981; Anderson, 1985). The active growth centers most often involved in osteomyelitis are the distal femoral metaphysis, proximal tibial metaphysis, distal tibial metaphysis and proximal femoral metaphysis (Ortner and Putschar 1981:111).

Osteomyelitis is rare in the adult, but "may complicate injury or debilitating disease."(Anderson 1985:23.6). In the adult, the periosteum is more fibrous (thick) and does not yield easily to pressure from the medullary cavity. For this reason, osteomyelitis tends to be more localized and usually affects only certain aspects of the bone. Osteomyelitis has also been shown to accompany other infectious diseases such as leprosy, smallpox and typhoid fever (Cockshott and MacGregor, 1958; Ortner and Putschar, 1981; Mader and Calhoun, 1989; Aufderheide and Rodriguez-Martin, 1998).

Osteomyelitis is common in children between 3 and 15 years of age and, as mentioned above, occurs most often at the metaphyses of the long bones (Steinbock, 1976; Brothwell, 1981; Ortner and Putschar, 1981; Aufderheide and Rodriguez-Martin, 1998). In adults, osteomyelitis is usually acquired via a direct haematogenous infection and is localized in the diaphysis of a particular long bone(s). Osteomyelitis does not affect the skull but has been observed in the mandible (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998). Osteomyelitis can either be acute or chronic.

In severe acute osteomyelitis, destruction and necrosis of the bone shaft (sequestrum) and formation of new bone (involucrum) may be observed. Heavy pus accumulation under the periosteum may cause thrombosis to the nutrient artery, which in turn would "cut-off" the supply of blood to the bone. Without a blood supply, the diaphysis becomes necrotic, separates from the epiphyses and develops into a sequestrum. Subsequent new bone growth begins to encase this sequestrum and is known as an involucrum. Several cloacae and sinus tracks can be observed in the involucrum and permit the drainage of pus from the bone. In chronic osteomyelitis, both closed and open cloacae are observed such that the involucrum appears riddled with holes.

If the diaphysis does not undergo a process of necrosis then the bone may appear "swollen" and the outer surface of the bone will have a rough/irregular appearance. Cloaca(e) may be observed on the bone shaft.

According to Ortner and Putschar (1981:113), the common characteristics of osteomyelitis are "the presence of sequestra, porous hypervascular periosteal lesions and cloacal openings." The appearance of cloacae distinguishes osteomyelitis from other infectious diseases such as periostitis and syphilis.

The frequency of osteomyelitis has been low in pre-historic skeletal samples (Ortner and Putschar, 1981; Larsen, 1997). In the 1930's, Hooten noted five cases of osteomyelitis (0.8%) in a post-Columbian New World Pueblo Indian sample (Ortner and Putschar, 1981). Ortner and Putschar (1981) suggest that the paucity of osteomyelitic cases in prehistoric skeletal samples is due to the misclassification of osteomyelitis as periostitis or osteitis.

Results

In this skeletal sample, 2.65% (n =3) of the individuals were tentatively diagnosed with osteomyelitis. A fourth person had a primary infection from leprosy or yaws and probable secondary osteomyelitis.

The first individual with possible osteomyelitis was a male who had been over 50 years of age (NANMUL375). This individual had two poorly remodelled fractures on both the right and left femora. Large callus formations were present around each fracture in which cloacae were visible (Figure 4.4). A more detailed description of these fractures is given under the section on trauma and the Appendix A (pg. 279).

The second case of possible osteomyelitis was found in a probable female who had been between 50 and 60 years of age (NANBUD627). A small, sharp and destructive lesion was noted on the anterior surface of the right humerus. No bone remodelling was present. Due to the poor preservation of the long bones, no further information could be obtained. A diagnosis of acute osteomyelitis has been suggested.

The third person was a male who had been between 20 and 25 years of age (NANMUL766) and had several small lesions that could be related to osteomyelitis. Small circular lesions, which were destructive in appearance, were noted on the distal epicondyle of the left humerus and proximal end of the right ulna. No sub-periosteal bone deposition was observed and the long bones had a normal and smooth appearance. A small circular lesion, with smooth edges and a crater like depression, was noted on the right parietal (Figure 4.5).

The fourth individual with possible osteomyelitis was a probable male over 40 years of age (NANMUL267). Two lesions that are suggestive of osteomyelitis were observed. The first lesion was observed on the upper right humerus at the insertion site for the tendon of the deltoid muscle. The lesion was on the anterolateral aspect of the bone, had an elongated shape, sharp edges and was destructive in appearance. Adhesive from a bandage was observed over the lesion, which suggests that the infection was active at the time of death (Figure 4.6). The second lesion was observed on the distal aspect of the left femur. The anterior and posterior aspect of the femur had an enlarged appearance due to the irregular deposition of sub-periosteal bone. Towards the middle of the lesion, a small cloaca was observed (Figure 4.7). The proximal aspect of the left femur had normal appearance. Destructive lesions were also noted in the skull, but have been described under the section on leprosy.

Discussion

A single case of chronic osteomyelitis was observed in a male, 25-35 years of age, from the Iron Age site of Schroda near the Limpopo/Shashi Valley (Hanisch, 1980). As far as it is known, no other cases of osteomyelitis in prehistoric skeletal samples have been observed in Southern Africa. From the prehistoric site at Fort Center (South Florida, North America) (AD1500/1000), osteomyelitis was observed in four individuals (out of 325 bones) or 1.2% (Miller-Shaivitz and Ýþan, 1991).

In the mid-20th century, Shandling (1960:520) suggested that South Africa had the highest percentage of acute haematogenous osteomyelitis in the world. He noted that the disease was most common in children between 6 and 10 years of age who were from lower socio-economic status groups. Cases of severe osteomyelitis began to decrease with the administration of penicillin (Shandling, 1960; Ortner and Putschar, 1981).

The frequency of osteomyelitis in 20th century Venda is not known. According to Stayt (1968:270) bone diseases "were rare" and usually diagnosed as witchcraft by the local shaman. Within this sample, four possible cases of osteomyelitis were observed of which two cases are tentative. In the two more definitive cases, osteomyelitis resulted from secondary infections due to either a compound fracture or another infectious disease. These cases are not indicative of acute haematogenous osteomyelitis in childhood that, according to Shandling (1960), was prolific in South Africa in the 20th century.

Osteomyelitis has been considered to be more common in rural, tropical environments with poor sanitation. The frequency of osteomyelitis in the Venda is high in comparison to other prehistoric South African samples (Hanisch, 1980; Patrick, 1989; Wiley and Pike, 1998). The reason for this may be due to poor sanitation in both the rural home environment and perhaps the hospital setting. The *Staphylococcus aureus* bacterium is present in most hospitals and some strains of the bacterium are immune to penicillin (Shandling, 1960). Either NANMUL375 or NANMUL267 could have contracted this bacterium in the hospital where they were being treated for their illnesses.

The absence of osteomyelitis in juvenile remains can be related to the poor preservation of individuals in the age category of 3 to 15 years.

4.3.3 Trauma

Introduction

Trauma is the result of violent or accidental encounters with animals, humans or inanimate objects such as cars or trains. A traumatic incident may also occur from self – mutilation and suicide (Merbs, 1989). Several categories of traumatic incidents exist and include fractures, crushing injuries, wounds caused by sharp instruments or bullets, scalping, trephination, dislocations, and mutilation (e.g., Steinbock, 1976; Brothwell, 1981; Ortner and Putschar, 1981; Aufderheide and Rodriguez-Martin, 1998).

Fractures are the most common type of trauma and occur from interpersonal violence, work related activities and accidents. The location and appearance of a fracture (such as healed, unhealed or infected) on skeletal remains can give indications of the availability of medical treatment within the community and the success of survival.

Results

Fractures were observed in 7.1% (n=8) of the Venda. Adult males and females were equally affected. Trauma was not observed in any of the juvenile remains. Within the adult males, four had fractures ranging from healed, partially healed to not healed. Perimortem fractures, which are fractures that occur at or around the time of death, were observed on the cranium, pelvis, femora, tibiae and fibulae of an adult male who had been between 30 and 40 years of age (NANMUT169). A full description of these fractures can be found in Appendix A (pg. 279). The relatives of this individual said that one afternoon a train had hit him while he was walking along the railroad tracks.
A violent death can be interpreted from the skeletal remains but the manner of death whether an accident or suicide cannot be determined.

The most severe remodelled fractures were observed on the femora of an elderly male individual (NANMUL375). The fracture on the right femur had occurred just below the femoral neck, and on the left femur the fracture occurred at the mid-shaft (Figure 4.8). Large calluses had formed around both fracture sites and several cloacae were noted within these calluses. The presence of cloacae implies an infection in the bone (osteomyelitis) and suggests that these may have been open fractures, which are fractures that have been exposed to the external environment (Steinbock, 1976; Ortner and Putschar, 1981; Aufderheide and Rodriguez-Martin, 1998). The individual survived this traumatic insult, but he must have had extensive care from friends or relatives. It is not known whether he sought medical treatment but the poor healing of the fractures suggests either inadequate medical treatment or a lack of understanding with regard to the medical instructions. Both femora, albeit shortened, would have been functional during the remainder of his life.

A remodeled fracture was noted on the coracoid process of the right scapula of an adult male, who had been over 40 years of age (NANMAC137). A heavy blow to the right shoulder or an unusually heavy load may have caused this injury. It is not possible to determine whether the injury was work or violence related.

Another fracture was observed on an adult male who had been between 40 and 60 years of age (NANMUL261). The fracture was located on the right side of the mandible. A surgical wire had been used to set the two bones (Figure 4.9). The fracture may have been the result of interpersonal violence.

Remodelled fractures were recorded on two female individuals, who had been between 30 and 50 years of age (MUTUP104 & MUTUP121). These fractures were observed on the distal portion of right humerus and around the elbow of MUTUP104, and on the right clavicle of MUTUP121.

Lastly, a compressed fracture was observed on the anterior portion of the eighth thoracic vertebra of another elderly female (Figure 4.10). This could be associated with the aging process (such as osteoporosis) or with compressive forces on the spine (Merbs, 1989).

Discussion

The aetiology of the trauma within the Venda, whether it resulted from interpersonal trauma, accidental trauma or both cannot be accurately determined due to the small sample size and the paucity of ethnographic information on violence within the Venda community.

Warfare was common in the early 19th century Venda, but does not appear to have persisted into the 20th century. According to Stayt (1930:71), the early 19th century Venda lived in a "perpetual state of petty internecine warfare" that included cattle raids, murder of the enemy and subsequent retaliation from the raided party. These battles continued until the first Anglo - Boer War (1899 – 1902) when the white settlers confiscated weapons from the Venda and enforced peaceful conditions (Stayt 1930). In the modern 20th century Venda, Van Nieuwenhuizen and Oosthuizen (1984) observed that poverty was high within the Venda community but incidences of crime and violence appeared to be low. This does not suggest that violence did not occur within these communities but perhaps that it was lower than what is present in South Africa today.

Little data are available with regard to the frequency of fractures in South African skeletal samples. Patrick (1989) observed a single remodelled fracture of the radius of a young male from the late Stone Age site at Oakhurst. Steyn (1994) noted a possible long bone fracture and depressed fracture from an adult male 35 and 45 years of age and a depressed fracture on an adult between 50 and 70 years of age from the Iron Age site at K2. From a 20th century mining community Maroelabult in the North West Province, Steyn et al. (2003) noted no traumatic injuries among the forty-seven individuals. This was not consistent with data from the cadaver collections in South Africa (Raymond A. Dart and Pretoria Bone Collections) in which 5-15% of the people had facial trauma (Rösing, unpublished data).

High frequencies of facial trauma were also observed among 20th century middle class American males, black (n=27; 14.8%) and white (n=85; 11.8%), and white American females (n=56; 12.5%); these frequencies are much higher than those observed in the Venda sample (n=2; 1.76%) (Angel, 1976). On the other hand, the postcranial trauma noted within the Venda (n=5; 4.42%) was higher than postcranial trauma of American black males (n=17; 1.7%) and black females (n= 44; 3.1%).

Angel (1976) attributed the high frequency of cranial trauma to an increase in violence in America. In general, cranial trauma has been related to interpersonal violence (Angel, 1976; Ortner and Putschar, 1981). Although the incidence of cranial trauma was low in the Venda communities, the relatively high percentage of postcranial fractures suggests that traumatic incidences, whether intentional or accidental, did occur frequently in these communities.

4.3.4 Arthritis - degenerative changes in the skeleton

A variety of factors such as age, physical activity, disease and metabolic changes can contribute to degeneration of the skeleton and skeletal joints. Clinically, arthritis is a non-specific disease, which refers to disease of the skeletal joints. In archaeological samples, it has a much broader context and can be related to any of the following conditions (which are visible on the skeleton) (Steinbock 1976):

1. Osteoarthritis (degenerative joint disease)
2. Vertebral osteophytosis
3. Traumatic arthritis
4. Rheumatoid arthritis
5. Ankylosing spondylitis
6. Infectious arthritis
7. Gout
8. Charcot joint in treponemal infection

Both osteoarthritis and vertebral osteophytosis were observed within the skeletal sample and will be discussed in the following sections.

4.3.4.1 Osteoarthritis

Introduction

"Osteoarthritis is a multifactorial disorder representing a pattern of responses to various predisposing factors" (Larsen 1997:162). More accurately known as degenerative joint disease, this is the most common form of arthritis and in modern groups is most often observed in individuals over 50 years of age. Osteoarthritis results from a breakdown of the synovial joints in the body, which includes the temporomandibular, shoulder, elbow, wrist, hip, knee, ankle as well as apophyseal joints of the vertebrae. Synovial joints, or diathrodial joints, are composed of two or more bones that are lined with hyaline cartilage and are surrounded by a joint capsule, which produces synovial fluid.

The primary etiology for osteoarthritis is the habitual use of these joints, which causes degeneration in the cartilage with a subsequent deposition of bone in its place (e.g., Steinbock, 1976; Brothwell, 1981; Ortner and Putschar, 1981; Aufderheide and Rodriguez-Martin, 1998). The joints that receive the most stress are the knees, hips, temporomandibular joint, and shoulder joint (Hodges, 1991; Slaus, 2000). Other factors that influence osteoarthritis are metabolism, nutrition, bone density, vascular deficiencies, infection, trauma and genetics (Larsen 1997:163). In the skeleton, osteoarthritis can be observed as lipping, erosion or eburnation of the joint surface.

Results

Osteoarthritic changes were noted in a total of eight individuals from Venda (7.07%): two in the temporomandibular joint (males, older than 50 years and 35-45 years, respectively), two in the apophyseal joints of the vertebrae (male and female, +/- 50 years), three in the elbow joint (males, 35-45 years and older than 50 years, respectively, and a female, 30-50 years), one in the knee joint (male, older than 50 years), and in the proximal and distal phalanges of the foot (female, older than 50 years). One probable case of traumatic arthritis was observed in the spine and involved the apophyseal joints and vertebral bodies of T8 and T9 (male, 40-50 years of age). The diagnosis of possible traumatic arthritis was made due to the fact that the other vertebrae were unaffected.

Two individuals had osteoarthritis at more than one location in the skeleton, which included the apophyseal joints, elbow joint, and knee joint (a male and a female, older than 50years). For statistical purposes, the individual was counted and not the specific joint.

The males (n=5) had a slightly higher distribution of osteoarthritic changes than the females (n=3). All individuals with osteoarthritic defects were within their 4th decade of life or older. No specific pattern in joint degeneration was observed.

Discussion

No comparable data were available from K2/Mapungubwe due to the young age of the individuals in the sample. Brighton et al. (1985) conducted X-ray examinations of the hands of the rural Venda and demonstrated that 7% of the females and 12% of males under the age of 40 had severe osteoarthritis, and the frequency rose to 38% of females and 36% of males over the age of 40. In the 19th century Afro-American slave cemetery from South Carolina, the frequency of osteoarthritis was much higher such that between 30 and 88% of the sample were affected at the shoulder, hip, elbow or knee (Kelley and Angel, 1987). Therefore, osteoarthritis found among the skeletal remains from Venda was quite low when compared to a group that had experienced strenuous physical labour. Brighton et al. (1985:324) also considered the prevalence of osteoarthritis to be low given that manual labour such as tilling of the fields, manual weeding and making of mud bricks was done regularly.

4.3.4.2 Spinal degeneration

Introduction

Vertebral osteophytes are generally considered to be an age-related response to spinal degeneration, a condition that is brought about by weight bearing and locomotion (bipedalism) (Steinbock, 1976; Jurmain and Kilgore, 1995). Vertebral osteophytes can appear as early as the 2nd decade of life and are ubiquitous by the 4th decade. According to Nathan (1962:258), osteophytes "are outgrowths of healthy bone that develop as a defense" against shear mechanical forces such as habitual walking and/or strenuous labour activities. For this reason, Nathan (1962) suggests that the bony osteophyte is stronger and has a higher bone density than the vertebra to which it is attached.

Schmorl's nodes are small circular depressions on the body of the vertebrae and are related to rupturing of the fibrocartilagous intervertebral discs. Invertebral disc ruptures can be caused by excessive anterior compression of the spine and have been related to activities such as manual labour, horseback riding and competitive downhill skiing (Kelley, 1982; O'Neill et al., 1999). They are sometimes accompanied by osteochondritis, which are crescent shaped lesions on the periphery of the vertebral body

(Kelley, 1982). In young individuals, the presence of intervertebral osteochondrosis and Schmorl's nodes are suggestive of atypical Scheuermann's disease, which can also be related to anterior compression of the spine (Kelley, 1982; Aufderheide and Rodriguez-Martin, 1998).

Each vertebra was scored by a degree, a method developed by Steinbock (1976:303) which is as follows:

Degree 0: no lipping present

Degree 1: slight lipping at the inferior and superior margins of the centra

Degree 2: more pronounced lipping at the margins

Degree 3: extensive lipping often resembling a mushroom-like eversion with bony spurs

Degree 4: actual ankylosis or bony union between two or more vertebrae

Results

Vertebral osteophytes on the cervical vertebrae were observed in 12 cases, on the thoracic vertebrae in 9 cases and on the lumbar vertebrae in 10 cases. All individuals with vertebral osteophytes were within their 3rd decade of life or older. The mean degree of vertebral osteophytes for the cervical vertebrae was 2.23 (n=12, standard deviation = .79), for the thoracic vertebrae 2.36 (n= 9, standard deviation = .96), and for the lumbar vertebrae 2.66 (n = 10, standard deviation .72). As a whole, the Venda did not suffer from severe vertebral osteophytes. The lumbar vertebrae appear to be more severely affected than the cervical vertebrae, but the difference is not significant.

In the Venda from this study, 19 individuals (12 males and 7 females) had observable vertebral osteophytes (16.81%). Four of these people also had Schmorl's nodes in the thoracic and lumbar vertebrae (2.65%). In all four cases, the skeletons were male and were within their 3rd decade of life or older. The first individual had Schmorl's nodes on the vertebral body of the lumbar vertebrae (L1-L5), the second on the body of L4, the third on the body of either T11 or T12, and the fourth on the bodies of T11 and T12.

Discussion

From these limited data, two, albeit extremely tenuous, conclusions can be postulated. Firstly, no significant difference was observed between males and females regarding the appearance of vertebral osteophytes. Secondly, low-grade osteophytes were common in both sexes and may indicate normal age degeneration of the spine.

In general, the frequency of Schmorl's nodes was quite low for the Venda (2.6%), when compared to skeletal samples known to have engaged in intensive, repetitive labour such as the mineworkers at Koffiefontein (13.9%) and the American slave sample from South Carolina (39%).

Habitual activities such as herding cattle for long distances, tilling of the maize fields and carrying heavy loads of either wood or water on the head may have contributed to the development of vertebral osteophytes and Schmorl's nodes. However, no direct cause and effect relationship can be made from this evidence. Carrying heavy loads on the head have been shown to cause osteoarthrosis, fractures of the vertebral arch (C1-C4), forward dislocation of the vertebra, and herniation of the vertebral disc (Levy, 1968; Scher, 1978).

4.3.5 Stature

Introduction

The factors that contribute the most to adult stature are genetics and environmental conditions (e.g., De Villiers, 1971; Hiernaux, 1972; Larsen, 1997). In North America, a dramatic increase in stature has been observed from the 19th century to present; this secular trend in body height has been associated with improvements in nutrition, sanitation, living conditions and medical care (Stewart, 1980). In a sample of KhoiSan, researchers Hausman and Wilmsen (1985) compared the mean body height of juveniles during the transition from a traditional hunting and gathering to an agro-pastoralist economy (1967-1980). They observed a significant increase in stature through time. This was due to better nutrition which included maize meal and milk (Hausman and Wilmsen, 1985). However, in a study on the body height of South African blacks during the 20th century, Tobias (1990) observed no improvement in body size and attributed this to an absence of change in environmental conditions. Henneberg and Van den Berg (1990) confirmed observations of Tobias and suggested that genetics contribute more to adult stature than nutrition. They proposed that "less than 10% of the variance in stature can be explained by socioeconomics"(Henneberg and Van den Berg, 1990: 464).

Therefore, the question whether nature or nuture is more or less responsible than the other for adult body size is widely debatable. However, it is clear that both genetics and environmental conditions, in particular nutrition, have an effect on adult stature.

Methods

The standard linear regression equations designed by Lundy and Feldesman (1987) to estimate stature in male and female South African Negroids were used for the skeletal remains from Venda. The combined metric dimensions of the physiological lengths of the femur and tibia provide the most accurate estimation of adult stature. The femur + tibia linear regression equation was used to calculate stature for 36 adult individuals, or 71% of the total sample. When preservation of the skeletal remains was less optimal, linear regression equations for the physiological length of the tibia (8%), physiological length of the femur (16%), and maximum length of the humerus (6%) were substituted.

Results

Due to poor preservation of the remains, stature could only be estimated for 51 (23 males and 28 females) of the 97 adult individuals. One male individual was over 180 cm but the other individuals (male and female) fell within a range of 150 to 170 cm in length. The mean stature for males was 166.9 cm (sd 7.19) with a range of 152.1 - 181.4 cm, whereas the mean stature for females was 157.8 (sd 5.90) with a range of 147.9 – 177.1 cm. On average, males exceeded female stature by 9 cm, however, this difference was not significant.

A comparison of stature from various Southern African skeletal samples, including the Venda, is presented in Table 4.4. The mean stature values of the Venda (this study) were compared with each of these groups via a Student's t-test. As can be expected, no statistically significant difference was observed between this study and the historic, rural, and urban Venda groups. Interestingly enough, there was also no statistically significant difference in stature between K2 and the Venda (skeletal), or between the Zulu sample and the Venda (skeletal). A statistically significant difference in stature was noted between the male Venda and the male Angola samples ($t = -2.863$, $p < 0.001$). This difference may be attributed to the fact that groups from Angola, Zambia, Nambia, and Botswana were found to be slightly taller than other South African Bantu-speaking groups (Tobias 1972).

Discussion

In a comparative study on male stature for Southern African groups, Tobias (1972) divided South African groups into three distinct categories, which were short (150 – 160 cm), medium (160 – 170 cm), and tall (170 – 180mm). The majority of these groups, which included South Africa, were within the range of medium body height (160-170 cm). In a similar study on stature for 23 groups of KhoiSan, it was noted that 22 of the 23 groups fell within the range of short body height (150 – 160) cm; a clear indication of genetic and perhaps environmental difference between the KhoiSan and their Southern African Bantu-speaking neighbours (Tobias 1972).

The estimated mean stature of the male Venda fits within the medium range of stature for Southern African groups as observed by Tobias (1972). Furthermore, no statistically significant difference was observed between the Venda (this study) and other Southern African groups, except for the sample of males in Angola, who were considered to be taller than most Southern African male groups. Therefore, it can be proposed that the stature of the Venda is similar to other South African Bantu speaking groups past and present; this also suggests that they have closer affinities with Bantu-speaking populations than other Southern African groups, such as the KhoiSan.

The absence of a secular trend in the Venda is in agreement with secular trend studies conducted by Tobias (1990) and Price et al. (1987), who suggested that black South Africans experienced a neutral secular trend during the 20th century. The little data we have about K2 support this conclusion.

Table 4.1. Frequency of skeletal pathology among the Venda (n = 113)

Pathology	n affected[1]	frequency (%)
Sub-periosteal lesions	6	5.31
Cribra orbitalia	0	0.00
Treponematosis*	1	0.88
Leprosy*	1	0.88
Osteomyelitis	3	2.65
Fractures	8	7.08
Osteoarthritis	8	7.08
Vertebral osteophytes	19	16.81
Schmorl nodes	4	3.54
No pathology	78	49.68

[1]n affected = number of individuals with a particular pathology

* = Treponematosis and leprosy are different diagnoses for the same individual NANMUL267

Table 4.2. Comparison of sub-periosteal bone growth on long bones

	n[1]	n affected[2]	frequency (%)	source
Venda	113	7	6.2	Present study
K2	106	6	5.7	Steyn 1994
Koffiefontein	36	4	11.1	L'Abbe et al. 2003
Maroelabult	47	8	17.0	Steyn et al. 2002
Catoctin Furnace	19	5	26.3	Angel and Kelly 1983
19th South Carolina	33	20	60.6	Rathbun 1987

[1]n = number of individuals

[2]n affected = number of individuals with subperiosteal lesions

Table 4.3. Frequency of cribra orbitalia in Southern African populations

	younger than 2 years	2-13 years	13-20 years	older than 20 years	total	source
Venda						
n	1	-	-	42	43	Current study
n affected	0	-	-	0	0	
%	0.0	0.0	0.0	0.0	0.0	
K2						
n	11	16	4	6	37	Steyn 1994
n affected	3	8	1	2	14	
%	27.3	50.0	25.0	33.3	37.8	
Riet River						
n	2	17	8	47	74	Morris 1992
n affected	0	4	1	2	7	
%	0.0	23.5	12.5	4.3	9.5	
Kakamas						
n	3	7	4	43	58	Morris 1992
n affected	1	2	0	0	3	
%	33.3	28.6	0.0	0.0	5.2	
Griqua						
n	10	2	3	25	40	Morris 1992
n affected	3	1	0	0	4	
%	30.0	50.0	0.0	0.0	10.0	
Oakhurst						
n	7*	1**	1***	10	18	Patrick 1989
n affected	7	1	1	2	11	
%	100.0	100.0	100.0	20.0	61.0	

n = number of individuals with observable orbits
n affected = number of individuals with cribra orbitalia
% = percentage of individuals affected with cribra orbitalia
* = category is for all individuals under three years
** = 3-15 years
*** = 15-20 years

Table 4.4. A summary of stature of the Venda and other South African populations

	Males			Females			
Population	N	Mean	sd*	N	Mean	sd*	Source
Venda (skeletal)	23	166.96	7.19	28	157.82	5.90	This study
Venda (historic)	168	167.60	4.60	56	154.00	7.90	Stayt (1931)
Venda (rural)	199	166.47	56.10	-	-	-	De Villiers 1972
Venda (urban)	148	166.89	63.10	-	-	-	"
K2	6	163.60	6.04	3	153.00	-	Steyn 1994
Zulu (Durban)	106	166.05	5.92	219	155.89	3.95	Tobias 1972
Kwangare (Angola)	109	170.84	5.30	25	159.32	13.40	"

sd* = standard deviation

Figure 4.1. Destruction of the hard palate and loss of the maxilla, possible leprosy or yaws (gangosa). NANMUL267.

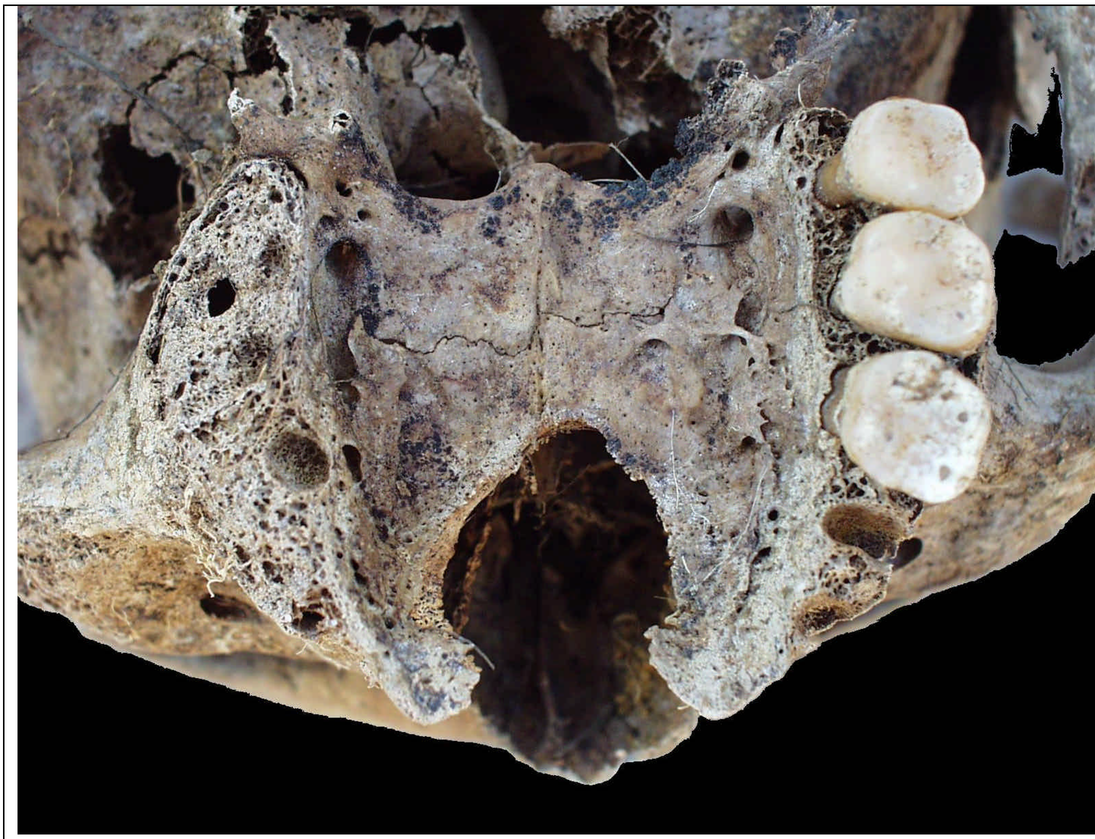


Figure 4.2. Possible case of leprosy: destruction of the hard palate of NANMUL267

Figure 4.3. Atrophy of the maxilla and nasal margin, possible case of leprosy

Figure 4.4. Compound fracture with visible cloacae NANMUL375

Figure 4.5. Possible case of osteomyelitis (NANMUL766).

Figure 4.6. Osteomyelitis on the humerus (NANMUL267)

Figure 4.7. Osteomyelitis. Distal aspect of the left femur. Note the swelling and cloacal opening (NANMUL267)

Figure 4.8. Poorly healed fracture (left femur) (NANMUL375)

Figure 4.9. Surgical wire on the mandible (NANMUL261)

Figure 4.10. Compressed fracture of T8 (NANMUL337).

Chapter 5 - Dental Health

5.1 Introduction & Literature Review

Very little is known about the dental health of the Venda. Stayt (1931) observed that toothache was common and dental extraction the only remedy but he did not discuss any other types of dental disease. Equally as vague, the results from a study of 134 individuals from a rural village in Venda (Tshikundamalema) showed that the incidence of dental caries was low but that of periodontal disease high (Pretorius, 1985; Van Staden, 1988). In this study, Pretorius (1985) observed periodontitis in all members in the sample of which 28.6% needed complex periodontal treatment. Furthermore, he noted that periodontal disease was common in all age groups from teenagers to elderly adults. A few years later, Van Staden (1988) conducted a similar study on a sample of 155 individuals from the same village. Similar to the study by Pretorius (1985), Van Staden (1985) observed a low prevalence of dental caries. However, in contrast to Pretorius (1985), it was noted that only 12% of the population had gingivitis, an early stage of periodontitis, and none had severe periodontal disease.

In a rural community without knowledge of dental care and possibly no access to dental treatment, a high frequency of periodontal disease is not considered unusual. In fact, Larsen (1997) suggested that the primary impetus for tooth loss in prehistoric skeletal samples was periodontal disease. In the anthropological literature, it has been shown that dental health is much poorer in agricultural groups than in hunter and gatherers. This difference has been attributed to the frequent consumption of soft or refined foods within an agricultural based subsistence economy (e.g., Turner, 1979; Lukacs, 1989; Roberts and Manchester, 1995). Therefore, it can be assumed that the dental health of the Venda would be similar to other early agricultural groups with little or no formal dental treatment.

Other factors that contribute to the incidence of caries and general dental diseases in a population are genetics, and oral hygiene. Genetic factors determine the susceptibility of an individual to dental caries and can include the position of the jaw (malocculsion, underbite or overbite), position of the teeth (overcrowding or general crookedness), quality of teeth (defects in dental enamel, unusually large or small teeth) and quantity of teeth (hypodontia or hyperdontia) (e.g., Pinborg, 1970; Silverstone et al., 1981; Kidd and Joyston-Bechal, 1997). No ethnographic information is available on the oral hygiene practices of the Venda but Pretorius (1985) implied that there was no available dental care for the rural community of Tshikundamalema.

5.1.1. Aim

The purpose of this chapter is to describe the frequency of dental disease observed in the skeletal remains from Venda. The presence of dental caries, periapical abscesses, antemortem tooth loss and enamel hypoplasia were recorded. Comparative data were obtained from various South African samples, both prehistoric and modern.

5.2 Materials and Methods

The presence or absence of dental caries, periapical abcesses, antemortem tooth loss (AMTL), and enamel hypoplasia was macroscopically assessed. Individual descriptions of the various diseases for each case are given in Appendix A. The presence or absence of periodontal disease was not evaluated, because the various methods available for scoring the disease are time consuming and could not be completed within the analysis time allocated per skeleton. However, digital photographs were taken of all the teeth for later evaluation, if necessary.

5.3 Results

The dentition of 97 adult individuals (50 males and 47 females) was assessed; to be classified as an adult, an individual had to be over 18 years of age. Adult males were significantly older than adult females with the average age for males at 42 years and females at 38 years ($t = 2.411$, p - value 0.04). Thirty-seven juveniles were also examined. However, the majority of juveniles were stillborns or infants under two years (86.1%), which significantly skewed the observation of dental disease in this group. For this reason, this chapter focuses only on dental disease found in the adult remains.

5.4 Dental Caries

Introduction

Dental caries is considered a multi-factorial disease that is affected by diet, oral hygiene, bacteria, dental morphology, and trace mineral contents such as fluoride in both food and drinks (Powell, 1985). These factors can be further divided into two components, namely essential and modifying factors.

Essential factors are necessary for the initiation of cariogenesis and include the susceptibility of the tooth, composition of dental plaque and type of diet consumed (e.g., Lukacs, 1989; Larsen, 1997). Dental caries can develop on any surface of the tooth that is exposed to the oral environment. However, the susceptibility of a tooth to decay is highly dependent on its morphology. Teeth with complex morphology (e.g., molars) are more prone to the accumulation of plaque and food particles than teeth with less complex morphology (e.g., incisors and canines). Therefore, the frequency of carious lesions in a population is usually highest in the molars and premolars and lowest in the incisors and canines (Roberts and Manchester, 1995; Hillson, 1996). According to Henneberg (1991), the frequency of carious lesions can be predictably ranked by tooth type (from highest to lowest). This ranked frequency pattern is molars, premolars, incisors, and canines.

The composition of dental plaque is essential to caries development in that the indigenous oral bacteria found in plaque (e.g., *Streptococcus mutans, Actinomyces, Staphylococcus*) participate in the fermentation of food substances that are embedded or attached to the tooth surface (Silverstone et al., 1981; Hillson, 1996). Fermentation of these food particles lowers the pH levels on the surface of the tooth, creating an acidic environment that stimulates the process of cariogenesis. Studies have shown that individuals with higher levels of oral bacteria are more susceptible to caries development than individuals with lower bacteria levels (Kidd and Joyston-Bechal, 1997).

The type of diet consumed, the manner in which it is consumed and the frequency of consumption also affects the initiation of cariogenesis. Simple sugars (mono - and disaccharides) and carbohydrates ferment quickly and are thus considered to be more cariogenic than fats and proteins. Foods that contain grit, such as sand or ash, are less cariogenic because the gritty substance within the food causes dental abrasions, which naturally cleanse the teeth (Živanovic, 1982). Multiple meals per day have also been shown to increase the chances of tooth decay (Hillson, 1996). As can be expected soft, sugary diets consumed more than twice daily are more common in agricultural (or westernised) urban diets than in traditional rural ones (Holm, 1990). For this reason, the presence of dental caries is much higher in urban than rural populations (Turner, 1979).

Modifying factors in dental caries are not essential for the initiation of the disease but are responsible for the location and rate of its development. These factors include, but are not limited to, the composition of the saliva, soil and mineral contents (e.g. fluoride, strontium), systemic disease and sex (e.g., Powell, 1985; Henneberg, 1991). Saliva is a natural cleansing agent for the teeth and contains enzymes and minerals (e.g., calcium, phosphate, magnesium) that can reduce the solubility of dental enamel by neutralizing the acidic waste products of oral bacteria (Kidd and Joyston-Bechal, 1997).

Minerals in drinking water, such as fluoride, have also been proven to reduce cariogenic activity in both children and adults by strengthening the dental enamel and thus enhancing its resistance to decay (e.g., Živanovic, 1982; Sealy et al., 1992; Van Loveren and Duggal, 2001). In adults, it has been shown that additional fluoride may provide a possible resistance to dental caries, since the dental enamel can absorb fluorine from saliva and food (Hillson 1996).

According to Silverstone et al. (1981), the optimal concentration of fluoride in the drinking water should be between 0.07p.p.m and 1.2 p.p.m. If the fluoride levels are too low then the population does not benefit from any additional resistance to tooth decay. On the other hand, a high concentration of fluoride has been shown to cause destruction of tooth enamel and to increase the incidence of dental caries in juveniles within a population (e.g., Carstens et al., 1995; Hillson, 1996; Grobleri et al., 2001).

Systemic diseases such as diabetes and syphilis increase the rate of carious activity, whereas other diseases such as hypothyroidism reduce it (Henneberg, 1991). Several researchers have noted a higher incidence of dental caries in females than males within agricultural groups (e.g., Walker and Hewlett, 1990; Lukacs, 1996; Larsen, 1997). However, this difference between the sexes has been attributed more to variations in dietary behaviour than genetics.

A strong relationship between diet, subsistence economy and dental disease has been well documented in the anthropological literature, such that a high incidence of dental caries is considered a hallmark of intensified agriculture. Researchers have demonstrated that agricultural groups have a higher frequency of dental disease than hunter and gatherers. According to Turner (1979), a hunting and gathering economy has the lowest incidence of caries (0-5.3%) a mixed economy has a slightly higher caries percentage which ranges from 0.4 to 10.3%, and an agricultural economy has the highest percentage of caries ranging between 2.3% and 26.9%. The wide, overlapping ranges for dental caries prevalence compensate for the modifying factors that affect the rate of caries development.

Materials and Methods

Lukacs (1989) and Buikstra and Ubelaker (1994) have developed standard procedures to record and calculate the frequency of dental caries in archaeological samples. In this study, the method proposed by Lukacs (1989) was used to record dental caries in the adult Venda.

Dental caries was recorded in the field. A carious lesion was recorded as present when destruction of either the dental enamel or tooth root was observed. Opacities or discolorations on the tooth, which may have indicated developing caries, were not evaluated. In archaeological samples, early indications of dental caries such as discolouration of the tooth are difficult to assess with the naked eye but can be easily observed with a microscope (Hillson, 1996). In the instance when a microscope is unavailable, Roberts and Manchester (1995) suggested that dental caries should be scored only when destruction of the tooth crown is clearly visible. This reduces possible misdiagnosis of discolourations due to normal taphonomic processes as dental caries.

If a carious lesion was present, the following observations were recorded: the location in the mouth (maxilla or mandible); the specific tooth (incisor, canine, premolar or molar); the specific area on the tooth (mesial, distal, buccal, lingual, occlusal, or tooth root); and the approximate size of the lesion.

Calculations

Four standard frequency calculations are available for the presentation of dental caries data and include individual frequency, caries intensity (or the tooth count method), caries intensity per tooth, and mean carious lesions per specimen (or per mouth) (Lukacs, 1989). Furthermore, these standard calculations have been used to report the incidence of dental caries in both living and archaeological Southern African samples (e.g., Till, 1927; Oranje et al., 1935; Morris, 1984; Patrick, 1989; Steyn, 1994).

1. **Individual caries frequency** = $\frac{\text{total number of individuals affected with caries}}{\text{total number of individuals in the sample}}$

The individual frequency is used to describe the number of people in the population with caries and provides the most general information about the incidence of the disease.

2. Caries intensity (tooth count) = $\frac{\text{total number of teeth affected with caries}}{\text{total number of teeth in the sample}}$

3. Caries intensity per tooth = $\frac{\text{total number of tooth type (x) affected with caries}}{\text{total number of tooth type (x) in the sample}}$

4. Carious teeth per mouth = $\frac{\text{total number of teeth affected with dental caries}}{\text{total number of individuals in the sample}}$

Carious teeth per mouth and caries intensity calculations are used to describe the severity of dental caries in a population. The total number of teeth affected refers to the teeth that have dental caries, irrespective of the severity of the carious lesion. The total number of teeth present in the sample refers to the number of teeth observed and does not include teeth which had been lost antemortem or postmortem.

A problem with the caries intensity formulae is that antemortem and postmortem tooth loss is not considered. A positive correlation has been noted between antemortem tooth loss (AMTL) and dental caries, such that dental caries is considered a direct contributor to AMTL in most archaeological skeletal samples (Lukacs, 1989).

Correction factors for dental caries

Several researchers have attempted to revise dental caries calculations to include both antemortem and postmortem tooth loss in the formulae (e.g., Erdal and Duyar, 1999; Lukacs, 1999). Lukacs (1995) designed the caries correction methodology to estimate the number of teeth lost antemortem from carious lesions. In order to calculate this formula, the following information must be known: the number of teeth lost antemortem, the number of carious teeth, and the number of carious teeth with pulp exposure due to either dental caries or dental attrition.

Lukacs (1999) stated that dental pulp exposure leads to AMTL. Furthermore, he suggests that AMTL can be caused by several factors, the most prominent of which are dental caries and dental attrition. Using the caries correction formulae, it is assumed that dental caries and dental attrition are the only contributors to AMTL within the population. If this is the case, the proportion of observed teeth with pulp exposure from dental caries and attrition represents the number of teeth lost before death. Therefore, he suggests that the proportion of teeth with pulp exposure from carious lesions should be multiplied by the number of teeth lost antemortem as a means to obtain the number of teeth lost antemortem due to dental caries.

The primary objective of the caries correction factor is to compensate for antemortem tooth loss from dental caries. However, two problems exist with the formula. The first is that the caries correction formula only permits two reasons – dental caries and dental attrition - for AMTL in a population. Lukacs (1995) acknowledged that such a situation is relatively artificial and that other factors such as periodontal disease, deliberate dental extraction, and trauma to the jaw or teeth may also contribute to AMTL. Therefore, it may be suggested that the caries correction factor would be less useful in skeletal samples with known incidences of periodontal disease and wilful dental extraction. Another problem with the caries correction factor is that it does not calculate postmortem tooth loss, which occurs during the normal process of decomposition (Hillson, 1996). Since anterior teeth have a single tooth root and less complex morphology, they are lost more often than the posterior teeth. Furthermore, the anterior teeth are usually not affected by dental caries such that a high rate of postmortem loss of these teeth creates an artificial "increase in the total caries rate" (Erdal and Duyar, 1999: 238).

To compensate for postmortem tooth loss in skeletal samples, Erdal and Duyar (1999) developed the proportional correction factor. The proportional correction factor is based on the principle that in all human populations the ratio of anterior to posterior teeth is 3:5, or a proportion of 0.6.

In this correction formula, the teeth are divided into anterior (incisors and canines) and posterior (premolars and molars) categories. The caries correction factor is calculated separately for each category (Lukacs, 1999). To reduce the effect of postmortem tooth loss, the caries correction frequency is recalculated for the anterior and posterior teeth so that the proportion of anterior to posterior teeth is 0.6. This recalculation involves multiplying the caries correction frequency of the anterior teeth by 3/8 and the posterior teeth by 5/8.

Even though they are not considered standard method, the dental caries correction factors should be considered in studies on dental health. In this study, these recalibration formulae were not used, because it would not have been possible to compare the results with data already obtained from other South African samples.

Results & Discussion

Of the 97 individuals, 59 or 60.8% had one or more teeth affected by dental caries (Table 5.1). Females had a higher individual frequency for caries (66%) than males (56%), but the difference was not statistically significant (chi-squared: 1.50, p = 0.22). However, a statistically significant difference was observed between males and females with regard to caries intensity, such that males had a higher frequency of affected teeth (9.2%) than females (6.5%) (chi-squared: 4.65, p-value = 0.031). Likewise, the number of carious teeth per mouth was also slightly higher in males (1.76) than females (1.46). These results may be attributed to either dietary differences between the sexes or to the older age of males in the sample.

The significant relationship in caries intensity between males and females was further explored by dividing the groups into two age categories, under 40 and over 40. The results of these frequency calculations are presented in Table 5.2. A higher frequency of caries was observed in males under 40 (11.5%), when compared with males over 40 (7.8%). In contrast, the females under 40 had a lower caries rate (5.7%), than the women over 40 (7.9%). However, differences between the young and old male and female groups were not statistically significant (chi-squared: 3.08, p-value = 0.079 (males); 2.52, p-value: 0.113 (females).

When males and females were compared in the same age category, a statistically significant difference was observed between males and females under 40, with males demonstrating a much higher incidence of caries (11.5%) than females (5.7%), (chi-squared: 10.15. p-value = 0.001). When the results were compared for the over 40 group, no statistically significant difference was observed.

Since dental caries is an age progressive disease, these results are unusual. One would expect older individuals to have a higher incidence of caries than younger individuals. However, this was not the case here. One of the factors that may account for this observation is the association of AMTL and age. As an individual becomes older, the carious teeth are lost either to deliberate extraction or natural avulsion. Therefore, the seemingly higher percentage of dental caries in young males when compared to older males may be related to AMTL in the older group. It may also be tentatively suggested that the relatively higher incidence of dental caries in young males than young females is due to differences in behavioural activities such as diet, cultural practices, and oral hygiene of the younger individuals.

The susceptibility of a particular tooth to dental caries varies depending on the dental morphology. The normal pattern of caries frequency for tooth types from the highest to lowest percentage is molars, premolars, incisors, and canines. This pattern reflects the increased susceptibility of the molar and premolar teeth to caries due to their more complex occlusal morphology and is seen in most groups regardless of their subsistence economy or access to dental treatment (e.g., Lukacs, 1989; Henneberg, 1991).

As can be expected, this caries pattern is seen among the dentition of the Venda and is shown in Table 5.3. Furthermore, it can be noted that males had a higher rate of dental caries than females in all teeth except M1, but the difference was only statistically significant for I2. From these results, it can be suggested that the dentition of both males and females was equally susceptible to carious attack.

A comparison of the incidence of caries from various South African skeletal samples is presented in Table 5.4. The groups were separated into four general subsistence economies, which include hunter-gatherer, mixed economy, agricultural-traditional, and agricultural-urban. Riet River, Kakamas and Oakhurst represent the hunter-gatherer groups and have been described in chapter 3 &4 (pg. 33 & 57). The

Iron Age site of K2/Mapungubwe and the 18th century Griqua represent the mixed economy and have also been discussed in chapter 4 (pg. 58). The agricultural/traditional economy category was created to reflect groups who participated in both the gathering of wild food and the growing of grains, but consumed only small quantities (if at all) of refined foods and sugars. This group is comprised of a living population of migrant gold mine workers (modern Xhosa) and the skeletal sample from Maroelabult. Both groups represent skeletal samples, which had traditional diets similar to the Venda. In contrast, the diet of the agricultural/urban group was primarily based on refined store bought goods.

Caries intensity and the number of carious teeth per mouth for the agricultural/ traditional groups (modern Xhosa: 7.2%, 2.5, Maroelabult 4.5%, 2.0) and mixed economy group (Griqua: 5.2%, 1.2) compares well with that of the Venda (7.8%, 1.6) and may possibly reflect a similarity in behaviour with regard to dietary habits and oral hygiene. In fact, the modern Xhosa (2.5), Maroelabult (2.0), and the Venda (1.6) have a slightly higher number of carious teeth per mouth than prehistoric skeletal samples which include K2/Mapungubwe (1.4), Riet River (1.0), and Kakamas (0.3). The discrepancy in the number of carious teeth per mouth between these groups may be explained by the potential access to refined/store bought foods such as biscuits, maize meal, flour, sugar, and coffee, by the Venda, modern Xhosa, Griqua and individuals from Maroelabult; whereas the prehistoric population of K2/Mapungubwe, Riet River, Kakamas and Oakhurst would not have had access to these products. However, due to either financial reasons or cultural habit, the agricultural/traditional group did not rely solely on store bought foods, as did the urban/agricultural group, and thus had a lower rate of caries.

Lastly, it should be mentioned that the unusually high caries intensity at both the Oakhurst and K2/Mapunguwe sites have been attributed to the low content of fluoride in the groundwater and is not a reflection of dietary factors (Sealy et al., 1992; Steyn, 1994).

In two studies on the fluoride content of the drinking water at Tshikundamalema, a low fluoride concentration was noted in the water (less than 0.05mg), and a similar low daily intake of fluoride for children (0.598mg) (Rautenbach, 1986; Janse van Rensburg and Pitout, 1989). However, the daily intake of fluoride for adult Venda males and females was high, between 3.54 and 5.32 mg. Janse van Rensburg and Pitout (1989) tested the fluoride content of various foods and drinks consumed by the Venda, and attributed this phenomenon to a high fluoride content in both meroho and home brewed beer. Thus the intake of additional fluoride from food and drink may have provided additional resistance to tooth decay for adults within the Venda community. Other types of foods that are known to have a high fluoride content are tea and "softboned fish, such as canned sardines and salmon" (Silverstone et al. 1981:229).

5.5 Periapical abscesses

Introduction

There are various aetiological factors responsible for the development of periapical abscesses. However, untreated dental caries or severe dental attrition is the most common cause. An abscess usually begins with exposure of the tooth pulp to bacterial invasion and subsequent necrosis. After the tooth pulp dies, the bacterium spreads into the periodontal tissue and, possibly, the root canal, and causes an inflammatory response known as periapical periodontitis. If the abscess is not treated, then pus builds up within the infected periapical space and eventually leads to necrosis of the periodontal tissue. During the stage of periodontal necrosis, a granular fistula forms and it is through this fistula that the accumulated pus drains into the oral cavity. In skeletal material, the periapical fistula can be found at the apex of the tooth and is round in shape with smooth edges (Brothwell, 1981; Lukacs, 1989; Hillson, 1996).

Most bacterial infections in the periapical space or root canal cause inflammation, but the drainage of pus via a fistula is less common. Without the presence of a fistula, the periapical abscess cannot be observed. For this reason, the incidence of these abscesses within skeletal samples is usually underestimated when only macroscopic observations are performed (Hillson, 1996).

Materials and Methods

As the name suggests, a periapical abscess forms in the periapical space or root canal of the tooth (Hillson, 1996). In skeletal remains, a periapical abscess is scored only when the fistula is visible. The fistula is a broad, circular pit with smooth edges and can be found on the lingual or buccal aspect of the alveolar bone at the apex of the tooth root. The round, smooth edges of the fistula are distinct in appearance from postmortem damage to the alveolar bone.

Calculations

$$\textbf{Individual frequency} = \frac{\text{total number of ind. affected with periapical abscesses}}{\text{total number of individuals in the sample}}$$

An individual frequency was used to describe the percentage of the population who had periapical abscesses.

Results & Discussion

A total of seven individuals, or 7.2%, had visible periapical abscesses. Of these seven, four were males (8.0%) and three were females (6.4%) and age ranged from young to older adults. Four individuals had single abscesses, one had two abscesses, and one had three large abscesses above the molar teeth in both the maxilla and mandible. All the cases observed were associated with severe dental attrition, except for one, which was associated with dental caries. The association of the abscesses with dental attrition suggests that the jaws of some individuals may have undergone heavy masticatory stress.

5.6 Antemortem tooth loss (AMTL)

Introduction

In the absence of dental treatment, all dental diseases such as caries, periodontal disease, and abscesses eventually lead to AMTL. Other factors that can contribute to tooth loss are dental attrition, trauma and cultural practices (e.g., Turner, 1979; Hillson, 1996; Morris, 1998)

Dental extraction can be performed either to alleviate pain from a diseased tooth or for cultural aesthetics. If a population does not have access to dental treatment, tooth extraction is the only means by which to alleviate dental pain. For example, Stayt (1931:273) observed that dental pain within the Venda "could only be cured by extraction such that the [affected] tooth is levered out by means of a pointed rod while the patient's head is held between the knees of the operator." Tooth extractions are most often performed because of carious teeth. Therefore, if all other factors that contribute to AMTL are held constant, the frequency of caries should mirror the frequency of AMTL in a population.

The extraction of teeth for cultural purposes focuses on the most visible teeth, which are the incisors and canines. Although the phenomenon of purposeful tooth extraction is not found in the Venda, Morris (1998) has documented the practice within several modern communities in the Western Cape. If the cultural practice of removing teeth were practiced within a community, then a distinct pattern of anterior AMTL would be observable in the skeletal remains.

Tooth avulsion is the culmination of degenerative processes in the mouth, which result from caries, dental wear or periodontal disease. Dental wear is initiated by both occlusal attrition and dental abrasion. The main difference between these two phenomena is that the former is direct tooth on tooth contact and the latter involves foreign particles such as grit or sand between the occluding surfaces of the teeth (Hillson, 1996).

In moderation, abrasive substances such as grit or sand within the diet are useful in cleansing the teeth of dental plaque and food particles. However, if dental abrasion is persistent and excessive, the enamel on the tooth is worn quickly and consequently causes exposure of the tooth pulp. Exposure of the tooth pulp can lead to bacterial invasion, infection, and eventual AMTL (Lukacs, 1989). Other factors that contribute to rapid wear of dental enamel include disease, quality of dental enamel and heavy masticatory stress (Kennedy, 1989).

In sedentary agricultural groups, like the Venda, abrasives are usually absent due to the soft, refined content of the diet and thus dental plaque is easily built up on the teeth. An amassing of dental plaque in the mouth is also associated with an accumulation of bacterial microorganisms on the surface and within the interproximal fissures of the teeth. In addition to creating organic acids, which cause lytic lesions in the tooth enamel, these bacterial organisms cause irritation and inflammation of the gingival tissue that surrounds the root of the tooth and the alveolar bone (Pinborg, 1970; Ortner and Putschar, 1981). Continuous inflammation of the gingival tissue forms the initial stages of periodontal disease. If this inflammation is prolonged, the result is infection of the gingival tissue and separation of the periodontal ligament from the root of the tooth (Hillson, 1996). This separation causes a periodontal pocket in which bacterial organisms can readily invade the sub-gingival space. Over time, the chronic irritation of the sub-gingival space causes resorption of the alveolar bone and eventual avulsion of the tooth (Ortner and Putschar, 1981).

Materials and Methods

According to Turner (1979:621), antemortem tooth loss is "recognized by alveolar bone resorption, socket filling, mesial or distal wear facets on remaining adjacent teeth, and mesial drift." In this study, if the alveolar bone was partially or completely resorbed, tooth loss was considered to be antemortem**.** If the alveolar socket was open, tooth loss was recorded as postmortem. A tooth was considered 'not recovered', if neither the alveolar bone nor the tooth was present for observation.

Calculations

The calculations used to describe AMTL included an individual count and a tooth count. Similar calculations have been used to describe AMTL by Morris (1984), Lukacs (1989), and Steyn (1994).

1. Individual AMTL frequency = $\frac{\text{total number of individuals with AMTL}}{\text{total number of individuals in the sample}}$

2. **AMTL per mouth** = $\frac{\text{total number of teeth lost antemortem}}{\text{total number of individuals in the sample}}$

3. AMTL intensity (tooth count) = $\frac{\text{total number of teeth lost antemortem}}{\text{total number of teeth in the sample}}$

4. AMTL per tooth (tooth count) = $\frac{\text{total number of tooth type (x) lost antemortem}}{\text{total number of tooth type (x) in the sample}}$

Results & Discussion

The incidence of AMTL in the Venda population is shown in Table 5.5. AMTL affected approximately 65% of the population (male and female). Although males (68%) appeared to be more affected than females (61%), the difference was not significant (chi-squared: 0.42, p-value: 0.5159). AMTL intensity, or the number of teeth lost, was higher in males (19.6%) than females (15%), and this difference was statistically significant (chi-squared 7.29, p-value 0.007) (see Table 5.5). The higher values for males with regard to AMTL per tooth may be attributed to the significantly higher mean age for males in the sample than females (42 and 38 years). This is supported by the fact that no difference in AMTL intensity was observed between the sexes when the ages were separated into younger and older categories (Table 5.6).

The older than 40 categories from both sexes demonstrated a significantly higher incidence of AMTL per tooth than their younger counterparts (male, under 40: 10.5%; over 40: 23.9%; chi-squared = 24.11, p-value: 0.000; females under 40: 7.5%; over 40:27.9%; chi-squared = 82.18, p-value 0.000). These results lend credence to the idea that a positive relationship exists between AMTL and age in the Venda population.

The range of antemortem tooth loss from highest to lowest was molars, incisors, premolars, and canines (Table 5.7). This pattern is slightly different from the pattern observed for carious lesions, which was molars, premolars, incisors, and canines. From a comparison of these two patterns, it can be proposed that a direct relationship exists between dental caries and AMTL for the molar teeth such that carious molars were probably extracted to alleviate dental pain.

However, the high percentage of tooth loss of the incisor teeth is unusual. For the central and lateral incisors, males had a higher percentage of tooth loss than females in both the young and old categories (Table 5.7). However, in the younger category (under 40), the percentage of incisors lost antemortem among the males (I1: 16.7%, I2: 15.2%) was not statistically significantly different from those observed in the females (I1: 9.0%, I2: 8.7%). This was not the case for the older category, where the difference in tooth loss of the central and lateral incisors was highly significant between males (I1: 64%, I2: 39.1%) and females (I1: 34.2%, 14.9%). The reason for this difference in the older categories is not clear and may be attributed to a combination of factors such as trauma (interpersonal violence), periodontal disease, wilful extraction, and possibly decoration.

In summary, the frequency of AMTL in the adult Venda can be associated with the normal, degenerative process of aging in a community with no access to dental treatment. This is supported by the results, which clearly demonstrate an increase in AMTL with age in both male and female groups (Keenleyside, 1998). The absence of differences between males and females suggests that both were subjected to the same diet and environmental stresses. Furthermore, the relationship between AMTL and caries may suggest that dental extraction, as a means to alleviate dental pain, had a substantial contribution to the percentage of AMTL on the molar teeth. Degenerative dental changes, such as periodontal disease and dental attrition, and/or wilful extraction may have contributed to high percentage of tooth loss of the central and lateral incisors in males over 40 years of age.

It should be mentioned that the high frequency of AMTL in the central incisors (upper and lower) of males over 40 is unusual and could be related to intentional tooth extraction. However, the practice of dental mutilation in the Venda is not mentioned in either the ethnographic or medical literature.

5.7 Enamel hypoplasia

Introduction

Poor environmental conditions such as inadequate nutrition and/or infectious disease are known to cause physiological stress to the body, which can disrupt skeletal development (Brothwell, 1981). Skeletal markers of physiological stress include enamel hypoplastic lesions, cribra orbitalia and sub-periosteal lesions. Similar to cribra orbitalia and sub-periosteal lesions, enamel defects cannot be directly associated with any particular disease and are thus considered to be an indicator of non-specific childhood diseases and/or malnutrition (Blakey et al., 1994a). Several factors are responsible for the appearance of enamel hypoplasia and include hereditary defects, localized trauma, systemic metabolic stress, and suceptibility of the individual, which includes current nutritional intake and pathogen load.

The mineralization of dental enamel during tooth crown development (both deciduous and permanent) begins around the sixth week in utero and continues until 8 years of age (Goodman and Rose, 1990). Three developmental phases occur during the formation of a tooth, which are classified as bud, cap, and bell. It is during the last phase (bell) that the development of dental enamel, or amelogenesis, is initiated by the ameloblast cells. During amelogenesis, the ameloblasts begin to secrete an organic-mineral matrix in a ring-like fashion from the occlusal surface of the tooth towards the dento-enamel junction (e.g., Goodman and Rose, 1990). Shortly after the matrix is secreted by the ameloblasts, these ring-like secretions (dental prisms) calcify and transform "into an acellular material composed (>97%) of inorganic salt" (Larsen 1997:44). Once calcification is complete, the tooth can no longer be remodelled.

Dental prisms, also referred to as perikymata or imbrication lines, are parallel lines with valleys and ridges on the crown surface and are clearly visible under both a light and electron microscope (e.g., Hillson and Bond, 1997). Other normal anatomical structures that can be observed on the dental crown are the brown striae of

Retzius, which run diagonally to the perikymata, and the Tomes process pits, which are small dots along the surface of the dental crown (Hillson, 1996). In the majority of cases, dental defects affect the formation and subsequent macro - and microscopic appearance of the perikymata.

As can be expected, a defect in the perikymata results from a cessation of activity by the ameloblasts during amelogenesis. Ameloblasts only begin to secrete matrix after the physiological stress period has passed and the body has returned to its normal state. Since dental enamel does not remodel, any defects in the enamel surface prior to the recommencement of ameloblast activity are permanent and serve as skeletal markers for this period of physiological stress. These enamel hypoplastic defects may be macroscopically visible as pits or furrows (both horizontal and vertical) on the enamel surface of the tooth.

Enamel hypoplastic defects are observed most often in populations that experience severe episodes of physiological stress due to inadequate nutrition, infectious disease, or both (e.g., Goodman et al., 1980; Slaus, 2000; Cucina, 2002; Bonfiglioli et al., 2003). According to Blakey et al. (1994b: 382), the frequency of enamel hypoplastic lesions from skeletal remains of 19th century African American slaves is "among the highest observed in [any] human population" and have been associated with the unprecedented levels of mental, physical and physiological stress experienced by this group. In a summary of enamel hypoplasia research contributed from various skeletal samples, Larsen (1997:50) stated "hypoplasias are [more] commonplace in underdeveloped settings… with poorer diets, more disease, or some combination of undernutrition and disease."

Materials and Methods

Linear enamel hypoplasia (LEH) is identified as lines, pits, or grooves on the enamel surface of the tooth (Hillson, 1996). On account of time constraints in this study, enamel defects were scored on the anterior teeth only. Goodman and Rose (1990:91) support this method and suggest that "a dozen teeth (anterior) [can] be studied relatively rapidly…without much loss of information." On account of the fact that most of the juveniles in the sample were stillborn, the presence or absence of enamel hypoplasitic lesions was not observed in the deciduous teeth.

Since time constraints were a problem, a method was devised to score the presence or absence of enamel hypoplasia in the field. In any laboratory setting, the scoring of defects on dental enamel should involve the use of a dental probe and a low power microscope (Goodman and Armelagos, 1985).

In order to score a LEH with the field-adapted method, the sharp pointed end of a sliding caliper was scraped along the enamel surface of each of the twelve anterior teeth. If no resistance was encountered, then enamel hypoplasia was scored as absent. If resistance was encountered and a defect in the tooth enamel observed then enamel hypoplasia was recorded as present. A problem with this technique is that it can only discern moderate to severe enamel hypoplasia (type IV).

Multiple lesions on a single tooth were recorded in the notes and photographed, but in the calculations were considered by tooth only and not by the number of defects on that tooth. The distance of the enamel hypoplasia from the CEJ was not recorded on account of time constraints during skeletal analysis.

Calculations

The calculations used to describe enamel hypoplasia included an individual count and a tooth count. Similar calculations have been used by Lukacs (1989) and Bonfiglioli et al. (2003).

$$\textbf{1. Enamel hypoplasia frequency} = \frac{\text{total number of individuals with EH}}{\text{total number of individuals in the sample}}$$

$$\textbf{2. Enamel hypoplasia (tooth count)} = \frac{\text{total number of anterior teeth with EH}}{\text{total number of anterior teeth in the sample}}$$

Results & Discussion

The incidence of enamel hypoplastic defects for adult males and females is shown in Table 5.8. Enamel hypoplasia occurred more in females (11.1%) than male individuals (male 2.2%), and the difference was statistically significant (chi-squared: 5.75, p – value:0.0165). In Table 5.9, the frequency of enamel hypoplastic lesions is presented by tooth type for the maxilla and mandible. As can be seen, lesions occurred most often in females for the upper incisors and lower canine.

The frequency of enamel hypoplasia in adults from Venda was compared with other individuals from prehistoric, historic, and modern groups in South Africa and a

19th century slave population from South Carolina. The results of these comparisons are shown in Table 5.10.

The samples that were used for comparison included K2/Mapungubwe, Oakhurst, Maroelabult, modern South African Negroids, Koffiefontein, and a 19th century slave population from South Carolina. The health status of all these groups, excluding modern South African Negroids, has been discussed in chapters 3 & 4 (pg. 26 -79). The South African Negroid population is represented by a large modern 20th century sample, which contains approximately 3000 dissection room cadavera and is housed in the Raymond A. Dart collection. Most, if not all, of these individuals came from low socio-economic backgrounds with possibly poor health status (Tal and Tau, 1983).

The highest frequency of enamel hypoplasia was noted in the 19th century slave population (100% males, 71% females). These high rates of enamel defects are attributed to the extremely poor diet, poor living conditions and high incidences of infectious disease among African American slaves during the 19th century. In fact, the African American slave cemeteries are known to have the highest "incidences of enamel hypoplasia observed in [any] human population" (Blakey et al., 1994b:382).

A high frequency of enamel hypoplasia was also noted at the prehistoric sites, K2/Mapungubwe and Oakhurst (63.3% and 47%, respectively), the historic site of Koffiefontein (61.1%), and a modern Negroid population of dissection room cadavers (36%).

When compared to the African American slaves, modern Negroids and the prehistoric groups, the frequency of enamel hypoplasia found in Maroelabult (18.8%) and Venda (12.4%) is quite low. These results may indicate a balanced adaptation to childhood diseases in both groups. This does not suggest that there was no disease in the Venda community, only that the individuals were well adapted (nutritionally) to handle the various stressors within their environment. However, these conclusions are made with caution due to the small sample size from both Venda and Maroelabult.

Table 5.1. Summary of the incidence of dental caries in the Venda

Variables Caries	Per individual[1]			Per mouth[2]			Per tooth[3]		
	N	NIA	%	N	NTA		NT	NTA	%
Male	50	28	56.0	50	88	1.76	957	88	9.2
Female	47	31	66.0	47	69	1.47	1059	69	6.5
Total	97	59	61.0	97	157	1.61	2016	157	7.8

1 - total number of individuals affected by dental caries / total number of individuals present

2 - total number of carious teeth / total number of individuals

3 - total number of carious teeth / total number of teeth present

NIA - total number of individuals affected with dental caries

NTA - total number of teeth affected with dental caries

NT - total number of teeth present

Table 5.2. Caries intensity for the Venda sorted by sex and age

	Male				
	N[2]	Na[3]	%		
Under 40[1]	305	35	11.5		
Over 40	652	51	7.8		
	Female				
	N[2]	Na[3]	%		
Under 40[1]	669	38	5.7		
Over 40	390	31	7.9		
	Total				
	N[2]	Na[3]	%	Chi-squared	p-value
Under 40[1]	974	75	7.7	10.15	0.001
Over 40	1042	82	7.9	0.05	0.816

1 Range from 18 to 39 years of age

2 - total number of teeth present excluding postmortem loss

3 - total number of teeth affected with dental caries

* Caries correction factor was used (Lukacs 199

Table 5.3. Caries intensity for the Venda sorted by sex and tooth type

Tooth	Male			Female			Total				
	N[1]	Na[2]	%[3]	N[1]	Na[2]	%[3]	N[1]	Na[2]	%[3]	Chi-squared*	p-value
I1	74	7	9.50	114	4	3.51	188	11	5.85	2.88	0.0894
I2	97	3	3.10	129	0	0.00	226	3	1.33	4.04	0.0443[a]
C	118	5	4.20	152	3	1.97	270	8	2.96	1.18	0.2766
P1	149	10	6.70	152	6	3.95	301	16	5.32	1.14	0.2852
P2	137	11	8.00	148	8	5.41	285	19	6.67	0.79	0.3750
M1	133	9	6.80	129	11	8.53	262	20	7.63	0.29	0.5917
M2	132	22	16.70	122	17	13.93	254	39	15.35	0.36	0.5462
M3	117	21	17.90	113	20	17.70	230	41	17.83	0	0.9666
Total	957	88		1059	69		2016	157			

1 - the number of teeth present per tooth type

2 - the number of teeth affected with dental caries per tooth type

3 - the total number of teeth affected by caries for a particular tooth type/ total number of teeth present for a particular tooth type

a - statistically significant at 0.05 or less

* degree of freedom: 1

Table 5.4. Incidence of dental caries in various South African populations

	N[1]	Caries frequency %	Caries Intensity %	Carious teeth per mouth	Source
Venda	2016	60.8	7.8	1.6	This study
Hunter-Gatherer					
Riet River	1061	41.7	4.3	1.0	Morris 1992
Kakamas	989	18.8	1.3	0.3	"
Oakhurst	192	-	17.7	-	Sealy et al. 1992
Mixed economy					
K2/Map[2]	306	54.5	18.3	1.4	Steyn 1994
Griqua	575	42.3	5.2	1.2	Morris 1992
Agricultural - traditional					
Xhosa[3]	3043	68.0	7.2	2.5	Cleaton-Jones 1979
Maroela.[4]	582	56.6	4.5	2.0	Steyn et al. 2002
Agricultural - urban					
Urban 'bantu	-	68.0	-	3.1	Staz 1938
Urban negro	9178	90.0	14.3	4.4	"

1 = total number of teeth present (excludes postmortem loss).

2 = K2 & Mapungubwe

3 = Modern Xhosa

4 = Maroelabult

Table 5.5. Summary of the incidence of AMTL in the Venda

Variables	Individual frequency[1]			Per mouth[2]			Intensity[3]		
	N	Na[4]	%	N	Na[5]	%	NT	Na[5]	%
Male	50	34	68.0	50	188	3.76	957	188	19.6
Female	47	29	61.7	47	159	3.38	1059	159	15.0
Total	97	63	64.9	97	347	3.58	2016	347	17.2

1 - total number of individuals with one or more teeth lost antemortem/ total number of individuals present

2 - total number of teeth lost antemortem / total number of individuals

3 - total number of teeth lost antemortem / total number of teeth present

4 - total number of individuals with one more teeth lost antemortem

5 - total number of teeth lost antemortem

NT - total number of teeth

Table 5.6. AMTL intensity for Venda sorted by sex and age.

		Male			
	N[1]	Na[2]	%		
Under 40*	305	30	9.8		
Over 40	652	156	23.9		
		Female			
	N[1]	Na[2]	%		
Under 40*	669	50	7.5		
Over 40	390	109	27.9		
		Total			
	N[1]	Na[2]	%	chi-squared	p-value
Under 40*	974	76	7.8	1.16	0.2811
Over 40	1042	265	25.4	2.28	0.1313

1 = total number of teeth present

2 = total number of teeth that were lost antemortem

Table 5.7. AMTL per tooth type for the Venda sorted by sex and age

Under 40*

Tooth	Male			Female			Total				
	N[1]	Na[2]	%	N[1]	Na[2]	%	N[1]	Na[2]	%	Chi-squared*	p-value
I1	24	4	16.7	76	5	6.6	100	9	9.0	2.27	0.1322
I2	33	5	15.2	82	5	6.1	115	10	8.7	2.43	0.1192
C	40	2	5.0	92	1	1.1	132	3	2.3	1.92	0.1696
P1	45	3	6.7	92	1	1.1	137	4	2.9	3.32	0.0685
P2	41	4	9.8	92	1	1.1	133	5	3.8	5.89	0.0152[a]
M1	38	5	13.2	83	10	12.0	121	15	12.4	0.03	0.8635
M2	42	3	7.1	80	12	15.0	122	15	12.3	1.58	0.2092
M3	42	4	9.5	72	15	20.8	114	19	16.7	2.44	0.1181
Total	305	30	9.8	669	50	7.5	974	80	8.2		

Over 40

Tooth	Male			Female			Total				
N		156			109			265			
	N[1]	Na[2]	%	N[1]	Na[2]	%	N[1]	Na[2]	%	Chi-squared*	p-value
I1	50	32	64.0	38	13	34.2	88	45	51.1	7.67	0.0056[a]
I2	64	25	39.1	47	7	14.9	111	32	28.8	17.25	0.000[a]
C	78	12	15.4	60	4	6.7	138	16	11.6	2.51	0.1128
P1	104	6	5.8	60	7	11.7	164	13	7.9	1.81	0.1781
P2	96	8	8.3	56	12	21.4	152	20	13.2	3.44	0.0636
M1	95	21	22.1	46	24	52.2	141	45	31.9	14.66	0.0001[a]
M2	90	23	25.6	42	21	50.0	132	44	33.3	7.7	0.0055[a]
M3	75	29	38.7	41	21	51.2	116	50	43.1	1.7	0.1919
Total	652	156	23.9	390	109	27.9	1042	265	25.4		

1 = total number of teeth present per tooth type

2 = total number of teeth lost antemortem per tooth type

% = total number of teeth lost antemortem per tooth type/ total number of teeth present per tooth type

* = df = 1

a = statistically significant at 0.01 or less

Table 5.8. Summary of the incidence of enamel hypoplasia in the Venda*

	N[1]	Na[2]	%
Male	44	2	4.5
Female	46	10	21.7
Total	90	12	13.3

1 = total number of individuals

2 = total number of individuals with enamel hypoplasia

* permanent teeth only

Table 5.9. Enamel hypoplasia in the Venda sorted by sex and tooth type*

Maxilla					
Tooth		Male			
	N[1]	Na[2]	%		
I1	38	3	7.9		
I2	49	2	4.1		
C	58	2	3.4		
Maxilla		Female			
	N[1]	Na[2]	%		
I1	52	6	11.5		
I2	59	5	8.5		
C	72	9	12.5		
Maxilla		Total			
	N[1]	Na[2]	%	Chi - squared	p-value
I1	90	9	10.0	0.32	0.5693
I2	108	7	6.5	0.85	0.3559
C	130	11	8.5	3.40	0.0653
Mandible					
Tooth		Male			
	N[1]	Na[2]	%		
I1	36	1	2.8		
I2	48	3	6.3		
C	60	3	5.0		
Mandible		Female			
	N[1]	Na[2]	%		
I1	62	4	6.5		
I2	70	3	4.3		
C	80	11	13.8		
Mandible		Total			
	N[1]	Na[2]	%	Chi - squared	p-value
I1	98	5	5.1	0.63	0.4256
I2	118	6	5.1	0.23	0.6333
C	140	14	10.0	2.92	0.0877

1 = total number of teeth present per tooth type

2 = total number of teeth with enamel hypoplasia per tooth type

% = total number of teeth with enamel hypoplasia per tooth type/ total number of teeth present per tooth type

* = permanent teeth, only

Table 5.10. Incidence of enamel hypoplasia in various South African population

	N[1]	Na[2]	%	Source
Venda*	90	12	13.3	This study
K2/Mapungubwe	60	38	63.3	Steyn 1994
Oakhurst	22	11	50.0	Kennedy 1989
Maroelabult	16	3	18.8	Steyn et al. 2002
South African				
Negroid	-	-	36.6	Lunz 1987
Koffiefontein*	37	22	61.1	L'Abbe et al. 2003
19th century slaves				
SC				Rathbun 1987
Males	13	13	100.0	
Females	14	10	71.0	

1 = total number of individuals present

2 = total number of individuals affected with enamel hypoplasia

* permanent dentition only

SC = South Carolina, USA

Chapter 6. Population Affinity

6.1 Craniometry

6.1.1 Theories on the origins of the Venda

Two theories have been proposed with regard to the origin of the Venda, which include a historical migration theory (Stayt, 1931; Van Warmelo, 1932) and a more modern theory based on local development in the Soutpansberg Mountains (Loubser, 1988; Loubser, 1989; Huffman, 1996).

Migration theory

Early ethnographers and historians suggested an East African origin for the people of Venda (e.g., Stayt, 1931; Wilson, 1969). The migration theory focuses on the unique aspect of Venda culture and language as motivations for their separation from other South African 'Bantu' speaking populations.

According to Stayt (1931:14), the people who refer to themselves as Venda originated from " a very warm climate where many rivers emptied themselves into large 'silent stretches of water', the description [of this country] leading to an assumption that it must have been in the great lakes region of East Africa such as Lake Malawi." Wilson (1969:170-171) also proposed an East African origin and described the "lush and wooded Soutpansberg" as being similar to the East African environment from which the Venda "had migrated at least one month before reaching the many Shona chiefdoms". She also noted "similarities in custom between the people of Rwanda, Kilimanjaro and Rungwe with people in eastern Rhodesia (Zimbabwe) and the Soutpansberg region" and thus speculated that the Shona in Zimbabwe may have either had origins in East Africa or that the Venda had spent a considerable amount of time with the Shona before travelling to the Soutpansberg region.

Although ethnographic, linguistic and genetic evidence is available for a migration of Bantu speaking tribes from Central and East Africa in the 1st and 2nd millennium; there is no direct archaeological evidence a later migration of people who consider themselves 'Venda' from East to South Africa (Mitchell, 2002;Lane et al., 2002). Rightmire (1972b) was the first researcher to examine the relationship between the Venda and East African groups (Rwanda and Rundi). His results showed that the body dimensions of the East Africans were more closely related to the Venda than to other South African groups. However, the dimensions for the Venda were equally as close to South African groups such as the Zulu and Sotho-Tswana as they were to the East Africans. Rightmire (1972b) concluded that the Venda represented an intermediary group, possible due to their former connection with East African populations and their present association with South African groups. Although the results suggest a possible connection with East Africa, it is not a solid affiliation. Additional research is needed to better understand the connection between the Venda and both East and South African populations.

Theory of Local Development

Loubser (1989) used archaeological evidence, ethnographic accounts and oral traditions to support a theory of local development of the Venda in the Soutpansberg Mountains. In contrast to the migration theory of cultural replacement, this places emphasis on cultural diffusion between Shona and Sotho-Tswana groups in the Soutpansberg region after AD 1500.

It has been shown that an aggressive expansion of the Shona into the region occurred during the initial decentralization of Great Zimbabwe (A.D. 1500 - 1600). At this time many Shona chiefs had immigrated southward into Botswana and South Africa with the intention of establishing new, smaller trade networks with the East Coast of Mozambique. Archaeologically, these migrations have been mapped by the spread of Shona type pottery and socio-political systems (e.g., stone wall hilltop constructions and divine rule) (Loubser, 1989; Loubser, 1990; Huffman, 1996).

Loubser (1989) suggests that the Shona interacted extensively with the indigenous Sotho - Tswana groups in the area. His hypothesis is based on the apparent blending of both Shona and Sotho ceramic styles at various archaeological sites (e.g., Harmony village, Dzata) in the Limpopo Province. Loubser (1989) and Huffman (1996) suggest that the interactions between these two groups were the precursors for the development of the Venda culture, language and socio-political system. In contrast to the theory of migration (as mentioned above), the theory of local origins proposes the idea of cultural assimilation between the Shona and Sotho-Tswana groups rather than cultural subjugation of the indigenous groups by the Shona. Thus, the people of Venda are a result of accumulative trade networks, exchange and alliances between Shona and Sotho-Tswana groups since A.D. 1500. This theory emphasizes the local development of these people and indirectly associates them with the early Shona people who may have inhabited Mapungubwe and K2.

6.1.2. Cranial variation among humans

Cranial variation in modern human populations has been ascribed to both environment (such as climate, annual rainfall and temperature) and genetic factors (Hiernaux, 1968; Howells, 1989; Froment, 1998). Genes and gene flow contribute most to the variation present in human populations. In a recent craniometric study, Froment, (1998) demonstrated that geography (or the distance of two populations from each other) has the strongest effect on gene flow and thus the biological variation within and between populations. The reason for this is that the geographical distance between two populations is directly related to the possibility of gene flow. Other factors that can inhibit or encourage gene flow between neighbouring populations include culture, history, language, economic circumstances and sexual dimorphism.

Gene flow can be bi-directional, uni-directional or restricted. For example, if the gene flow between populations A and B is bi-directional (for example, exogamous marriage), then the cranial morphology in the two groups will be relatively similar such that it will be difficult to separate them into two distinct populations. Furthermore, if exogamous marriage remains continuous into successive generations, then these groups will eventually form a single homogenous population. South African Negroids are an example of bi-directional gene flow. Based on cranial morphology, the various tribal groups of South Africa are considered to belong to a single population, even though they have different cultural practices and may have originated from different Bantu-speaking groups from Western and Eastern Africa (De Villiers, 1968; Jacobson, 1982).

However, if the exchange of genes between populations A and B is uni-directional such that marriages occur only from population A into population B, then population A will retain homogeneity whereas population B will become more admixed. Morris (1992) demonstrated this clearly with the relationship between skeletal samples of San (KhoiSan) hunters and gatherers and Bantu-speaking agricultural populations in the Orange River Valley from the early 19th century. He suggested that the San (KhoiSan) females (for economic reasons) would marry into the Bantu-speaking agriculturist groups but the Bantu-speaking females would not marry into the San (KhoiSan) group. The result was a uni-directional flow of genes from one population to another and, according to Morris (1992), might have contributed to the eventual demise of the San (KhoiSan) population in this region. Lastly, if population A is compared to population C, a group with whom they do not share their genes, then both populations A and C will appear more homogenous in relationship to each other.

The basic theorem of all craniometric studies is that there is a strong relationship between genetics and cranial morphology. This is supported by Relethford (2002) who showed that the pattern of human variation is similar in both craniometric traits and classic genetic markers, such as DNA polymorphisms. In order to determine the similarities and differences between populations, the cranial variables are analysed using both univariate and multivariate statistics (Rightmire, 1972a; Howells, 1973; Howells, 1989; Ribot, 2002). Knowledge of the history of the population in question is useful in order to interpret results from the various statistical analyses.

6.1.3. Aim

The purpose of this section was to use metric variables from the skull in conjunction with uni- and multivariate statistical procedures as a means to provide additional evidence on the origin of the people of Venda. Firstly, the cranial morphology of the Venda was compared to other large heterogeneous skeletal samples from both Eastern and Southern Africa. This was done in order to establish the relationship between the Venda and 'Bantu' - Speaking Eastern and Southern African groups on an inter-regional level. Secondly, the relationship between the Venda and the Iron Age skeletal sample of K2 was explored. Interpretation of the results from these various statistical analyses is made in conjunction with the ethnographic and archaeological evidence available.

6.1.4. Materials and Methods

A summary of the categorical variables used in the analysis is provided in Table 6.1.1. These categorical variables were separated into two groups, which were named population 1 and population 2. In population 1, the various groups are large and are used to compare craniometric dimensions on a broad inter-regional level. For example, the whole of East Africa (which contains both Tutsi and Bahutu ethnic groups) are compared with other large geographical regions such as the Horn of East Africa (which contains the Teita and Haya ethnic groups) and South Africa (which contains Sotho-Tswana and Nguni ethnic groups). The reason for comparisons at an inter-regional level is to assess whether the Venda are more closely related to the Eastern African or Southern African groups. In population 2, the groups are smaller and are assumed to be more homogenous than the groups found in population 1. At this level, it is possible to assess the inter-ethnic variation among the various populations and to evaluate the relationship between Venda and Mapungubwe/K2. A brief description of each of these populations that includes their location, subsistence economy, language and skeletal sample is given below. A map that shows the origin of these comparative African samples is provided in Figure 6.1.1.

6.1.4.1. Comparative samples

East Africans (n = 282) and Horn of East Africa (n = 177)

On account of the suspected East African origin of the people from Venda, several East African tribes were selected for multiple discriminant analysis and factor analysis. These groups included tribes from Rwanda (Tutsi and Bahutu) and Uganda, the Teita tribe from Kenya and the Haya tribe from Tanzania.

The Bahutu skeletal collection (n = 103) represents a broad East African population and is housed at the Institut Royal des Sciences Naturelles of Brussels and have been analyzed by Ribot (2002). Although various cemeteries are represented in this collection, they are all from the Burundi-Rwanda area and are believed to be descendants of an early Bantu expansion (A.D. 200) from Chad-Niger. The Bahutu were agriculturists with some aspects of pastoralism, which they had obtained from the Tutsi who ruled the area from the 14th to 18th century (Yakan, 1999). Data for the Tutsi and Ugandan skeletal sample were acquired from Ribot (2002).

South Africans (n = 125)

Both Sotho-Tswana and Nguni populations are represented in the skeletal material from South Africa. Neither the Sotho-Tswana nor the Nguni populations developed the large states or chiefdoms which have been seen at Mapungubwe (A.D. 1220-1290) and Great Zimbabwe (A.D. 1220-1450). One reason for this is the absence of trade and a ruling elite (Newman 1995: 192). Rather, the Sotho-Tswana was comprised of several small autonomous villages, which participated in subsistence farming and the raising of domesticated livestock such as goats and cattle. An exception to this small village structure was the town of Toutswe, which is believed to have accommodated 15,000-20,000 people. However, this large town was an amalgamation of several small villages for the purposes of mutual protection from cattle raids and not a clearly defined chiefdom on its own (Denbow, 1982; Huffman, 1996; Ribot, 2003).

The Nguni (also known as the Coastal Nguni) was an early farming community in Southern Africa and date to approximately A.D. 1000 (Newman, 1995). The cultivation of maize among the Nguni increased population growth and expansion along the East coast (Newman, 1995; Mitchell, 2002). The skeletal data for these two populations were acquired from Ribot (2002).

Riet River (n = 116)

The Riet River skeletal remains are attributed to a 19th century San (KhoiSan) hunting and gathering population. The relationship between hunting and gathering and agricultural economies has been well documented in Sub-Saharan Africa (Morris, 1992; Mitchell, 2002). However, the process by which this agricultural transition took place is not fully understood. At Riet River, evidence for exchange networks between these groups was noted among the grave goods, which contained copper earrings, glass beads and cowrie shells (Morris, 1992). According to Morris (1992), the San (KhoiSan) group was less wealthy than their Bantu-speaking agriculturist neighbours. On account of this, he suggests that intermarriages between the two groups would have been uni-directional;

that is the San (KhoiSan) women would 'marry up' into the Negro population but very few Negro women would 'marry down' into the San (KhoiSan) population. This uni-directional gene flow may be a reason for 'extinction' of these hunter and gatherer groups (Mitchell, 2002).

The skeletons found at Riet River represent San (KhoiSan) individuals who were buried before 1820 (Morris, 1992). Several researchers, (Hiernaux, 1974; Morris, 1992; Yakan, 1999), consider the San (KhoiSan) to be an autochtonous population, which are biologically different from other adjacent populations despite possible admixture with them. Rightmire (1970b) also noted a clear distinction between the San (KhoiSan) and South African Negro populations with regard to skull morphology.

Mozambique (n = 21)

Little information is available on the skeletal remains from the Zambezi River area in Mozambique, except that they were considered to be agriculturists. The remains of these individuals are housed at the British Museum. Skeletal data on this population were acquired from Ribot (2002).

Maroelabult (n = 7)

The skeletons excavated at Maroelabult date between the late 19th and early 20th century and were most likely farm workers of Sotho-Tswana descent (Steyn et al., 2002). The Sotho-Tswana affinity was extrapolated from both informants and historical documentation. From this evidence, it was suggested that the geographical region in which Maroelabult was located had been controlled by 17th century Sotho-Tswana chiefdoms such as Kgatla, Po and Fokeng. The individuals from Maroelabult can be expected to be a relatively homogenous population and will provide a useful comparison with the Venda.

K2 (n = 4)

Occupied between A.D. 1030 and 1220, K2 represents a turning point in social structure for the early Iron Age 'Bantu'speaking populations of South Africa. It is at K2 that the first reorganizations of space from the 'egalitarian' central cattle pattern to a more socially stratified society with ruling elite has been noted (Vogel, 2000; Mitchell, 2002). The hilltop site at Mapungubwe, which was occupied between A.D. 1220-1250 (phase III) and A.D. 1250-1290 (phase IV), is representative of this new socially stratified society (Vogel, 2000). Although the site was possibly occupied before A.D. 1200, it has been suggested that the skeletons date to the later phases (Steyn, 1994).

Many of the graves excavated from Mapungubwe were accompanied by elaborate grave goods such as a gold rhinoceros, bowl and scepter. This is reflective of the high status of these individuals. A total of six adults and nine juvenile skeletons were excavated from Mapungubwe Hill, but the preservation of these skeletal remains was poor. On account of this, it was not possible to include any of the adult skulls from Mapungubwe into either the multiple discriminant functions or the factor analysis. Therefore, only a comparison between K2 and the Venda was made.

The skeletal remains excavated from K2 were mostly found in the main midden and a total of 94 individuals were exhumed. Of these 94 people, 76 were juveniles and adolescents (Steyn, 1994). Only four adult skulls (A1715, A1722, A1747, A1730) were complete enough to be used in this study.

Pottery assemblages found in the late phases of K2 and Mapungubwe have been associated with Shona immigrants from the North and possibly early Sotho-Tswana populations (Loubser, 1990; Huffman, 1996; Mitchell, 2002). This admixture of style is suggestive of some type of exchange between the Shona and Sotho-Tswana and is supportive of the theory of local development (as opposed to foreign invasion) at Mapungubwe, Great Zimbabwe and Venda.

The people of Venda have been indirectly linked to the individuals from K2 due to their possible relationship with the descendants of these early Shona and Sotho-Tswana groups and on account of the geographic proximity of Venda and the K2/Mapungubwe site, although there is no firm evidence for a biological relationship.

6.1.4.2. Metric variables and statistical analyses

A total of 27 standard anthropometric cranial and mandibular measurements were used in the analysis and are comparable to those of Howells (1973), Morris (1992) and Ribot (2002). A description of these variables is given in Table 6.1.2. The majority of these measurements correspond with the face (10 variables) and the remaining measurements were from the vault (6 variables), the mandible (8 variables) and the skull base (3 variables). The variable codes were adopted from Howells (1973) and Ribot (2002). The skull was analysed in terms of these structural components.

SPSS (version 11.5) and SYSTAT (version 8.0) statistical programs were used to perform both univariate and multivariate statistical procedures, which included a one-way analysis of variance (ANOVA), discriminant function analysis, factor analysis, and independent Student's t-test. These tests were used as a means to statistically determine the similarities and differences in cranial morphology among the various populations. A description of each statistical procedure is given below:

6.1.4.3. Univariate Statistics

ANOVA (one way analysis of variance)

The analysis of variance tests the equality of the mean values among the various selected groups (Sokal and Rohlf, 1995). ANOVA results are presented as F-values with a certain level of significance. The higher the F-value, the less equal (or more variable) are the means among the various groups. The higher the amount of variation present within a particular variable (e.g., cranial height), the better that variable is in discriminating among the various populations. An ANOVA can also be used with the Levene's test of the homogeneity of variance to check for irregularities, such as skewness, in the data set which can affect the outcome of the multivariate analysis (Ribot, 2003). Levene's test assesses the homogeneity of the variance of the median and is thus a good reflection of the distribution of the values in the dataset (Ribot, 2003).

6.1.4.4. Multivariate Statistics

As the name suggests, multi-variate statistics involve the "simultaneous analysis of multiple variables" (Pietrusewsky 2000:377). These types of analyses allow for exploration of group differences and interrelationships among variables. For example, a particular skull has a series of measurements for a single individual. The multivariate statistic takes these single measurements from one individual and transforms them into a unit. These units are then plotted individually within the multivariate space. Within this space, each unit determines the range of variability for their particular population. Therefore, the variation within a population is observed not as a single mean or a centroid but as swarms of individual units within an individual population (Pietrusewsky, 2000). "The differentiation of these swarms from one another constitutes a statement of the degree and nature of the difference between the populations" (Howells, 1973:4).

As one can expect, multivariate statistical procedures need a relatively large sample size and a normal distribution of data. According to Pietrusewsky (2000), no clear definition of a "large" sample size has been determined but approximately 50 to 55 individuals of each sex have been proposed. However, these standards are not always maintained especially when dealing with archaeological samples that usually have a small sample size.

Discriminant function analysis

Discriminant analysis is a multivariate procedure that attempts to maximize differences between two populations (Pietrusewsky, 2000). The exaggeration of group means demonstrates relative morphological similarities between groups and identifies morphologically deviant groups or individuals (Morris, 1992). When more than two groups are being compared, it is known as a multiple discriminant function or canonical variate analysis. For this purpose, the multiple discriminant analysis (MDA) was used to measure the similarities and differences among the various groups in population 1 and 2. In order to use the discriminant function formulae, a larger sample size was needed. This was obtained by pooling the sexes. The differences in size and shape between males and females were accounted for by transforming the values for the cranial variables into Z-scores (Howells 1973, 1989).

Factor Analysis

In contrast to multiple discriminant analysis, which maximizes the differences between populations, factor analysis (or principal components analysis) looks for similarities between the various groups (Pietrusewsky, 2000). Since factor analysis compares all the measurements within a single sample, it does not require a full set of cranial or mandibular measurements from a single individual. Another advantage of factor analysis over multiple discriminant function analysis is that it deals with individuals and not groups of individuals. Therefore, factor analysis is useful for skeletal samples that are poorly preserved or small in size.

Factor analysis takes a set of correlated variables (e.g., cranial length, cranial breadth, basion-nasion length, and basion-bregma height) and by forming linear combinations of these observed variables converts them into sets of uncorrelated factors. A varimax method is then applied to rotate the factors. In rotating the factors, the number of variables with a high loading factor (a component score above 0.7) is minimized, which assists in simplifying the interpretation (Sokal and Rohlf, 1995).

Usually, the first and second factors explain most, if not all, of the variance but on occasion three factors may be involved. The smaller the number of factors necessary to explain the variance within the sample set, the more accurate the factor analysis. However, if the variance is explained by only one factor, then it is not a good factor analysis and is discarded. This is because there is not enough variance to be explained in two dimensions. Individual specimens can also be plotted between the two axes of a factor analysis (Pietrusewsky, 2000).

Scatterplots are useful to visualize the factor analyses within a multivariate space. Using a scatterplot, one can visualize the distribution of variation and the distribution of the various groups within this variation (Ribot, 2003).

To test for statistical significance with the factor analysis, a one-way ANOVA is used to analyze the regression factor scores. *Post hoc* multiple comparison tests, which include both the Scheffe and Tamhane tests, are selected to assess which of the independent variables (in this case, African populations) contribute most to the differences between the dependent variable (regression factor score). For example, given a particular regression factor score, the differences between the Venda and Riet River samples may be statistically significant but the differences between the Venda and the other groups may not be significant. To put it simply, the *post hoc* test localizes the differences and similarities between the independent and dependent variables in the ANOVA. When the homogeneity of variance is not met in the Levene's test, the Tamhane's test is used instead of the Scheffe's test. *Post hoc* multiple comparison tests cannot be performed when at least one of the independent variables (in this case African populations) has a sample size of two or less.

6.1.5. Results

The various cranial and mandibular measurements are provided in Table 6.1.3. Of the 96 individuals present, 45 were males and 51 females. Due to poor preservation of the remains, none of the individuals were complete, which reduced the sample size to between 6 and 34 individuals depending on the measurement.

6.1.5.1. ANOVA

The F-values for the 27 variables for population 1 (inter-regional groups) and population 2 (inter-ethnic groups) were ranked from highest to lowest and are shown in Table 6.1.4. On account of the small sample size for many of the groups (particularly the Venda), the sexes were pooled and the variables were standardized into Z-scores in order to compensate for size differences due to sexual dimorphism. A large F-value indicates a high amount of variation among the groups whereas a small F-value infers that little variation exists and that the groups are relatively the same. In multiple discriminant analyses and factor analyses, only the variables with the highest F-values are used.

The variables with the highest F-values in population 1 are basion-bregma height, nasion-prosthion height, orbital height, basion-prosthion height and nasal height, and for population 2 are basibregmatic height, cranial breadth, orbital height, maximum ramus height and palatal breadth. Although mandibular length had the highest F-value for both population 1 and 2, it was also significantly skewed as can be seen with the Levene's test of homogeneity. Among these particular populations, only mandibular length and interorbital breadth are skewed. In Table 6.1.4, for population 1, the variables that do not show statistically significant differences among the various populations are foramen magnum breadth, chin height, bigonial width, minimum ramus breadth, and maximum ramus breadth. In population 2, the non-significant variables are biauricular breadth, foramen magnum length, foramen magnum breadth, minimum ramus breadth, maximum ramus height and mandibular angle. Given the high levels of variability within the mandible, the absence of statistically significant differences among these variables was expected (Ribot, pers. comm.).

6.1.5.2. Discriminant function (canonical analysis)

Four discriminant function analyses were performed for population 1, and the results were inconclusive and difficult to interpret. There are two reasons for this outcome. Firstly, several of the comparative groups were excluded from the analysis due to small sample size, and secondly the larger groups such as those from East and South Africa were highly heterogenous. For this reason, the multiple discriminant analysis results from the more regional homogenous groups in population 2 were used.

Another four multiple discriminant functions were performed for population 2. Since preservation of the crania from Venda was poor, few variables had more than 50 values, which is the minimum number of values needed for calculation of a discriminant function. Therefore, all the variables, which included the vault, face and base, were used in Function I and II. In Function III and IV, only the vault and face were used. The mandibular measurements were excluded due to their high variability. The results showed that the best discrimination among the variables was found when the entire cranium (vault, face and base) was used (Ribot, pers. comm.).

In the second set of equations, discriminant function II was excluded because the results were not clearly interpretable. The eigenvalues for functions I, III and IV are shown in Table 6.1.5. The eigenvalue expressed the amount of differentiation between the various groups. A high eigenvalue indicates a large amount of differentiation whereas a small eigenvalue indicates a small amount. Usually, the first axis is represented by the variables that are most discriminatory between the various groups for that particular analysis. The multiple discriminant comparison of the Venda with South Africans, Bahutu and Riet River for dimensions from the vault, face and base are shown in Figures 6.1.2 – 6.1.4.

The most discriminating variables in Analysis I are cranial breadth and orbital height for Function 1 (54.7% explained variance) and frontal sagittal chord length and bi-zygomatic breadth for Function 2 (35% of explained variance). Overall classification for the original group was 71.5%, which changed to 67.5% when the results were cross-validated. Cross-validation was performed by using a 'leave-one-out' procedure. In this test, a single case is removed from the data set and the remaining cases are reclassified. This procedure is repeated for every case in the analysis. The purpose of this test is to assess the possible bias a single set of measurements may have on the classification results (Sokal and Rohlf, 1995).

The results of individual group classification accuracy for Analysis I can be seen in Table 6.1.6. In looking at the 'Venda' column, it can be seen that 45.5% of the Venda were classified as Venda, 0% were classified as Riet River or Bahutu and 45.5% were classified as South Africans.

Eighty-two percent of the South African and 70.5% of the Bahutu groups were classified correctly. These high classifications represent homogeneity within these populations, whereas low classification accuracy such as the Venda (45.5%) reflects heterogeneity (Pietrusewsky, 2000). In this analysis, the Venda were largely misclassified as South Africans (45.5%), with only nine being misclassified as Bahutu and none as Riet River (San (KhoiSan). The latter suggests a clear morphological difference, particularly in Function 1, between the Venda and Riet River with the former having a narrower cranium and higher orbits than the latter.

In Analysis III, basibregmatic height is the most discriminating variable in Function 1 and explains 72.6% of the variance. Function 2 explains only 19.6% of the variance with cranial breadth and upper facial height being the most discriminating variables. Classification for the groups was 70.7% and dropped to 67.9% after the results of cross validation. The accuracy of original individual group classifications for Analysis III can be seen in Table 6.1.7. Similar to Analysis I, the group that had the highest percentage of correct classification was the South African group (88.9%) and the group with the lowest percentage of correct classification was the Venda (33%). The Venda were primarily misclassified within the South Africa group (56.7%) with only two Venda individuals being misclassified as Bahutu and none of the Venda being misclassified as Riet River. Within this analysis, the Riet River sample appears morphologically distinct and exhibits a shorter basion-bregma height, wider parietal breadth and shorter nasion-prosthion length than either the Venda or South African groups.

The Nguni sample was removed from the South African black sample in Analysis IV. In this analysis, three variables, nasal height, basibregmatic height and cranial breadth, explained 75.6% of the variance on Function 1. Function 2 explains 21% of the variance with nasion-prosthion length being the most discriminating variable. Overall classification of the group was 61.3% and changed to 59.3% with cross validation. Accuracy for individual original group classification for Analysis IV can be seen in Table 6.1.8. The groups with the highest percentage of correct classification were South Africa (66.7%) and the Bahutu (68.3%). Within this analysis, 51.6% of the Venda were correctly classified, which is the highest classification accuracy for the Venda in the three multiple discriminate function analyses. However, the Venda were still predominantly misclassified into the South African population (45.2%) with only one individual misclassified as Bahutu and no individuals misclassified in Riet River.

From these three analyses, the following summary can be made:

- The Venda are most likely to be misclassified within the South African group.
- The Venda were never misclassified in the Riet River group.
- Morphologically, the Venda and South African populations have a higher facial height, orbital height, basion-bregma height and narrower cranial width than the Riet River sample.
- The Venda have a higher skull vault, larger nasal height and a narrower cranial width than the Bahutu sample.

6.1.5.3. Factor Analysis

A summary of the eigenvalues for factor analysis I – VI is shown in Table 6.1.9. For each analysis, metric variables from the skull vault and base (cranial length, cranial breadth, basibregmatic height and biauricular breadth) and from the face and skull vault (minimum frontal breadth, cranial base length, basion-prosthion length) were used. In Analysis I and IV, the sexes were pooled and Z-scores were calculated for the various variables. Analysis II & III and V & VI were calculated using males and females respectively, thus the Z-scores were not used. The cumulative percentage of variance explained for the six factors was relatively high and varied between 60-75%.

The variables with the highest loading (≥ 0.7) on the factor analyses I - III included basibregmatic height and basion-prosthion length on factor 1 and cranial breadth on factor 2, and upper facial height, nasal height and orbital height on factor 1 of analyses

IV – VI. Groups of interrelated variables were devised from the six factor analyses. These variables depict certain morphological features of the skull and include:

Analysis I: vault height and facial prognathism (factor 1) and vault breadth (factor 2) (Figure 6.1.5).

Analysis II: facial prognathism and vault length (factor 2) and vault height (factor 3) (Figure 6.1.6).

Analysis III: facial prognathism and vault height (factor 1) and vault breadth (factor 2) (Figure 6.1.7).

Analysis IV: vault height, vault length and nasal height (factor 1) and facial prognathism, nasal and orbital height (factor 2) (Figure 6.1.8).

Analysis V: facial, nasal and orbital height (factor 1) and vault length and forehead width (factor 2) (Figure 6.1.9).

Analysis VI: facial, nasal and orbital height (factor 1) and nasal breadth (factor 2**)** (Figure 6.1.10).

To test for statistical significance, the regression factor scores of each factor analysis were analyzed using a one-way ANOVA. The summary of this ANOVA is shown in Table 6.1.10. The F-test was highly significant for all cases except for factor 2 of Analysis II, III and VI.

Factor analysis I – VI can be visualized in the scatterplots presented in Figures 6.1.5-6.1.9. From scatterplots of Analysis I – Analysis III (Figures 6.1.5-6.1.7), the following morphological trends were discernable from the variables of the vault and face. These results are summarized below:

- In both Analysis I and Analysis III, A1722 and A1730 (K2) were plotted within the variability of the Venda, and suggest a similar morphology between these two individuals and this modern group.
- In Analysis I and Analysis III, the majority of the variability of the Venda can be plotted in the lower right quadrant, which indicates a high and narrow skull vault and distinct facial prognathism. The Bahutu and Maroelabult have a shorter and wider skull vault and less facial prognathism than the Venda.

From the scatterplot of Analysis IV to VI that are shown in Figures 6.1.8 – 6.1.10, which assessed variables predominantly from the face and the vault, the following morphological trends were observable and are summarized below:

- No statistically significant difference was observed between the Venda and South African samples. These two groups had a longer and higher cranial vault, higher orbits, taller facial height and wider nasal breadth than either the Bahutu or San (KhoiSan).

- K2 (A1715 and A1722) are morphologically more similar to Venda and South African groups than to either East African (Bahutu) or San (KhoiSan) (Riet River) samples.

An independent t-test was performed on the regression factor scores to assess the relationship between each of these groups and the Venda more closely. The results of this independent t-test are shown in Table 6.1.11. All six comparisons between Riet River and Venda, and eight of the twelve comparisons between Bahutu and Venda were statistically significant. No statistically significant difference was noted between Venda and the South African group or K2. However, the K2 sample is quite small, which renders the results obtained between K2 and the other groups relatively meaningless. From this evidence, it can be suggested that the Venda are most similar to South African populations (including Maroelabult) and most dissimilar from Riet River (San (KhoiSan)) and Bahutu (East Africa).

6.1.6 Discussion

The purpose of this section was to compare the cranial morphology found within the Venda with East and South African populations. Through the various univariate and multivariate analyses, similarities and differences between the various groups were evident. This discussion is divided into two sections. First, the cranial morphology of the Venda is presented and compared with other African populations. Second, the possible relationship between the Venda and K2 is evaluated.

6.1.6.1. Relationship between the Venda and other African groups

The most distinct cranial features within the Venda population were found in the vault and face. As has been seen in previous studies, the vault and face are usually the most morphologically diagnostic features within sub-Saharan African populations (Ribot, 2002). The narrow cranial vault and high orbits, tall basibregmatic height and long nasal length of the Venda population were similar to the general South African group but contrasted with those of the Bahutu and San (KhoiSan) in which the cranial vault was wide and the orbits, basion-bregma height and nasal length were short.

In three multiple discriminant analyses (Figures 6.1.2 – 6.1.4), 45-60% of the Venda were misclassified within the South African group, which is nearly as much as they were classified within their own group (45%-52%). The percentage of misclassification of the Venda was much less in the Bahutu (0-3.2%) and Riet River (0%) groups. From these results, three conclusions can be proposed. Firstly, the Venda are quite similar in morphology to South African populations. Secondly, the Venda are a heterogeneous group such that they are misclassified as South African nearly as often as they are correctly classified as Venda. Thirdly, the Venda are quite dissimilar in appearance from both Bahutu (East African) and San (KhoiSan) (Riet River) populations.

In her study of the cranial morphology of the South African Negro, De Villiers (1968) proposed that the various tribes in South Africa, which are culturally and linguistically distinct, were quite similar in cranial morphology. On account of these results, she concluded that all South African tribes could be classified as belonging to the general category of South African Negroids. Although De Villiers (1968) suggested that the Venda might be more biologically homogenous than other South African groups, her conclusions were tentative due to the small sample size of known Venda skulls in the Raymond A. Dart collection. In this study, the high amount of homogeneity between the Venda and South African groups clearly shows that the Venda are morphologically similar to South African Negroids and should be considered to belong to this group. However, the heterogeneity found in the Venda crania suggests that they may share a genetic relationship with a population that was not used as a comparative group in this study.

The dissimilarity between the San (KhoiSan) and Bahutu populations implies less genetic similarity between these groups and the Venda, than between the Venda and South African Negroid populations. Rightmire (1970a), with the use of multiple discriminant analysis, noted distinct differences in the face and cranial morphology of San (KhoiSan) and South African Negro populations and suggested that the former population should not be subsumed under the latter. If it is accepted that the Venda are included within the South African Negroid group as has been proposed, then the dissimilarity between the Venda and the San (KhoiSan) groups is easily understood.

The similarities observed between the Venda and South African Negroids are supportive of the theory by Loubser (1989, 1990) for local development of the Venda within the Soutpansberg Mountains. Since the rise of the Mapungubwe complex, the involvement in trade networks with the East Coast was an important economic commodity for the Shona. Around A.D. 1450, several Shona groups (most likely chiefs) began to move aggressively across the Limpopo River in search of small, easily controllable trade networks with the coast (Mitchell, 2002). In doing so, they may have interacted extensively with the Sotho-Tswana populations. These interactions have been noted in the blending of pottery styles between these two groups (Loubser, 1989; Huffman, 1996). Furthermore, the unique culture and language of the Venda have been attributed to an amalgamation of these two populations (Shona and Sotho-Tswana) (Huffman, 1996; Mitchell, 2002). Huffman (1996) has also observed cultural and religious similarities between the Venda and the Shona such as Domba (girls initiation school) and the symbolic system of sacred leadership, which is best represented in the stylistic construction of the stone walls at Dzata, in Venda, and the modern day spatial layout of the Venda villages.

In summary, the archaeological, ethnographic and craniometric evidence is more supportive of a regional theory of development for the people of Venda than the direct migration theory from East Africa as proposed by Stayt (1931) and Wilson (1969). The morphological dissimilarity between the Venda and East African populations (Bahutu) also lends further credence to a theory of local origins.

The biological evidence alone, however, cannot prove or disprove the migration of the Venda from East Africa due to the lengthy time depth (600 years) since the supposed exodus of the Venda from the North. According to Ribot (2002), the East African region is quite diverse, which would make it difficult to ascertain the ancestral population of the Venda due to the large amount of admixture that has occurred in both populations over time. It is clear that the Venda are dissimilar from the homogenous, Bahutu population, but this does not necessarily mean that they are dissimilar from all East African groups. Since ethnographic and archaeological evidence have implied a genetic relationship between the Venda and Shona populations, it would be of interest to examine the similarities and dissimilarities in cranial morphology between these two groups. In all, questions remain with regard to the ancestral origins of the Venda and future research in this area is needed.

6.1.6.2. Relationship between the Venda and K2

Factor analysis, a multivariate statistical method used for comparing small sample sizes, was used to assess the relationship between the Iron Age population of K2 and the Venda. However, the sample of well-preserved adult crania from K2 was quite small (only three individuals, one male and two females). This small sample size has been attributed to an overabundance of juveniles excavated from the middens at K2 and the poor preservation of adult crania from both K2 and Mapungubwe Hill (Steyn, 1994). Similarly, the preservation of crania from the excavations in Venda was poor. Thus, due to small sample size, poor preservation, and unknown population variation from both skeletal samples, only general interpretations can be made.

In separate craniometric studies both Rightmire (1970a) and De Villiers (1979) concluded that the skeletal remains (adult and juveniles) from K2 and Mapungubwe should be classified as South African Negroids. In this study, the three K2 individuals (A1715, A1722 and A1730) fell consistently within the range for both the Venda and South African groups in analysis IV and VI (Figures 6.1.8 and 6.1.10). The last individual from K2 (A1715) did not have enough variables to warrant use in the factor analyses. In Analysis I and III (Figures 6.1.5 and 6.1.7), A1730 is completely within the range of variation for the Venda but A1722 falls within the variation of the three population groups (Bahutu, Maroelabult and Venda).

As mentioned earlier, little morphological difference was observed between the Venda and South African groups, such that the Venda can be broadly considered South African Negroids. With this in mind, it is logical to assume that K2, which falls within the range of variation for the Venda and Southern Africans, can also fall into the broad variation for South African Negroids. However, a direct ancestral link between K2 and the Venda cannot be established due to small sample size and the inability to distinguish the Venda from the general Southern African group.

In conclusion, the distinct language, social structure and ritual practices of the Venda make them the most enigmatic of all the sub-Saharan African tribes (Mitchell, 2002). The cultural and linguistic uniqueness of the Venda from other South African groups has lead to the assumption that they were also biologically different and thus descended from "foreign stock" (Stayt, 1931; Wilson, 1969). In this study, the biological similarities of the Venda and K2 with South African Bantu-speaking populations suggest that the Venda and K2 may be both related to South African Bantu-speaking groups. This conclusion supports earlier work by De Villiers (1968) and Jacobson (1982) who noted a morphological similarity among the various Southern African tribes.

Table 6.1.1. Summary of categorical variables for population 1 and 2

Population 1	N	Ethnic groups
East Africa	282	Bahutu, Tutsi
Horn of East Afric	177	Teita, Haya
South Africa	125	Sotho-Tswana, Nguni
KhoiSan	116	KhoiSan
Mozambique	24	-
Venda	97	Venda
Population 2	N	Regional affliation
Bahutu	103	Eastern Africa
Venda	97	Southern Africa
Riet River	116	Southern Africa
Maroelabult	7	Southern Africa
K2/Mapungubwe	4	Southern Africa

Table 6.1.2.Metric variables used from the cranium and mandible*

Location	Variable	Abbreviations Martin & Saller (1957)
Vault		
	Cranial length (g - op)	1
	Cranial breadth (eu - eu)	8
	Minimum frontal breadth (ft - ft)	9
	Frontal chord (n - b)	29
	Parietal chord (b - l)	30
	Basibregmatic height (ba - b)	17
Face	Bizygomatic breadth (zy - zy)	45
	Cranial base length (b - n)	5
	Basion-prosthion length (b - pr)	40
	Palatal breadth (ekm - ekm)	63
	Upper facial height (n - pr)	48
	Bifrontal breadth (fmt - fmt)	43
	Nasal height (n - ns)	55
	Nasal breadth (al - al)	54
	Orbital height (obh, distance btw. superior and inferior orbital margins)	52
	Interorbital breadth (da - da)	49a
Base		
	Biauricular breadth (au - au)	11
	Foramen magnum length (ba - o)	7
	Foramen magnum breadth (fob, btw. lateral margins of foramen magnum)	16
Mandible[1]		
	Chin height (in - gn)	69
	Bigonial width (go - go)	66
	Bicondylar breadth (kdl - kdl)	65
	Minimum ramus breadth	71a
	Maximum ramus breadth	71
	Maximum ramus height	70
	Mandibular length	68(1)
	Mandibular angle	79

* Table format borrowed from Ribot (2003)

Table 6.1.3. Descriptive statistics of metric variables from the cranium and mandible

		Male (n = 45)			Female (n = 51)		
Location	Variable	N	Mean	sd*	N	Mean	sd*
Face							
	Bizygomatic breadth (zy-zy)	6	123.8	5.7	7	122.5	5.8
	Cranial base length (b - n)	21	103.6	6.4	20	99.4	5.6
	Basion-prosthion length (b - pr)	20	102.9	5.7	18	100.2	5.8
	Palatal breadth (ekm - ekm)	19	63.8	3.3	19	59.6	4.2
	Upper facial height (n - pr)	23	64.6	7.5	24	65.0	4.5
	Upper facial breadth (fmt - fmt)	16	105.8	4.1	18	102.2	4.8
	Nasal height (n - ns)	24	49.6	3.2	24	47.5	4.9
	Nasal breadth (al - al)	24	28.2	1.5	25	27.2	3.4
	Orbital height (obh)	23	36.1	3.0	22	35.4	2.1
	Interorbital breadth (da - da)	24	25.6	3.0	22	25.3	2.8
Vault							
	Cranial length (g - op)	24	183.9	6.5	26	180.1	7.2
	Cranial breadth (eu - eu)	23	123.0	5.3	25	125.2	5.7
	Basion-bregma (ba - b)	21	135.1	7.5	21	130.1	6.0
	Minimum frontal breadth (ft - ft`	20	96.9	5.3	22	95.8	3.6
	Frontal sagittal chord (n - b)	21	112.3	5.4	25	111.0	6.1
	Parietal sagittal chord (b - l)	21	118.5	8.4	24	114.6	6.7
Base							
	Biauricular breadth (au - au)	19	117.5	5.1	21	112.2	5.4
	Foramen magnum length (ba - o	20	37.3	2.2	19	37.4	3.0
	Foramen magnum breadth (fob)	18	29.3	3.3	19	29.1	2.4
Mandible							
	Chin height (in - gn)	32	32.0	3.6	33	32.0	4.6
	Bigonial diameter (go - go)	20	94.3	7.9	20	88.7	3.9
	Bicondylar breadth (kdl - kdl)	11	117.1	10.1	14	112.0	5.7
	Minimum ramus breath	34	36.0	2.7	33	33.2	3.2
	Maximum ramus breath	25	44.6	3.2	25	41.3	5.2
	Maximum ramus height	22	60.1	8.0	20	54.6	10.7
	Mandibular length	24	88.0	10.6	25	78.4	7.4
	Mandibular angle	14	118.8	5.7	16	126.5	6.8

* standard deviation

Table 6.1.4a. One way analyses of variance for testing group differences on individual variables*

POP 1 Variables [1]	N	F	Sig.[2]	L.[3]	Groups compared[4]
Basibregmatic height (ba - b)	1047	70.86	***	NS	EA,HEA, MOZ, V, SA, K
Upper facial height (n - pr)	980	60.448	***	NS	EA, HEA, MOZ, V, SA, K
Orbital height (obh)	1048	57.24	***	NS	EA, HEA, MOZ, V, SA, K
Basion - prosthion length (b - pr)	908	54.52	***	NS	EA,HEA,V,SA,K
Nasal height (n - ns)	631	52.28	***	NS	EA,HEA, V,SA,K
Mandibular length	175	49.58	***	xxx	V, SA, K
Cranial base length (b - n)	997	45.52	***	NS	EA,HEA, MOZ, V, SA, K
Bizygomatic breadth (zy - zy)	808	35.27	***	NS	EA, HEA, MOZ,SA,K
Cranial breadth (eu - eu)	1130	31.87	***	NS	EA,HEA, MOZ, V, SA, K
Max. ramus height	168	29.07	***	NS	V, SA, K
Nasal breadth (al - al)	1044	28.6	***	NS	EA,HEA, MOZ, V, SA, K
Interorbital breadth (da - da)	822	28.51	***	x	EA,HEA, MOZ, V, SA, K
Frontal chord (n - b)	665	21.83	***	NS	EA, HEA, V, SA, K
Cranial length (g - op)	1137	20.39	**		
Parietal chord (b - l)	675	14.526	***	NS	EA, HEA, V, SA, K
Min. frontal breadth (ft - ft)	837	14.52	***	NS	EA,HEA, MOZ, V, SA, K
Palatal breadth (ekm - ekm)	645	13.66	***	NS	EA,HEA, MOZ, V, SA, K
Upper facial breadth (fmt - fmt)	148	13.23	***	NS	V, SA, K
Chin height (in - gn)	237	10.42	***	NS	V, SA, K
Bigonial width (go - go)	284	6.21	***	NS	EA, V, SA, K
Biauricular breadth (au - au)	242	6.06	**	NS	EA, HEA, V, K, MOZ
Mandibular angle	174	4.92	**	NS	HEA, V, SA, K
Foramen magnum length (ba - o)	788	4.39	**	NS	EA,HEA, MOZ, V, SA, K
Max. ramus breadth	72	1.51	NS	NS	V, SA
Min. ramus breadth	253	1.43	NS	NS	SA, V, K
Foramen magnum breadth (fob)	709	0.94	NS	NS	EA,HEA, MOZ, V, SA, K
Bicondylar breadth (kdl - kdl)	-	-	-	-	-

[1] - Z-scores used

[2] - Level of significance: p <0.05*, p < 0.01**, p < 0.001***, ns = not significant

[3] - Levene's test of homogeneity of variance

[4] - Groups selected for population 1 (n >/= 20) : EA = East Africa, HEA = Horn of East Africa, MOZ = Mozambique, SA = South Africa, V = Venda, K = Khoisan

* Table format borrowed from Ribot (2003)

Table 6.1.4b. One way analyses of variance for testing group differences on individual variables*

POP 2 Variables [1]	N	F	Sig. [2]	L. [3]	Groups compared [4]
Mandibular length	149	136.16	***	xx	V, R, SA
Basibregmatic height (ba - b)	403	45.74	***	NS	V, R, B, SA
Cranial breadth (eu - eu)	428	42.73	***	NS	V, R, B, SA
Orbital height (obh)	404	30.03	***	NS	V, R, B, SA
Max. ramus height	143	28.92	***	NS	V, R, SA
Palatal breadth (ekm - ekm)	293	19.96	***	NS	V, R, B, SA
Nasal breadth (al - al)	414	18.74	***	NS	V, R, B, SA
Frontal chord (n - b)	241	18.38	***	NS	V, R, B, SA
Nasal height (n - ns)	318	17.62	***	NS	V, R, B, SA
Cranial base length (b - n)	404	15.44	***	NS	V, R, B, SA
Interorbital breadth (da - da)	415	15.3	***	NS	V, R, B, SA
Basion - prosthion length (b - pr)	382	13.84	***	NS	V, R, B, SA
Parietal chord (b - l)	241	13.41	***	NS	V, R, B, SA
Upper facial height (n - pr)	400	12.7	***	NS	V, R, B, SA
Min. frontal breadth (ft - ft)	322	10.69	***	NS	V, R, B, SA
Chin height (in - gn)	191	8.95	***	NS	V, R, SA
Upper facial breadth (fmt - fmt)	116	8.27	**	NS	V, B
Bizygomatic breadth (zy - zy)	303	6.98	**	NS	R, SA, B
Bigonial width (go-go)	168	6.01	**	NS	R, SA, V
Cranial length (g - op)	434	5.32	**	NS	V, R, B, SA
Bicondylar breadth (kdl - kdl)	149	4.8	**	NS	V, R, SA
Biauricular breadth (au - au)	117	3.11	NS	NS	V, B
Foramen magnum length (ba - o)	296	2.24	NS	NS	V, R, B, SA
Foramen magnum breadth (fob)	290	1.32	NS	NS	V, R, B, SA
Min. ramus breadth	203	0.89	NS	NS	V, R, SA
Mandibular angle	147	0.44	NS	NS	V, R, SA
Max. ramus breadth	-	-	-	-	-

[1] - Z-scores used

[2] - Level of significance: p <0.05*, p < 0.01**, p < 0.001***, ns = not significant

[3] - Levene's test of homogeneity of variance

[4] - Groups selected for population 2 (n >/= 20): V = Venda, R = Riet River, B = Bahutu, SA = South Africa

* Table format borrowed from Ribot (2003)

Table 6.1.5. Eigenvalues for analysis I, III and IV for the discriminant axes of population 2*[1]

	Axis 1		Axis 2		Axis 3	
Analysis I	Value	%	Value	%	Value	%
n = 136						
Vault, Face, Base[a]	0.986	54.7	0.631	35.0	0.187	10.4
Range: 67.4-71.5%						
Analysis III	0.756	72.6	0.204	19.6	0.082	7.8
n = 286						
Vault and Face[b]						
Range: 67.9-70.7%						
Analysis IV	0.708	75.6	0.197	21.0	0.032	3.4
Vault and Face						
Excluding Coastal						
Nguni						
Range: 59.3-61.3%						

* = Venda, Bahutu, South Africa and Riet River

1 = table format borrowed from Ribot (2003)

a = cranial length, cranial breadth, bizygomatic breadth, basibregmatic height, cranial base length, basion-prosthion length, palatal breadth, upper facial height, minimum frontal breadth, nasal height, nasal breadth, orbital height, interorbital breadth, frontal chord, parietal cord, foramen magnum length, foramen magnum breadth.

b = cranial length, cranial breadth, basibregmatic height, cranial base length, basion - prosthion length, upper facial height, nasal height, nasal breadth.

Table 6.1.6. Classification results: predicted group membership for MDA 1*

	Venda		Riet River		Bahutu		South Africa		Total
	n	%	n	%	n	%	n	%	
Venda	5	45.5	0	0.0	1	9.1	5	45.5	11
Riet River	0	0.0	17	60.7	2	7.1	9	32.1	28
Bahutu	0	0.0	2	4.5	31	70.5	11	25.0	44
South Africa	2	3.3	3	4.9	6	9.8	50	82.0	61

* 71.5% of original group classified correctly

Table 6.1.7. Classification results: predicted group membership for MDA 3*

	Venda		Riet River		Bahutu		South Africa		Total
	n	%	n	%	n	%	n	%	
Venda	10	33.3	0	0.0	2	6.7	18	60.0	30
Riet River	0	0.0	17	44.7	7	18.4	14	36.8	38
Bahutu	0	0.0	5	8.3	34	56.7	21	35.0	60
South Africa	4	5.3	7	4.3	7	4.3	144	88.9	162

* 70.7% of original group classified correctly

Table 6.1.8. Classification results: predicted group membership for MDA 4*

	Venda		Riet River		Bahutu		South Africa		Total
	n	%	n	%	n	%	n	%	
Venda	16	51.6	0	0.0	1	3.2	14	45.2	31
Riet River	0	0.0	18	47.4	8	21.1	12	31.6	38
Bahutu	0	0.0	5	8.3	41	68.3	14	23.3	60
South Africa	4	5.3	7	9.3	14	18.7	15	66.7	75

* 61.3% of original group classified correctly

Table 6.1.9. Summary of eigenvalues for Factor Analysis I - VI for population 2[1]

	Factor 1	Factor 2	Factor 3	% of variance	factors extracted	factor loading after varimax rotation		% of variance*	
								factor 1	factor 2
Analysis I[a]	3.157 (45.1%)	1.489 (21.3%)	-	66.37%	2	factor 1	factor 2		
Vault (face)					Cranial length	0.563	0.61		
n = 101					Cranial breadth	-.137	0.86		75%
					Basibregmatic height	0.797	0.100	63%	
					Biauricular breadth	0.236	0.752		57%
					Min. frontal breadth	0.190	0.657		
					Cranial base length	0.911	0.138	83%	
					Basion - prosthion length	0.778	0.104	60%	
Analysis II[a]	2.235 (31.9%)	1.845 (26.3%)	1.179 (16.8%)	75.12%	2	factor 2	factor 3	factor 2	factor 3
Vault (face)					Cranial length	0.679	0.0046	55%	
Male					Cranial breadth	0.190	-.553		
n = 42					Basibregmatic height	0.0099	0.901		82%
					Biauricular breadth	0.0026	-0.056		
					Min. frontal breadth	-0.015	0.273		
					Cranial base length	0.678	0.64		
					Basion - prosthion length	0.913	0.001	82%	
Analysis III[a]	3.140 (44.9%)	1.492 (21.3%)	-	66.16%	2	factor 1	factor 2	factor 1	factor 2
Vault (face)					Cranial length	0.553	0.646		
Female					Cranial breadth	-0.85	0.892		80%
n = 52					Basibregmatic height	0.821	0.145	67%	
					Biauricular breadth	0.228	0.671		
					Min. frontal breadth	0.101	0.618		
					Cranial base length	0.865	0.207	75%	
					Basion - prosthion length	0.853	0.003	73%	

Table 6.1.9. Cont.

	Factor 1	Factor 2	Factor 3	% of variance	factors extracted	factor loading after varimax rotation			% of variance* factor 1	factor 2
Analysis IV[b]	3.29 (46.9%)	1.18(16.86%)		63.80%	2					
Face (vault)						Cranial length	0.791	0.283	60%	
n =187						Min. frontal breadth	0.697	0.150		
						Basibregmatic height	0.681	0.213	50%	
						Upper facial breadth	0.286	0.855		76%
						Orbital height	0.001	0.797		62%
						Nasal breadth	0.683	0.004	52%	
						Nasal height	0.358	0.837		73%
Analysis V[b]	2.98 (42.6%)	1.26 (17.9%)		60.50%	2					
Face (vault)						Cranial length	0.275	0.792	60%	59%
Male						Min. frontal breadth	0.009	0.723		50%
n =86						Basibregmatic height	0.161	0.598	50%	
						Upper facial breadth	0.904	0.165		
						Orbital height	0.729	0.006		
						Nasal breadth	0.005	0.626	52%	
						Nasal height	0.873	0.286		
Analysis VI[b]	3.06 (43.8%)	1.17 (16.7%)		60.43%	2					
Face (vault)						Cranial length	0.279	0.692		
Female						Min. frontal breadth	0.268	0.556		
n = 93						Basibregmatic height	0.157	0.686		
						Upper facial breadth	0.835	0.266	70%	
						Orbital height	0.839	0.001	70%	
						Nasal breadth	-0.025	0.726		63%
						Nasal height	0.832	0.325	65%	

1= Table format borrowed from Ribot (2003)

[a] = Bahutu, Maroelabult, Venda

[b] = Bahutu, Venda, South Africa, Riet River

* = the percentage of variance accounted on each factor is obtained by squaring the correlation coefficient (or factor loading) for the variables that have the highest factor loadings (>0.07) (Ribot 2003:9)

Table 6.1.10 One way analyses of variance: testing group differences on the regression factor scores[1]

Analysis	Factor	N	F	Sig.[a]	L[b]	Groups compared
I	1		7.085	***	NS	Bahutu, Maroelabult and Venda
	2	105	4.096	**	NS	
II	2		0.811	NS	NS	Bahutu, Maroelabult and Venda
	3	45	9.241	***	NS	
III	1		4.169	**	NS	Bahutu, Maroelabult and Venda
	2	52	1.789	NS	NS	
IV	1		4.726	***	*	Bahutu, Venda, Riet River, South Africa, K2
	2	206	10.321	***	NS	
V	1		4.769	**	NS	Bahutu, Venda, Riet River, South Africa, K2
	2	96	6.413	***	NS	
VI	1		7.284	***	NS	Bahutu, Venda, Riet River, South Africa, K2
	2	101	2.096	NS	NS	

a = level of significance * = 0.05, ** = 0.01, *** = 0.001

b = Levenes test for the homogeniety of variance

1 = Table format borrowed from Ribot (2003)

Table 6.1.11. Independent sample t-tests on regression factor scores between Venda and each other group

	Analysis I				**Analysis II**				**Analysis III**			
	Factor 1		Factor 2		Factor 2		Factor 3		Factor 1		Factor 2	
	t	sig[a]	t	sig[a]	t	sig[a]	t	sig[a]	t	sig[a]	t	sig[a]
Riet River	-	-	-	-	-	-	-	-	-	-	-	-
Bahutu	5.228	***	-4.399	***	-.425	ns	5.445	***	3.206	**	-2.732	**
SA Negroids	-	-	-	-	-	-	-	-	-	-	-	-
Maroelabult	1.796	ns	-2.713	**	-1.762	ns	1.01	ns	2.855	**	-1.206	ns
K2	-.442	ns	0.08	ns	-	-	-	-	-.819	ns	-.323	ns

	Analysis IV				**Analysis V**				**Analysis VI**			
	Factor 1		Factor 2		Factor 1		Factor 2		Factor 1		Factor 2	
	t	sig[a]	t	sig[a]	t	sig[a]	t	sig[a]	t	sig[a]	t	sig[a]
Riet River	3.124	**	5.062	***	2.674	**	2.874	**	4.433	***	2.587	**
Bahutu	3.772	***	-.563	ns	-1.124	ns	2.694	**	-.340	ns	3.031	**
SA Negroids	0.183	ns	1.679	ns	0.809	ns	-.428	ns	1.459	ns	1.556	ns
Maroelabult	-	-	-	-	-	-	-	-	-	-	-	-
K2	0.31	ns	1.446	ns	-	-	-	-	0.594	ns	-.287	ns

a = level of significance p = 0.05*, p = 0.01**, p = 0.001***

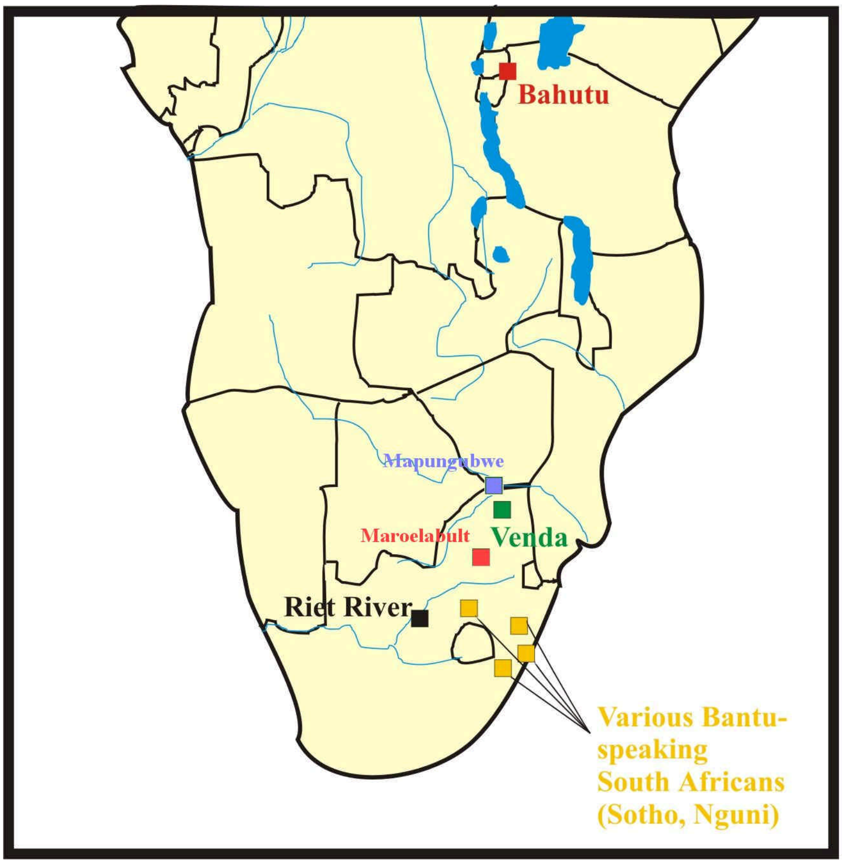


Figure. 6.1.1. Map of comparative samples

Analysis 1

Variables entered: Cranial length, cranial breadth, bizygomatic breadth, basibregmatic height, cranial base length, basion-prosthion length, palatal breadth, upper facial height, minimum frontal breadth, nasal height, nasal breadth, orbital height, interorbital breadth, frontal chord, parietal chord, foramen magnum length, foramen magnum breadth

N=136

67.4-71.5%

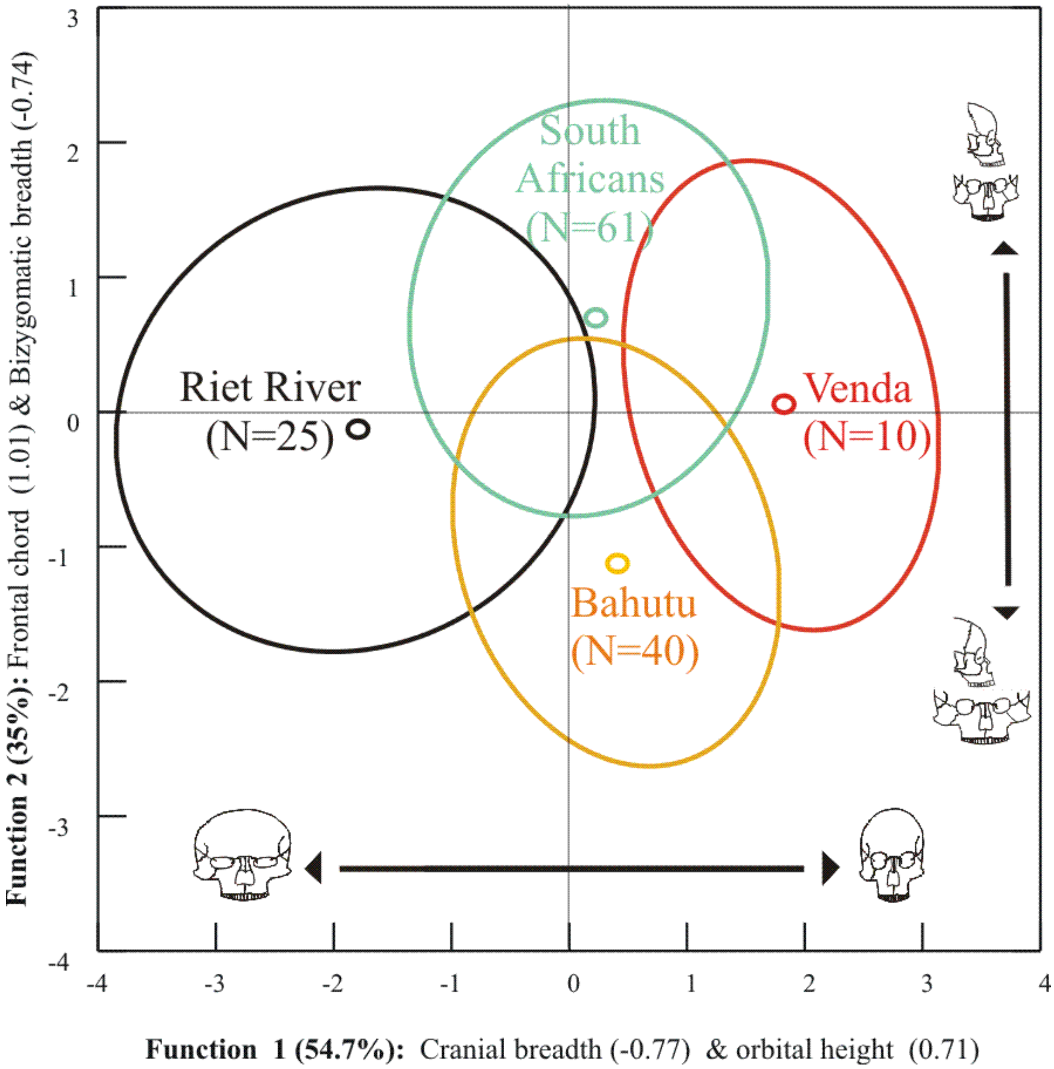


Figure 6.1.2. Scatterplot of MDA I

Analysis 3

Variables entered: Cranial length, cranial breadth, basibregmatic height, cranial base length, basion-prosthion length, upper facial height, nasal height, nasal breadth

N=286

67.9-70.7%

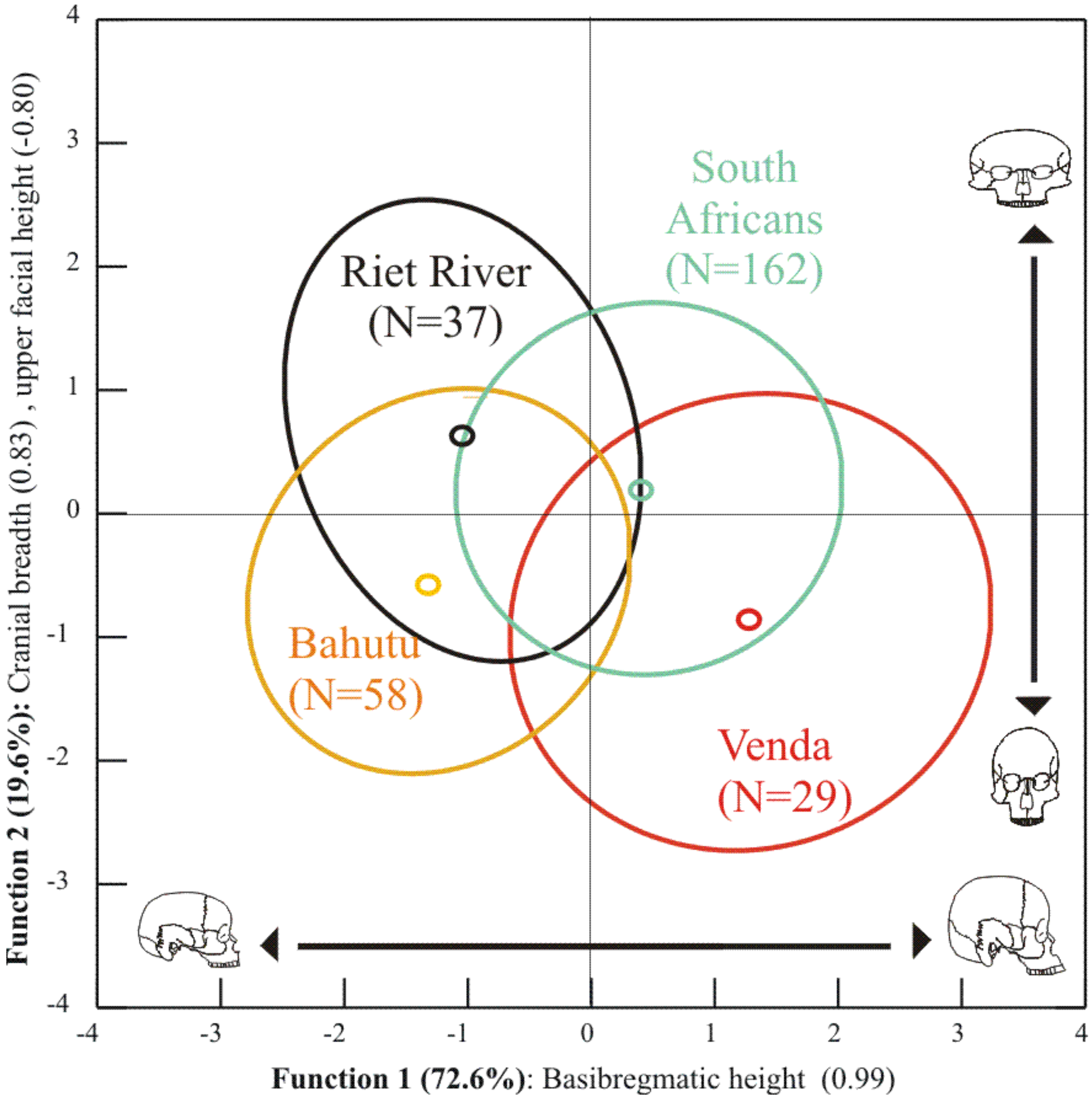


Figure 6.1.3. Scatterplot of analysis III of MDA

Analysis 4
Variables entered: Cranial length, cranial breadth, basibregmatic height, cranial base length, basion-prosthion length, upper facial height, nasal height, nasal breadth
N=199
59.3-61.3%

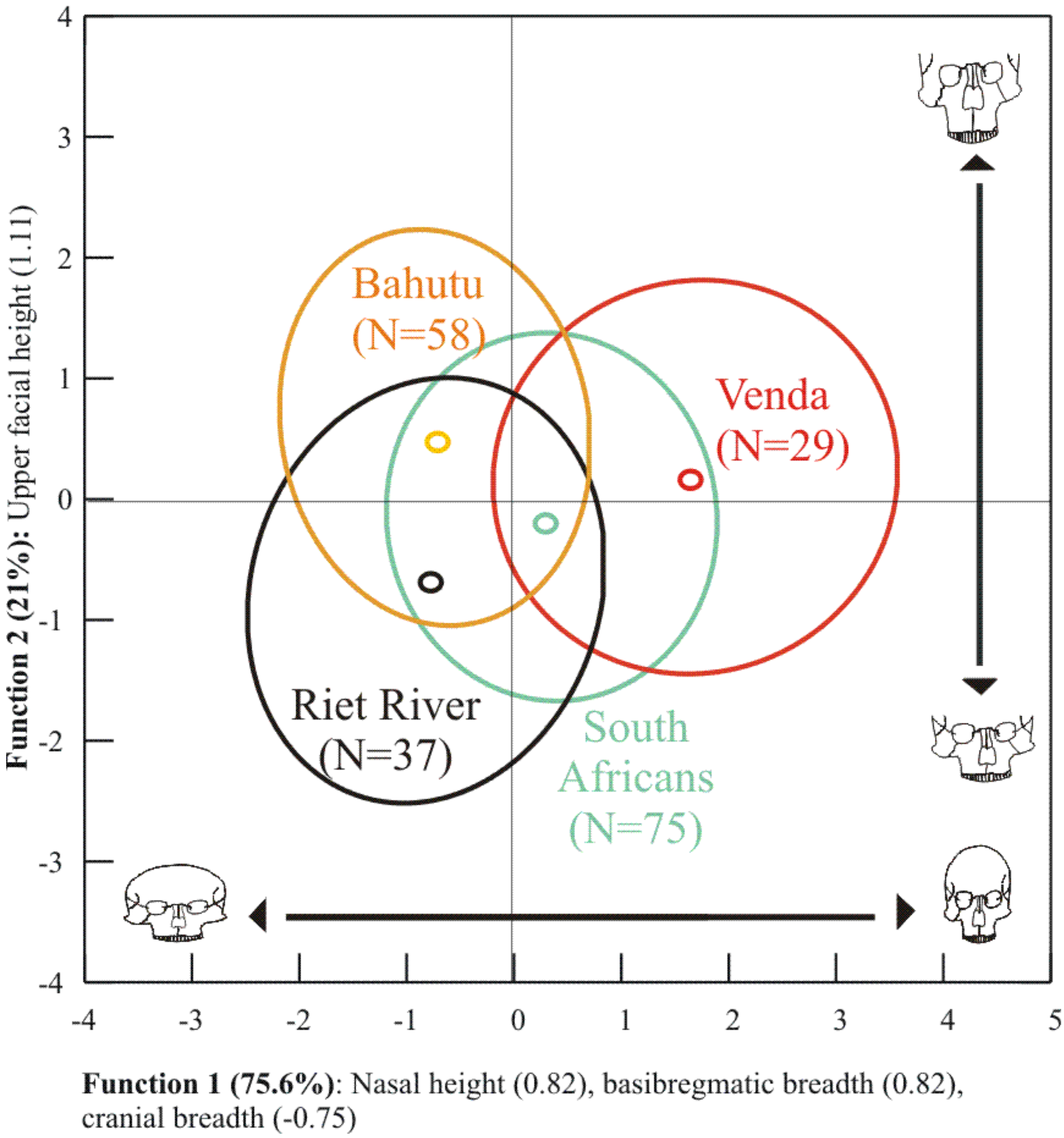


Figure 6.1.4. Scatterplot of analysis IV of MDA

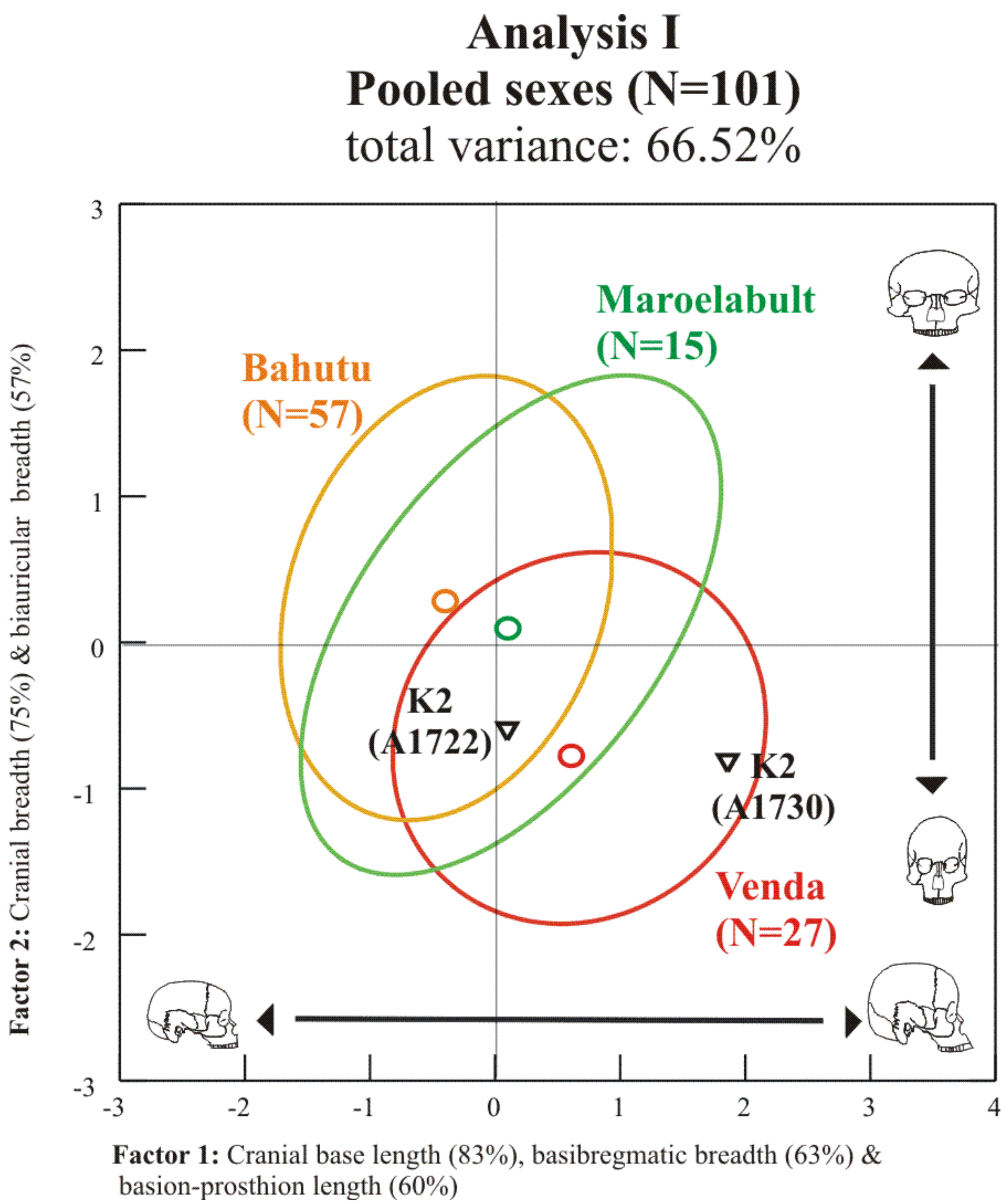


Figure 6.1.5. Scatterplot of factor analysis I: Vault (Face)

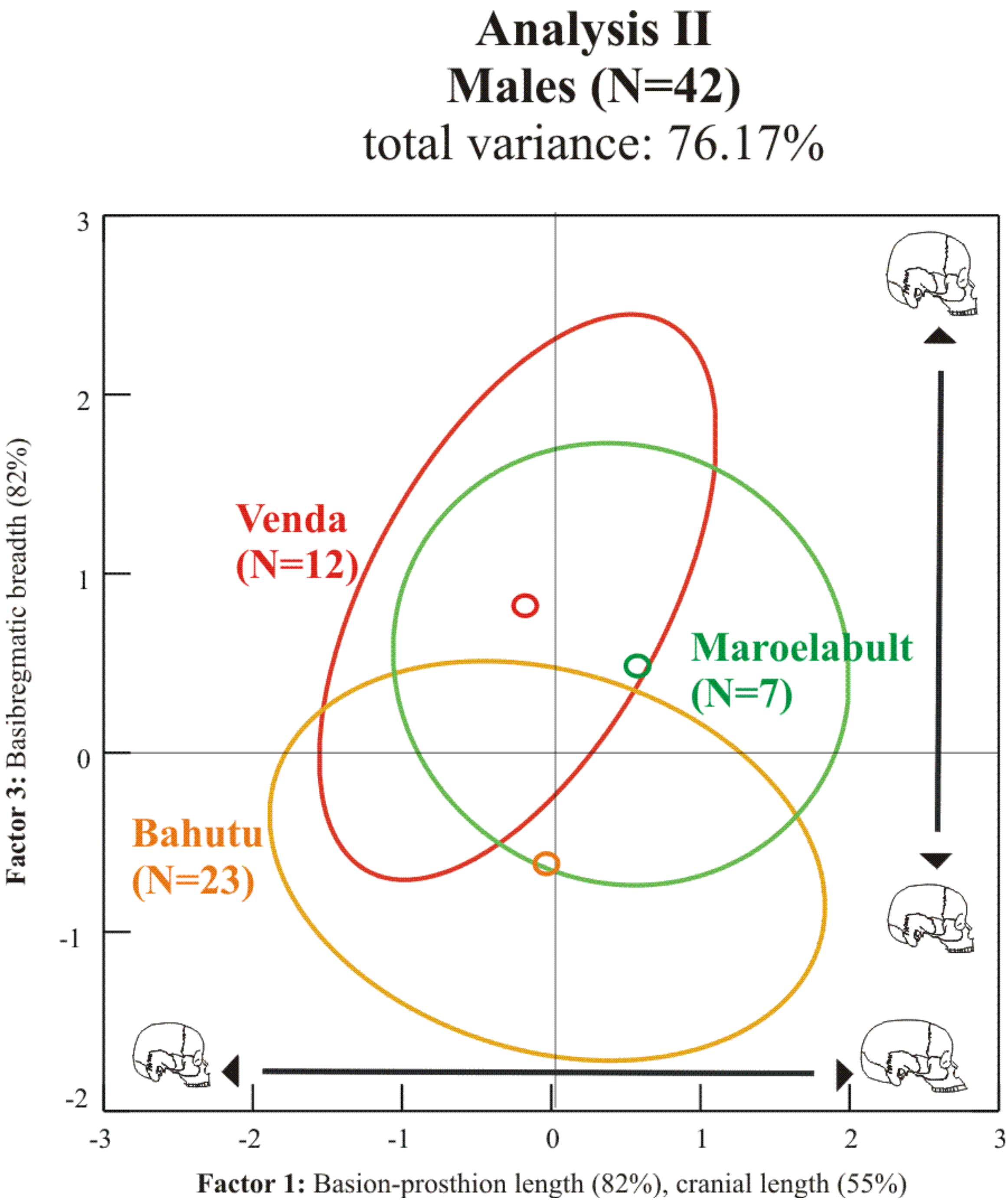
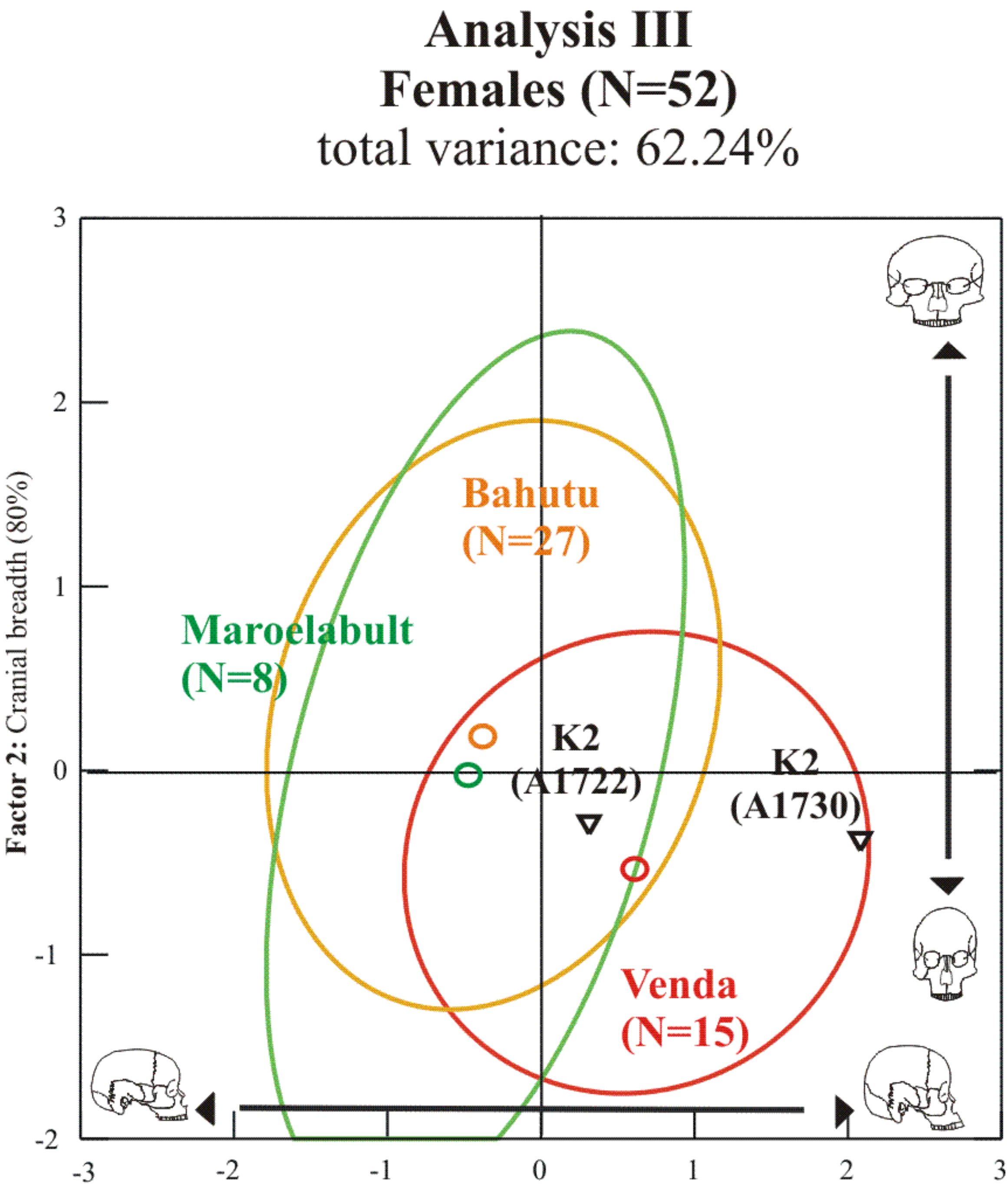


Figure 6.1.6. Scatterplot of factor analysis II: Vault (Face)



Factor 1: Cranial base length (75%), basion-prosthion length (73%), basibregmatic height (67%)

Figure 6.1.7. Scatterplot of factor analysis III: Vault (Face)

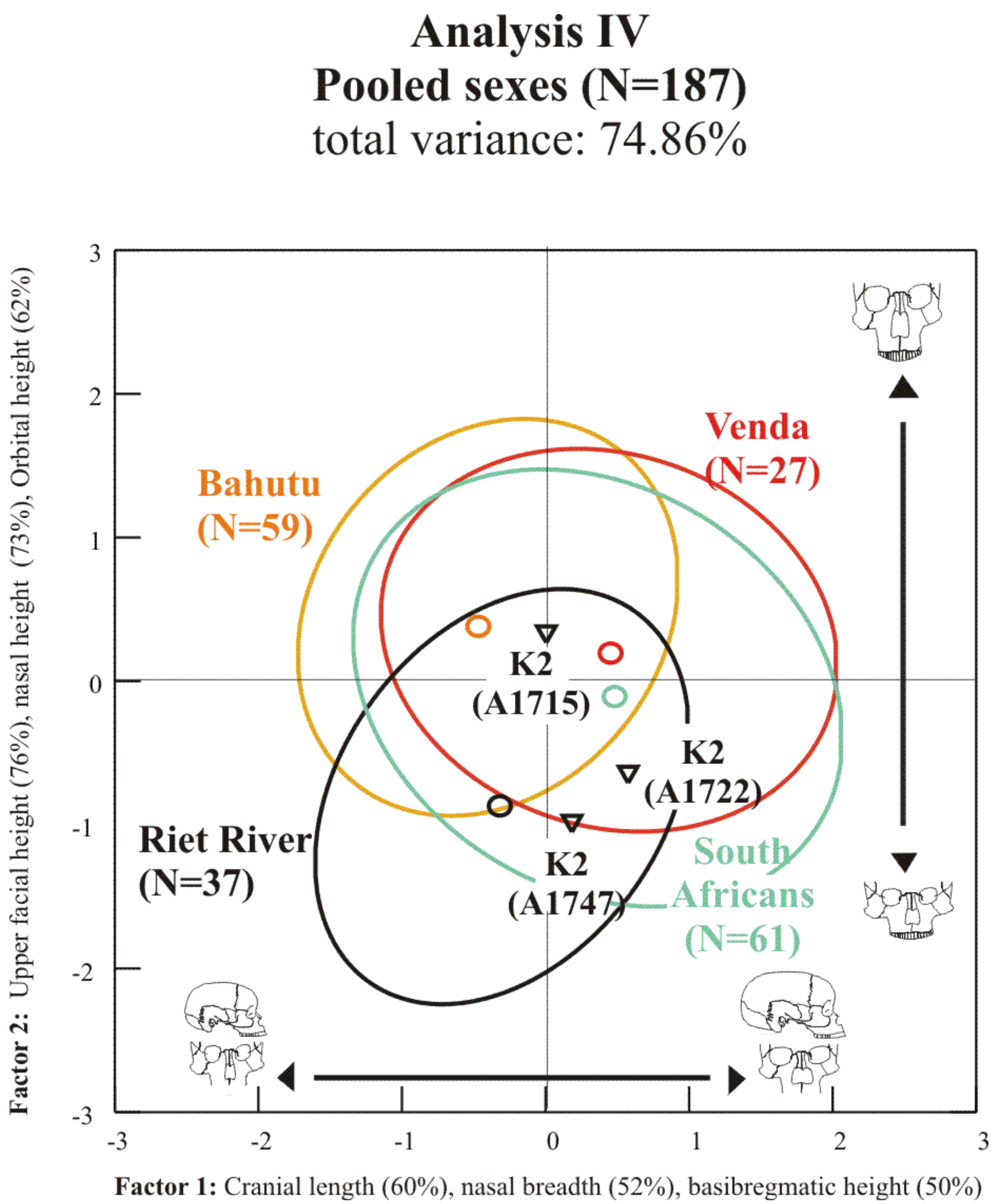


Figure 6.1.8. Scatterplot of factor analysis IV: Face (Vault)

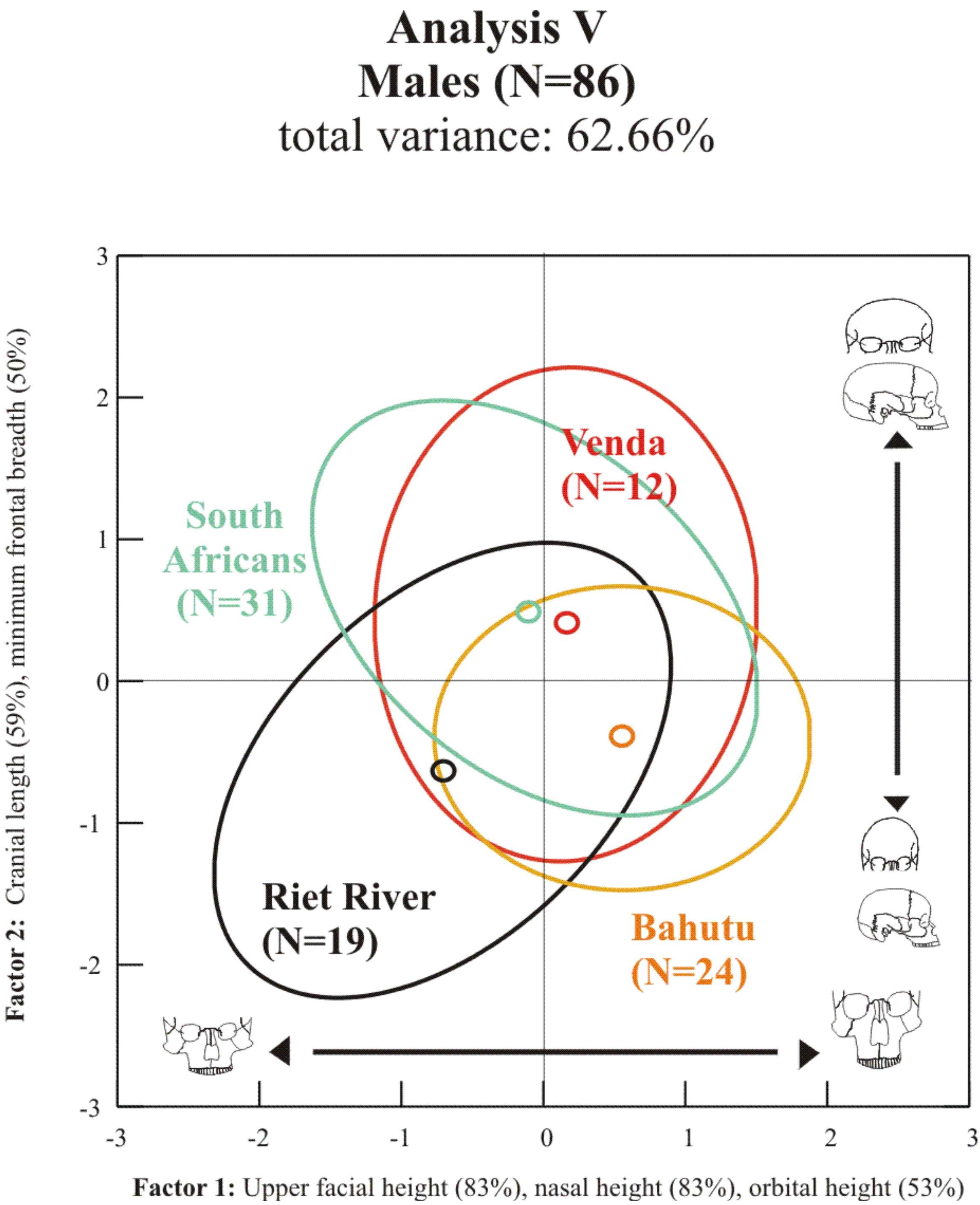


Figure 6.1.9. Scatterplot of factor analysis V: Face (Vault)

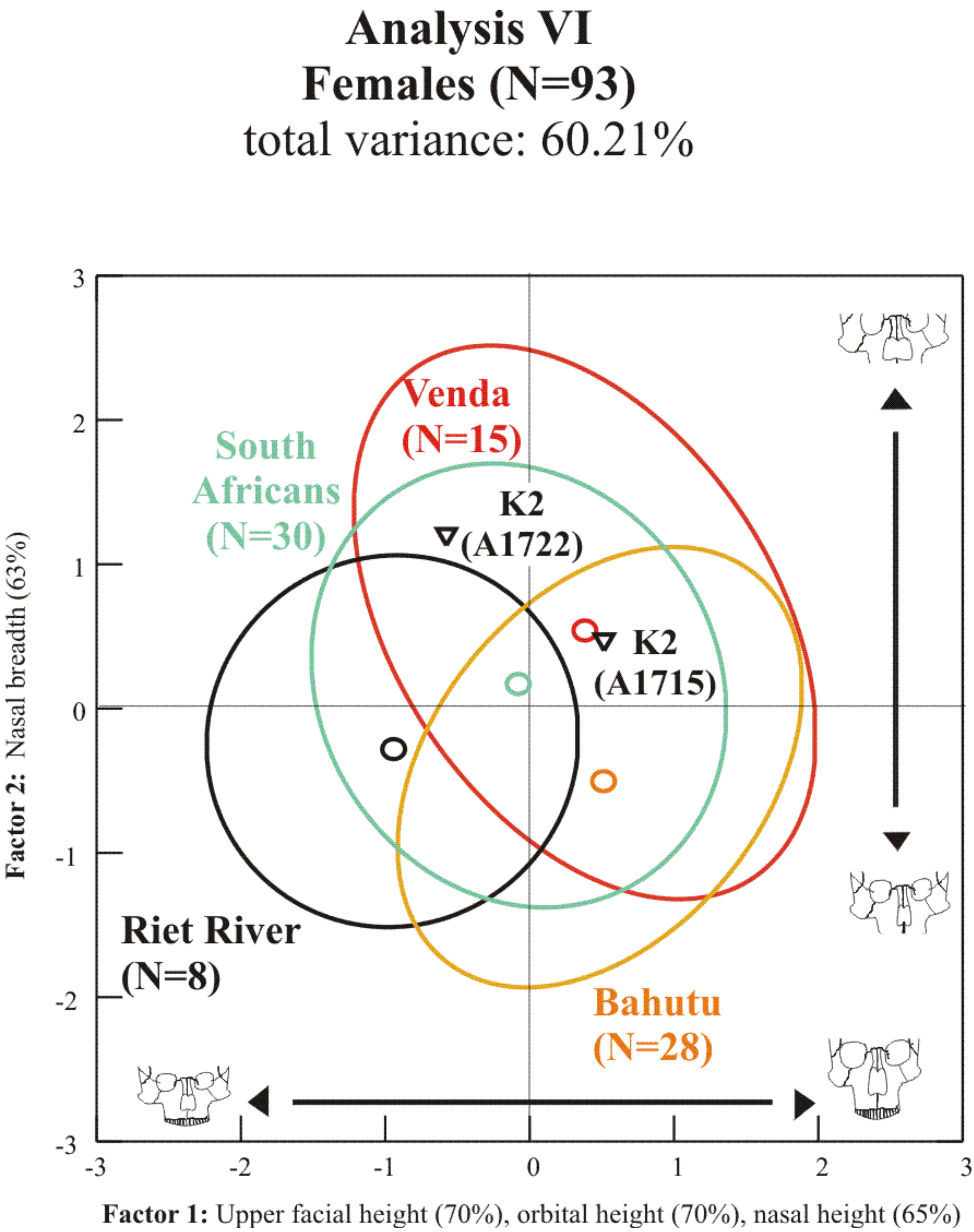


Figure 6.1.10. Scatterplot of factor analysis VI: Face (Vault)

6.2. Odontometry

6.2.1. Introduction

Teeth are more resistant than bone to postmortem destruction such as inhumation, fire or chemical treatments and can thus be a valuable source of data about an extant population. Several factors, such as genetics and environment contribute to the size and morphology of dentition in a population. In a study on the mesiodistal and buccolingual diameters of monozygotic and dizygotic twins, Dempsey and Townsend (2001) demonstrated that genetics contributed significantly more to dental variation within a population than non-genetic factors such as environmental conditions and lifestyle. In an earlier study Townsend and Brown (1978), found that genetics accounted for approximately 64% of dental variation in permanent dentition of a group of Australian Aborigines, whereas the rest was attributed to the environment and other non-genetic factors. These results imply that diet and the environment do have an effect on dental size, but that genetics contribute more significantly than non-genetic factors with regard to overall tooth size and shape. For example, dental morphology, such as shovel-shaped incisors, incisor winging, and Carabelli's trait, are shown to be predominantly under genetic control regardless of dietary influences (e.g., Barnes, 1969; Scott et al., 1978; Morris et al., 1978). Likewise, sex linked chromosomal mutations, such as Down's syndrome and Turner's syndrome, are associated with a reduction in tooth size and modifications in dental morphology, irrespective of the environment (e.g., Kirveskari and Alvesalo, 1982; Peretz et al., 1996).

Change in the subsistence economy and dietary habits of a population, however, have been shown to affect dental size over a lengthy period of time. In several prehistoric North American populations, the change from hunter and gatherer to horticulture/agriculture subsistence patterns is associated with a reduction in dental size from the earlier to the later archaic groups (Perzigian, 1976; Sciulli, 1979). Thus, environmental factors may not contribute greatly to the size and shape of a tooth within a single generation, but these factors do appear to have additive effects on dental size over a longer period of time.

Since the variation in tooth size is under strong genetic control, Dempsey and Townsend (2001) has suggested that dental dimensions are useful to determine genetic relationships among populations. Several genetic distance studies have been conducted in Southern Africa using odontometric data (e.g., Morris, 1992; Steyn, 1994; Mosothwane, 2004). The results from these studies have shown that South African Negroids (in general) have closer genetic affinities to other prehistoric Negroid populations, such as those from K2 and Toutswe, than to non-Negroid populations such as the San (KhoiSan). Problems encountered within these studies were dental attrition, particularly among the San (KhoiSan) populations, and small sample size.

Small sample size has also been problematic in other genetic distance studies. For example, Doran and Freedman (1974) observed large, megadont dentition in the Goroka and Lufa populations of Eastern New Guinea. Using the Penrose shape coefficients, they noted that the dentition from the Goroka and Lufa tribes was most similar to other aboriginal groups within a close geographic proximity. Furthermore, the dentition from these two tribes was most dissimilar from a geographicaly distant population, the Naisoi. However, due to a small sample size, the authors were cautious with their interpretations and suggested that geography alone may not explain the similarities or differences between these various groups.

In another Penrose distance study on the Ticuna Indians from South America, Harris and Nweeia (1980) noted that with the Penrose shape coefficients, they were able to separate the Native Americans (of North and South America) from the Caucasoid, Negroid and Australian aborigines. They were unable to show any difference between Native Americans from either North or South America, which are geographically distinct groups. Therefore, Harris and Nweeia (1980:89) suggested that "phenetic dental affinity is not [necessarily] a reflection of geographic propinquity", which means that non-genetic factors, such as environment and diet were more influential in the maintenance of dental size than genetic divergence due to geographic isolation. From these various studies, it is clear that the relationships between dental variation, genetics and the environment are quite complex and thus interpretations of genetic distance studies should bear these factors in mind.

Genetic distance studies require the use of multivariate statistics such as Mahalanobois (D^2), multiple discriminant analysis and Penrose shape distances (Corruccini, 1975; Morris, 1992). Mahalanobois ($D^{2)}$ and multiple discriminant analysis usually require variable measurements to be complete (which is not entirely realistic when dealing with fragmented remains) and the raw data for comparative samples (which are usually unavailable). The Penrose shape distance calculations are more simplistic in that it uses the mean value and the standard deviation of all samples and thus overrides the need for complete variable measurements or raw data. Furthermore, Morris (1992) has pointed out that although various 'distance' studies produce different results, "the degree of distance is the same" regardless of the statistics used.

The Penrose distance statistics is comprised of both size and shape coefficients. The size coefficient calculates the difference in mean values between the two samples, and the shape coefficient calculates the differences in standard deviations for these values. From these coefficients, size and shape distances can be created. The size distance is determined by squaring the difference between the means of the two groups (e.g., Penrose 1954; De Villiers, 1968). For the most part, size distance is considered less accurate than shape distance in determining a relationship between two groups (Harris and Nweeia, 1980; Corruccini, 1975).

Penrose shape distance measures the amount of morphological distance between two populations (in this case the morphological distance in tooth shape). For example, when assessing a particular population, small shape distances are more similar and large shape distances are more dissimilar. However, the terms 'similar' and 'dissimilar' are relative in relation to the populations being compared. For example, the relationship between population A and population B cannot be interpreted unless both A and B are compared to a third population, in this case, C. Thus the more populations included in the Penrose distance matrices, the more visible are the similarities or dissimilarities between and among the various populations under comparison.

A biological link has been proposed between the people of Venda and the Iron Age populations of Mapungubwe and K2. Previously this relationship could not be tested due to a paucity of Venda skeletal material. Thus the purpose of this odontometric analysis was to assess the biological relationship of the Venda to various South African groups including the Iron Age people of Mapungubwe and K2, the San, Griqua and modern South African blacks and whites through the use of Penrose distance statistics. This study is also used in conjunction with craniometry (section 6.1) to draw conclusions regarding the biological affinity of the Venda.

6.2.2. Materials and Methods

Two dental measurements were taken to the nearest 0.01 mm using a dial caliper. These measurements included the crown dimensions (mesiodistal and buccolingual) of the permanent teeth. Numerous techniques are available to record dental measurements. In this study, the techniques of Brothwell (1963) and Kieser (1990) were adopted, which have been used by Jacobson (1982) on a skeletal sample of black South African Negroids. The measurements are as follows:

Mesiodistal (MD) is the maximum distance between the mesial and distal contact points or contact areas with regard to premolar and molar teeth.

Buccolingual (BL) is taken at a right angle to the MD measurement and represents the maximum distance between the labial and lingual surfaces.

Sources of error in dental measurement can be attributed to the type of caliper used, dental attrition, caries, calculus, fractures and restorations (Van Reenen, 1982; Kieser, 1990). Dental attrition changes the size and shape of the tooth through both interproximal attrition (shortens the MD diameter) and occlusal attrition (shorten the BL diameter). Dental caries, fractures and restorations also change the size and shape of a tooth through destructive or additive mechanisms. In this study, if a particular tooth had visible dental pathology or excessive dental wear, the measurements were not recorded. Only the left dental arcade was measured for both the maxilla and mandible. If the left dental arcade was not present, the right dental arcade was used.

On account of the variability in size and shape and frequent postmortem loss of the anterior teeth, only MD and BL measurements from the posterior teeth were taken. These included the first premolar (P1), the second premolar (P2), the first molar (M1), the second molar (M2), and the third molar (M3). The means and standard deviations of these dental variables were calculated using SPSS 11.5 (for Windows). These data were entered into Quattro Pro for DOS spreadsheet and Penrose coefficient equations were calculated to determine the size and shape coefficients.

The Penrose coefficient equations are as follows (Penrose, 1954):

C_H^2 (mean square distance):= sum $(d1^2 + d2^2 + d3^2 + d4^2 + d5^2 \ldots)/m$

C_Q^2 (size distance): =[sum $(d1^2 + d2^2 + d3^2 + d4^2 + d5^2 \ldots)]^2/m^2$

C_Z^2 (shape distance): $=C_H^{2} - C_Q^{2}$

To account for variation in each tooth measurement, the difference of the group means was divided by the standard deviation of that variable (Constandse-Westermann, 1972; Harris and Nweeia, 1980). In all pairwise comparisons, the standard deviation of the largest sample was used (Constandse-Westermann, 1972).

In the above - mentioned equations, 'd' refers to the difference between the standardized means and m is the total number of teeth measurements within the comparison (in this study 10 dental measurements were compared). A problem with Penrose statistics is that it is not able to measure intercorrelation among the variables.

6.2.2.1. Comparative samples

Samples used for comparison with the Venda were K2, Mapungubwe, Eest African Negroes (Teso), San (San (KhoiSan)), Griqua, modern SA blacks (for males this includes the four sub-groups Natal Nguni, Cape Nguni, Sotho and miscellaneous), modern SA whites, and one prehistoric North American population, the Pecos Pueblos (Drennan, 1929; Nelson, 1938; Barnes, 1969; Jacobson, 1982; Kieser et al., 1985; Morris, 1992; Steyn, 1994). This last group was considered an outlier and was used to test the efficacy of the Penrose distance statistics. It was assumed that there was no genetic relationship between the Venda and the Pecos Pueblos. Therefore, the Penrose distance statistics between the Venda and the Pecos Pueblos should be larger than the Penrose distance statistic between the Venda and other African groups. A brief description of the various comparative populations included within the Penrose matrices is provided.

K2 & Mapungubwe

The permanent dentition for K2 and Mapungubwe was kept separately in the Penrose study by Steyn (1994). She measured the mesiodistal and buccolingual diameters of the permanent dentition (I1-M3) of 10 individuals from Mapungubwe and 24 individuals from K2. In a comparative study of the dentition from K2 and

Mapungubwe with other African populations, it was noted that the individuals from Mapungubwe had much larger teeth than those from K2, the San (KhoiSan) or modern South African Negroids. This large tooth size for Mapungubwe individuals has been attributed to inbreeding, the high social status of the population, or perhaps it was possible that this population was not related to K2 or other South African Negroid groups (Steyn, 1994).

East African Negroes (Teso)

The Teso tribe is considered the second largest tribal group in Uganda. During the period 1962-1964, Barnes (1969) examined the morphology and disease prevalence in the dentition of both juveniles and adults at a local Ugandan dental clinic. The adults arrived at the clinics with particular dental ailments, such as caries, abscess or periodontal disease. Barnes (1969) extracted these diseased teeth, measured the mesiodistal and buccolingual diameters and used these measurements, in addition to dental morphology and the prevalence of dental disease, to describe the Teso dentition. Since only diseased or extracted teeth had been measured, the sample was inherently biased. Recognizing this bias, Barnes (1969) suggested that any interpretations from the study regarding the size and shape of the Teso dentition were general, at best.

San (KhoiSan) (pooled male and female)

Drennan (1929) measured the mesiodistal and buccolingual dimensions of the permanent teeth of twenty-seven skeletons of known, San (KhoiSan) origins. These measurements were part of a larger study that included dental disease and dental morphology, which aimed to describe the dentition of this relatively homogenous population. Drennan (1929) noted that the dentition of the San (KhoiSan) was much smaller in comparison to modern South African Negroids. Since the sample size was small, male and female dental measurements were pooled.

San (KhoiSan) (unpooled male and female)

Van Reenen (1982) conducted a larger study of the San (KhoiSan) dentition then Drennan (1929), which included 140 male and 102 female crania from various skeletal collections in Europe and South Africa (van Reenen, 1982). Since dental attrition was considered more pronounced in the San (KhoiSan) than other South

African groups, the study assessed the effect dental wear had on mesiodistal, buccolingual, and crown height dimensions in the San (KhoiSan) population.

As can be expected, Van Reenen (1982) observed that the teeth without, or with less, dental attrition had larger dental dimensions than teeth with more severe dental attrition. The dental measurement most affected by dental attrition was the crown height. Of the mesiodistal and buccolingual diameters, the mesiodistal length was more likely to be affected by dental attrition than the buccolingual width. In both instances, dental attrition was responsible for a decrease in these dimensions. Van Reenen (1982:200) considered dental attrition to bias metric dental studies on the San (KhoiSan) to such an extent that "the true dimensions of the Bushman teeth have as yet [to be] determined". The male and female dental measurements were not pooled, due to the large sample size.

Griqua

Unlike the East African Negroids (Teso) or the San (KhoiSan), which are relatively homogenous populations, the Griqua represent a heterogeneous group comprised of individuals of San (KhoiSan), Bantu-speaking agriculturist and Dutch descent. The Griqua skeletal material was obtained from a cemetery in Campbell, which dates from the period 1815 -1862 (Morris, 1992). From 1961-1971 the University of Witwatersrand exhumed 41 individuals (17 males, 11 females and 13 juveniles).

Metric analysis of the Griqua dentition has been conducted by both Kieser (1985) and Morris (1992). Kieser (1985) observed a distinct difference between males and females with regard to tooth size. In comparative studies, no significant difference was noted between the metric dimensions of the Griqua dentition and the San, South African blacks or whites (Kieser, 1985). According to Morris (1992), the inability to distinguish the size and shape of the Griqua dentition from other South African populations is due to population admixture with these various groups.

South African Negroids

Jacobson (1982) studied the morphological and metric characteristics of the South African Negroids, who were divided into four main groups: the Natal Nguni (Zulu, Swazi), Cape Nguni (Xosa, Fingo, Hlubi, Pondo, Baca), Sotho (S. Sotho, Tswana, Rolong) and a miscellaneous group (Shangaan, Tonga, Venda, Ndebele and

Shona). A total of 460 skulls (356 males, 104 females) from the Raymond A. Dart skeletal collection were observed. All the individuals within the sample had died during the 20th century and had been used as dissecting room cadavers at the medical school of the University of Witwatersrand.

With regard to the size and shape of the dentition from the various South African tribes, no significant difference was observed. On account of this, Jacobson (1982) proposed that the various ethnic groups in South Africa should be considered a single, homogeneous population. In a study on the cranial morphology of South African Negroids, De Villiers (1968) noted no difference in cranial size or shape among the various ethnic groups in South Africa and has also suggested that these various groups are a single, homogeneous population.

South African Whites

Kieser et al. (1985) measured the mesiodistal and buccolingual diameters of 125 orthodontic casts of South African whites (59 male and 66 female) at the University of Witwatersrand. The aim of this study was to assess the tooth size and amount of sexual dimorphism present in a population of South African whites. The results of the study showed that white South Africans were highly sexually dimorphic, and that their tooth size was similar to other Caucasoid populations in North America and Europe.

Pecos Pueblos

Pecos Pueblos are located in north central New Mexico, and has had a long period of occupation, which extended from A.D. 800 to 1830. Between 1915 and 1924, 1250 skeletons were excavated from these Pueblos, of which 250 were suitable for study and analysis (Nelson, 1938). In a study on the dentition of these Native Americans, Nelson (1938) compared the mean dental dimensions of the Pecos Pueblos with various other populations such as Australian, Bantu-speaking agriculturists, Modern whites, and San (KhoiSan). The result of this comparison demonstrated that the size of the Pecos Pueblo dentition was intermediary among these various groups. The teeth were much smaller than those of Australians "and only slightly smaller" than those of the Bantu-speaking agriculturists (Nelson, 1938: 378).

6.2.2.2. Statistical analysis

In this study, metric dental data obtained from the Venda and the comparative populations were used to calculate three separate Penrose distances (Table 6.2.2 – 6.2.4). In the first analysis, the sexes were pooled for the various populations before the Penrose statistics were calculated. Since the sample size of adult males and females from K2 and Mapungubwe was small, the pooling of the sexes was necessary in order to adequately compare these prehistoric groups to the Venda. In an attempt to increase the meaningfulness of the Penrose calculations between the three groups (Venda, K2 and Mapungubwe), dental data from the Teso in Uganda (East African Negros) and the San (KhoiSan) were included as they are the only other sources of pooled dental data from the African continent (Kieser, 1990). Pecos Pueblos, the Native American outlier group, was also used in this analysis.

The other two Penrose distance calculations examined the male and female populations separately and thus excluded K2, Mapungubwe and Pecos Pueblos. Odontometric data are sparse for female skeletal material and are due to poor representation of females in either departmental collections or archaeological sites. Therefore, only five populations were used in the Penrose distance statistics for females and included the Venda, Griqua, San (KhoiSan), South African Negroids, and South African whites. In the Penrose distance statistics for the males, the comparative populations included the Venda, Cape Nguni, Natal Nguni, Sotho, Miscellaneous, San (KhoiSan), Griqua and South African whites.

6.2.3. Results

Descriptive statistics for the upper and lower teeth are shown in Table 6.2.1. The sample consisted of approximately 19-39 individuals per category. A significant difference in tooth size between the sexes was observed in the upper P1, M2 and the lower P2, M1 and M2 for the mesiodistal and buccolingual diameters, the upper M1 for the mesiodistal diameter and the lower P1 and M3 for the buccolingual diameters.

Penrose shape distances for six pooled populations including Venda, Mapungubwe, K2, East African Negroids, San (KhoiSan), and Peco Pueblos are given in Table 6.2.2. As can be expected, the Venda were most distant from the prehistoric North Americans, the Pecos Pueblos [(C_Z^2 : 0.363 (maxilla) and 0.695 (mandible)]. The dental dimensions of the Venda were closest to dimensions from the maxilla of

K2 (C_Z^2: 0.048), the maxilla of the San (KhoiSan) (C_Z^2: 0.074), the mandible of East African Negroids (C_Z^2:0.081), and the mandible of K2 (C_Z^2: 0.137).

There was also a large amount of inconsistency among the various pooled populations. For example, the mandibular dimensions of the Venda were similar to the mandibular dimensions of Mapungubwe (C_Z^2: 0.137), but the maxillary dimensions between these two groups were quite dissimilar (C_Z^2: 0.446). In contrast, the San (KhoiSan) are more similar to the Venda in the maxillary dimensions (C_Z^2: 0.074) but are quite dissimilar in the mandibular dimensions (C_Z^2: 0.336).

As a whole, the relatively small Penrose shape distance in both the maxilla and mandible for K2 and Venda may suggest a close relationship between these two populations. The seemingly close relationship between the Venda and East Africans (Teso) may also imply a genetic relationship, but the errors in dental measurements mentioned by Barnes (1969) in the East African Negroid data are likely to have biased these results. On the other hand, the close distance between the Venda and the San (KhoiSan) is unusual, and may possibly be attributed to dental attrition noted among the San (KhoiSan) by Van Reenen (1982). Possible discrepancies with regard to shape distances between the other populations could possibly be due to sexual dimorphism, dental attrition, inter and intra-observer error with regard to dental measurements, and the small sample size of several of the populations such as Mapungubwe, San (KhoiSan), and the Venda.

Table 6.2.3 shows the shape distances for five female groups, which include the Venda, San (KhoiSan), Griqua, SA blacks and whites. The Venda are most similar to SA blacks [(C_Z^2 : 0.150 (maxilla) and 0.147 (mandible)] and least similar to the San (KhoiSan) (C_Z^2 : 0.514). Overall the shape distances imply a closer relationship between the Venda and modern SA blacks than between the Venda and the other populations. These results compare well with the multiple discriminant analyses from the cranium in which the Venda were frequently classified as South African Negroids (pg. 139-142).

The shape distances for male South Africans are shown in Table 4.2.4, and are similar to the results obtained from the shape distances for female South Africans. The Venda males are most similar to the SA blacks [(C_Z^2 :0.057 (maxilla) and 0.111 (mandible)]. Furthermore, no real difference was observed between the Venda and the various ethnic groups, which are Natal Nguni, Cape Nguni, Sotho, and miscellaneous. The extraordinarily high shape difference between the Venda and the

Sotho for the mandibular dimensions is unusual. Jacobson (1982) noted that the mandibular dentitions of the Sotho for P1, M2 and M3 were considerably smaller than the other South African groups. However, he could not explain the reason for this discrepancy in size.

The Penrose shape distances for males and females are relatively consistent. In both groups, the Venda population is most similar to modern SA blacks and Griqua, and most distant from the San (KhoiSan). Simply, this means that the Venda, SA blacks and Griqua are more similar to each other than to the San (KhoiSan), which is expected (Drennan, 1929).

6.2.4. Discussion

Sexual dimorphism within the Venda was noted in all the posterior teeth, except M3. This pattern is generally consistent with modern South African Negroid population in which the male dentition is larger than the female dentition for the posterior teeth (Jacobson, 1982, Kieser, 1985). Sexual dimorphism in the skull and pelvis is attributed to changes in secondary sex characteristics at puberty (Loth and Ýþan 2000). Although it has been broadly related to both genetics and the environment, no clear mechanism has been attributed to sexual dimorphism in dentition (Kieser, 1985). Similarities in sexual dimorphism for the posterior teeth may suggest possible genetic commonalities between the Venda and modern South African Negroids.

From the Penrose matrices, it was possible to suggest that the populations of Venda and K2 are more similar to each other (maxilla and mandible) than they are to Mapungubwe or the other comparative groups. Steyn (1994) also noted a closer relationship with K2 and modern South African Negroids than either group had with Mapungubwe. She created three possibilities to explain these results. The first possibility suggests a bias in the calculations due to the small sample size of Mapungubwe. Only 12 individuals were assessed from Mapungubwe Hill and most of the adult skeletons were in a fragmentary condition from which sex could not be determined. Thus, the large dental dimensions from these 12 individuals may be due to the population being over-represented by males with large teeth. Another possibility which Steyn (1994) suggested was inbreeding among the upper class on Mapungubwe Hill, which would have maintained the large tooth size within this group. Lastly, she postulated that K2 and Mapungubwe might have been separate populations.

The current study adds to the results of Steyn (1994) and suggests a closer relationship between the Venda and K2 than either group had with Mapungubwe. These results may tentatively suggest a genetic contribution from K2 to modern Venda populations, in particular, and South African Negroid populations in general. The more distant relationship between Venda and Mapungubwe presented in this study also correlates with the Penrose shape distances found in Steyn (1994). Thus, the relationship of Mapungubwe remains uncertain and the three possibilities presented by Steyn (1994) are equally valid.

In the pooled data sample, the Venda also demonstrated a closer relationship with the East African Negroids (Teso) than with the San, Mapungubwe or Pecos Pueblos. However, this relationship may be erroneous due to the method used to collect the Teso data (Barnes, 1969). The odontometric data were obtained from extracted teeth that had been removed due to either carious lesions or periodontal disease. According to Barnes (1976:185) difficulty arose when "in the case of carious attack the mesio-distal diameter was often unobtainable…or in the case or periodontal disease the teeth were often old and well worn." Since the method is inherently biased and does not represent the population as a whole, it was concluded that the shape distance between the Teso and the Venda does not represent biological reality.

The relationship between the Venda and Griqua is ambiguous. According to Morris (1992), the Griqua morphology is admixed with both San (KhoiSan) and Negroid features and is highly variable to such a degree that "any attempt to create an 'average' Griqua morphology is meaningless with such a range of variation" (Morris 1992:157). Therefore, one can assume that any relationship between the Venda and Griqua is due to the Negroid admixture that has been confirmed in the latter population and conveys no real meaning with regard to biological relationship between the two groups. The distant relationship noted between the San and the Venda is to be expected given the relative homogeneity of the San population at the time of analysis (Drennan, 1929).

Conclusions

Firstly, one can clearly argue the fact that the Venda are part of the general South African Negroid population, even though they may have some inter-tribal distinctions such as a difference in sexual dimorphism. Secondly, the relationship between the K2 and the Venda is quite strong and may suggest a genetic contribution of the K2 population to the Venda, in particular and the South African Negroid population, in general. Due to the small sample size of Mapungubwe, little can be said with regard to the origins of these people. The archaeological evidence is also controversial in this regard.

The Penrose distance statistics are much easier to calculate than other distance studies. However, it is not without its interpretative difficulties and appears to be less valuable in determining biological relationships when one is dealing with heterogeneity. For example, the high admixture of San (KhoiSan) and South African Negroid features within the Griqua population makes the mean value of a particular variable meaningless with regard to describing the amount of variation within that particular population.

Table 6.2.1. Descriptive statistics of the mesiodistal and buccolingual dimensions of the posterior teeth in the maxilla and mandible for the Venda

Variables		Male			Female			sexes
				Maxilla				
		N	Mean	SD	N	Mean	SD	t-value
P1	MD	39	6.96	0.91	27	6.63	0.70	1.59
	BL	39	9.26	0.87	27	8.86	0.80	1.89[b]
P2	MD	38	6.80	0.92	24	6.28	0.74	2.34[b]
	BL	38	9.26	1.25	24	9.08	0.82	0.60
M1	MD	35	10.45	0.76	25	10.01	0.66	2.34[b]
	BL	34	11.10	1.04	25	10.76	0.98	1.27
M2	MD	37	9.95	0.97	25	9.42	0.98	2.08[b]
	BL	37	11.40	1.00	25	10.74	0.90	2.66[a]
M3	MD	26	9.11	1.35	21	8.72	0.97	1.11
	BL	26	10.81	1.14	21	10.58	0.95	0.73
				Mandible				
P1	MD	38	7.16	0.66	26	6.98	0.72	1.05
	BL	38	8.33	0.59	26	7.92	0.64	2.65[a]
P2	MD	33	7.34	0.72	25	6.99	0.69	1.86[b]
	BL	33	8.48	0.68	25	8.14	0.75	1.79[b]
M1	MD	34	11.19	0.73	21	10.61	1.27	2.16[b]
	BL	34	10.50	0.86	21	9.96	0.76	2.38[b]
M2	MD	35	10.51	0.87	19	10.00	0.74	2.16[b]
	BL	35	10.57	0.90	19	9.69	0.74	3.62[a]
M3	MD	35	10.69	1.13	21	10.45	1.15	0.78
	BL	35	10.24	1.28	21	9.65	0.91	1.83[b]

a=p<0.01
b=p<0.05

Table 6.2.2. Penrose shape distances of pooled (male and female) groups for the maxilla and mandible

Maxilla

	A	B	C	D	E	F
A	-	0.446	0.048	0.174	0.074	0.363
B		-	0.485	0.408	0.705	1.295
C			-	0.187	0.173	0.307
D				-	0.423	0.559
E					-	0.404
F						-

Mandible

	A	B	C	D	E	F
A	-	0.173	0.137	0.081	0.336	0.695
B		-	0.419	1.669	6.486	0.785
C			-	0.429	0.476	0.380
D				-	1.743	0.742
E					-	0.527
F						-

A = Venda (this study)
B = Mapungubwe (Steyn 1994)
C = K2 (Steyn 1994)
D = West African Negros (Barnes 1969)
E = KhoiSan (Drennan 1929)
F = Peco Pueblos (Nelson 1938)

Table 6.2.3. Penrose shape distances for the maxilla and mandible in females

	A	B	C	D	E
Maxilla					
A	-	0.510	0.176	0.147	0.687
B		-	0.287	0.482	0.276
C			-	0.265	0.253
D				-	0.608
E					-
Mandible					
A	-	0.514	0.206	0.150	0.191
B		-	0.923	0.385	0.575
C			-	0.294	0.151
D				-	0.181
E					-

A = Venda (this study)
B = KhoiSan (van Reenen 1982)
C = Griqua (Morris 1992)
D = SA blacks (Jacobson 1982)
E = SA whites (Kieser et al. 1985)

Table 6.2.4. Penrose shape distances for the maxilla and mandible in males

Maxilla

	A	B	C	D	E	F	G	H	I
A	-	0.054	0.071	0.020	0.021	0.766	0.124	0.057	0.184
B		-	0.010	0.015	0.009	0.819	0.778	0.008	0.249
C			-	0.024	0.011	0.926	1.103	0.006	0.317
D				-	0.012	1.130	1.379	0.051	0.260
E					-	0.988	1.694	0.019	0.300
F						-	2.040	0.902	2.002
G							-	0.279	0.088
H								-	0.310
I									-

Mandible

	A	B	C	D	E	F	G	H	I
A	-	0.017	0.011	2.326	0.020	0.128	0.096	0.111	0.326
B		-	0.019	1.943	0.006	0.718	0.668	0.014	0.441
C			-	1.941	0.021	0.448	0.874	0.012	0.467
D				-	1.945	5.919	3.205	10.228	2.891
E					-	0.749	0.758	0.032	0.551
F						-	0.332	0.596	0.398
G							-	0.435	0.171
H								-	0.901
I									-

A = Venda (this study)
B = Natal Nguni (Jacobson 1982)
C = Cape Nguni (Jacobson 1982)
D = Sotho (Jacobson 1982)
E = Miscellaneous (Jacobson 1982)
F = KhoiSan (van Reenen 1982)
G = Griqua (Kieser 1985)
H = SA Blacks (Jacobson 1982)
I = SA Whites (Kieser et al. 1985)

Chapter 7. Discussion

7.1. Introduction

The primary objective of this study was to describe the health status of a modern Venda population from their skeletal remains. The culture of modern South African communities has been influenced by western practices and ideology such as medical care, diet and Christian ideology. It has often been suggested that the introduction of health care facilities into rural areas would improve the longevity of the people and decrease the devastation of infectious disease. However, health is rarely improved with the administration of medicine alone (Pyle, 1979; Foster, 1992). The rural community of Venda was no exception to this principle such that the availability of medical care did not appear to improve the health of the population, even though it did benefit the health of the individual. In fact, it can be suggested that improvements in longevity and health in the rural Venda communities will only occur if changes in social behaviour, living conditions and poverty are properly addressed. The findings from this study are in agreement with this rationale.

A secondary objective of this study was to evaluate the various theories regarding the origins of the Venda. In doing so, the cranial and dental morphology of this group was compared with various skeletal samples from both east and southern Africa. According to early ethnographic accounts, it was believed that the people of Venda were immigrants from East Africa who had entered the Soutpansberg region around AD 1500 and subjugated the local inhabitants (Stayt, 1931; Lestrade, 1960; Wilson, 1969). This theory was further supported by the fact that the language, traditions and lifestyle of the Venda are distinct from other South African groups. Recently, Loubser (1988) provided an alternative theory for the origin of the Venda, which is based on evidence from archaeology, linguistics and oral traditions. Simply, this theory postulates that trade alliances between Shona and Sotho-Tswana groups during the 16th century contributed to the emergence of a new ethnic identity of the people in the Soutpansberg region. This amalgamated group referred to themselves as the *BaVenda(s)*, which mean "people of the world" (Stayt, 1931). The results of this study are supportive of a theory of local development for the Venda. Furthermore, it confirms the findings of previous studies such as De Villiers (1968) and Jacobson (1982), which suggest that the inhabitants of Venda should be classified as South African Negroids.

In order to provide a general discussion on the above-mentioned objectives, this chapter was divided into three components namely sample representation, general health, and population affinity. The importance of evaluating sample bias is that it provides the background from which interpretations were made regarding health and population affinity of the rural Venda. The second and third sections discuss the findings of this study and compare them with ethnographic, historical and medical accounts written on the rural Venda communities.

7.2. Sample representation

Uncontrollable circumstances such as differential burial practices, poor preservation of female and juvenile skeletal remains, and selective excavation of a cemetery may lead to bias in skeletal samples (Ubelaker, 1989). In this study, inadvertent sample bias was caused by the scheduling of exhumation and reburial, selective sampling of graves only from areas affected by construction of the Nandoni Dam, inadequate recollection of family members regarding the exact location of the graves, and poor preservation of both early 20th century graves and juvenile remains.

7.2.1. Exhumation of graves in Venda

Since the excavation of graves in Venda was not initiated as a research project, it was necessary to incorporate analysis time into the schedule of exhumation and reburial as detailed by the archaeologists (exhumation) and local mortuaries (reburial). Archaeologists excavated at least seven graves a day. These exhumations would begin in the morning and were usually completed by 2 or 3pm in the afternoon. At 4pm, the body would be transferred to the local mortuary. If the family members had requested an immediate reburial, it was held around 5pm that evening. If the body was not scheduled for an immediate reburial, it was buried the following morning or early afternoon. Many skeletons were not buried immediately after exhumation, so it was possible to arrange a time for analysis with either the archaeologists in the field or with the funeral director at the mortuary. Two possible reasons for reburial prior to skeletal analysis were a late excavation coupled with an immediate reburial or a refusal of the family to grant informed consent. Also it should be noted that the seven graves were excavated in different villages (or areas) at the same time. This made it difficult (if not impossible) for the researcher to be present at every exhumation site.

Poor recollection of family members regarding the earlier 20th century graves may have biased the skeletal sample. In exhumations that involved burials before 1950, the person usually responsible for identifying the grave and its location was the grandchild or great grandchild of the deceased. Since many of these informants had not been born when their relative died, it was expected that their memories were not reliable. Most of them only remembered the general location of the grave, which had been shown to them by their parents. Many of these excavations would last an entire day and the skeleton was either not found or was poorly preserved. Therefore, poor memory coupled with poor preservation reduced the number of skeletons included in the sample.

During the exhumation of a grave, relatives and friends indicated to the researcher the approximate age at death (in years) of the deceased. This information was rarely accurate, because the age of a person in Venda (and many black South African cultures) is not only related to their date of birth but also influenced by the status they acquired in their family and in their community (Stayt, 1931; Sadie, 1951). For example, if the deceased had been the head of his/her household, the relatives suggested that s/he had been very old. In some cases, family members were adamant that the deceased had been 106 or 110 years of age! On account of these cultural factors, discrepancies exist in Appendix I between the information obtained from the relatives and from the skeletal remains with regard to age at death for adult individuals. For the most part, a mother provided relatively accurate information regarding the age at death of her infants and children. However, for the sake of consistency, only the age at death estimated from the skeletal remains was used in this study.

Lastly it should be noted that the Department of Water Affairs and Forestry paid the family a R600 (approximately $100 US dollars or 75 Euros) wake fee for every 'grave' that was exhumed regardless of whether skeletal remains were found or not. This fee was meant to cover the cost of reburying the deceased individual (s) in the new cemetery. In an area of high unemployment, it was not surprising that several person(s) were dishonest in claiming a pile of stones that looked like a grave in order to receive the monetary compensation. Although this does not directly bias the sample, it did lower the number of potential graves available for analysis and slowed the process of exhumation. A total of 1,021 graves were identified of which only 355 had human remains. Of these 355 individuals, it was possible to analyse 136.

7.2.2. Preservation of the skeletal remains

As mentioned in chapter 2, the manner and location of burial had an affect on the preservation of the skeletal material. According to Venda burial traditions, all individuals over the age of 5 years were wrapped in a cowhide or a blanket and buried in the veldt. Usually these burials were marked with stones and a few of the deceased belongings. The problem for the researcher with regard to these traditional burials is that the blanket, body and skeleton quickly disintegrated such that only the teeth and fragmented long bone shafts were recovered. It was also observed that the roots of the tree or bush could damage the skeleton by growing into the cranium or thorax region.

Around the mid-20th century, the manner of burial changed. This may be associated with an increase in hospital attendance and/or and a conversion to Christian ideology. According to Van der Waal (1977), women in labour and the very ill were taken to the nearest clinic or hospital. If the person (infant or adult) died in the hospital, the body was immediately wrapped in a white plastic body bag. The thick plastic bag did not decompose and thus prevented direct contact of the body with the soil, which prevented disintegration of the skeleton.

In summary, neither the excavators nor the researcher could control the above-mentioned factors. During the exhumation and analysis of the remains, there were numerous administrative obstacles to overcome such as time constraints, poor recollection of family members, unequal sampling of graves from the various communities and an inflated estimation of the actual number of graves present. However, it can be suggested that poor preservation of the remains, which may have led to an under representation of young individuals, was the greatest contributor to sample bias. This sample comprises the largest number of human skeletons to be analysed from the Venda region and most likely represents the later half of the 20th century.

7.3. General health status of the Venda

This section reviews life expectancy, infectious disease and dental health within the context of the living conditions, pathogen load and availability to resources such as medical care, present in rural Venda communities during the 20th century.

7.3.1. Demography

The demographic pattern observed in this study of the rural 20th century Venda was one of high child mortality (approximately 10%), low juvenile and adult mortality, and an increase in mortality after 40 years of age. The high incidence of child mortality may also be suggestive of a population with high fertility. The notion of high fertility among the rural communities of Venda was confirmed in a demographic study at Tshikundamalema, which showed that approximately half of the population was less than 16 years of age (51%) with the remaining group being young to middle aged adults between 17 and 45 years (36%) and older adults (over 46 years:13%) (Van Nieuwenhuizen and Oosthuizen, 1984). Possible reasons for a large family size include a need for labour in the fields, cultural traditions, and the absence of birth control.

On account of the high rate of infant mortality, the calculated life expectancy was low. At birth, a person could be expected to live for 44 years. If they reached adulthood (age 20), it was estimated that an individual could live another 29 years or to reach 49 years of age. These results are in accordance with the estimated life expectancy of males (49 years) and females (55 years) in Venda during the 1970's obtained in a study by the Institute of Development Studies at RAU (1979). Other contemporary black South African samples also demonstrate similar low values for life expectancy and include the Rebecca Street Cemetery (46 years at birth) and urban black communities (at birth: males: 48 years; females: 55 years) (Van Tonder and Van Eeden, 1975).

The distinct similarities in life expectancy at adulthood between the Venda and other contemporaneous black South African samples clearly show that it is possible to use palaeodemographic techniques to establish a general mortality profile for an archaeological population. This is a positive finding considering that the validity of palaeodemographic research has been intensely criticized for the past two decades (e.g., Bocquet-Appel and Masset, 1982;Masset, 1990). Many of these criticisms focused on the inherent problems of a skeletal samples such as sampling bias, errors in estimating age at death, and hidden heterogeneity (e.g., Jackes, 1992; Wood et al., 1992). Since these problems are not solvable, it was suggested that any mortality profile needs to be interpreted with caution and compared, whenever possible, with the known life expectancy of a population with a similar lifestyle (Buikstra and Konigsberg, 1985).

It can be said that the observed pattern of high infant mortality, high fertility and low life expectancy among the rural communities in Venda and other black South African groups is consistent with those of a developing population (e.g., Reader, 1961; Edingtonet al., 1971; Van Tonder and Van Eeden, 1975). In a developing nation, environmental conditions are generally poor such that there is usually no running water, electricity or proper sanitation. The majority of the population is below 21 years of age and few in the group are expected to live past the age of 65. The primary causes of death are infectious disease, parasitic infestations, and malnutrition (Foster, 1992). In many of these populations, it has been shown that mortality rates begin to decrease only after environmental and sanitary conditions have improved (Pyle, 1979).

For most of the 20th century, medical care and treatment was available in the region of Venda (Stayt, 1931). In the 1960's, clinics began to administer antibiotics and preventative medicines such as vaccinations (1962: rabies) to the general population (Blacking, 1964a; Ross, 1966). Antibiotics proved to be highly effective in alleviating infections in an individual, but were relatively ineffective in eradicating infectious disease in the general population. This phenomenon can be attributed to an absence of change in the environment and social behaviour of the people within the rural Venda communities.

The infrastructure of the social environment such as housing and access to basic resources was extremely poor (if not non-existent) in rural Venda communities in the 20th century (Stayt, 1931; Van Nieuwenhuizen and Oosthuizen, 1984). In Tshikundamalema, there was no access to electricity, sanitation or running water. Approximately six people (usually a mother and her children) lived in a single room hut structure, which was likely to be drafty and offer poor isolation from mosquitoes. On account of these living conditions, tuberculosis was common. Due to the tropical climate, infestation of tropical parasitic infections such as malaria and bilharzia was high.

It can be said that the absence of development in the community was most likely responsible for maintenance of high mortality rates in the population. Both McKeown (1979) and Foster (1992) agree that a decrease in mortality will occur in a population, only if general improvements in infrastructure such as sanitation, water, and education either precede or are associated with medical intervention. In the 21st century, there has been some improvement with regard to housing and sanitation in rural Venda communities. It is expected that upon the completion of the Nandoni Dam, the communities mentioned in this study will have access to running water.

7.3.2. Infectious disease

During the 20th century, the rural areas in Venda had high rates of infant mortality, parasite infestation and infectious disease. However, clinical evidence of overt malnutrition was minimal in both children and adults (Van Staden, 1985; Vorster et al., 1994). This does not suggest that malnutrition was not present in any of the communities, but that it was significantly less than in other developing countries in Africa. This phenomenon has been attributed to the tropical climate in which a wide variety of domestic plants could be grown throughout the year and included (to name a few) maize, sorghum, bananas, peanuts, and pumpkins. Wild foods such as stinging nettles, black jacks, figs, berries, prickly pears and apples are also plentiful in the region (Stayt, 1931).

According to Ross (1966), malnutrition was most prevalent during periods of severe drought in the region. It has been suggested that drought periods had the greatest nutritional effect on the elderly and infirm, because they were unable to harvest wild foodstuffs for themselves. During the 1980's, Teichler et al. (1985, 1986) observed several cases of malnourished children at the Donald Fraser hospital, but it is not known whether the time frame corresponded with a particular period of drought or hardship. In attempts to prevent malnutrition, a few community schools offered special feeding programs for school aged children (2-16 years). These programs were designed to supplement their traditional diet, which was low in protein and several essential vitamins (particularly vitamin A) (Lubbe, 1971a). No cases of malnutrition were observed in the rural community of Tshikundamalema, but this is most likely a unique case (Van Staden, 1982).

Although malnutrition has been documented in the Venda area, no evidence pertaining to nutritional deficiencies was observed on the skeletal remains. The estimated stature of both adult males and females was similar to other contemporary black South African samples. This does not imply that the people of Venda were well nourished, but it does suggest that they were not worse off than their contemporaries. However, the incidence of enamel hypoplasitic lesions, which is an indicator of nutritional or metabolic stress during childhood, was lower in the Venda than contemporary urban black South African groups. Possible explanations for this are better nutrition for the people in Venda, young children dying from malnutrition or infectious diseases such that enamel hypoplasia did not develop, and a misrepresentation of juvenile skeletons (3-15 years) in the sample. Lastly, if elderly or infirm adults were affected by malnutrition more than children, then no evidence of this period of stress would be observed on their dentition or long bones.

The tropical climate of the Venda area also meant a greater exposure of the inhabitants to parasites and bacteria. The effect these pathogens had on the rural communities was further exacerbated by poverty, poor sanitation and less than adequate living conditions. According to clinical studies, the most common ailment among children was superficial fungal infections of the scalp. It has been shown that *Trichophyton violaceum* was present in no less than 10% of the children in the region and was observed to be as high as 54% in the rural community of Tshikundamalema (Van Staden, 1988). Other common infections included upper respiratory ailments (tuberculosis) and alimentary canal (gastroenteritis) (e.g., Loubser, 1974; Brighton, 1983).

Parasitic infestations were also prominent in rural areas and can be directly associated with poor hygiene and sanitation. In two separate haematological studies, low levels of haemoglobin were observed in adults and children in the rural Venda communities (Lubbe, 1971b; Vorster et al., 1994). Since the dietary intake of iron was above average for this group, it was suggested that these results were directly attributable to chronic parasitism such as bilharzia and malaria. A high count of eosinophils was also observed in their blood, and is clearly indicative of exposure to parasites (Lubbe, 1971b). Therefore, it can be suggested that these various rural communities were chronically anaemic.

According to Kent et al. (1994) and Stuart-Macadam (1992), anaemia caused by infections from microorganisms is considered to be a defensive response to pathogenic invasion. Microbes such as parasites and bacteria need iron to replicate but lack their own iron production stores such that these microbes are forced to depend on the iron stores of their host for survival. In response to bacterial or parasitic invasion, the body reduces its amount of absorbable iron by either binding iron molecules to proteins such as transferrin or lactoferrin, or by diverting iron stores to the liver or spleen (Kent et al., 1994). Although a reduction in absorbable iron in the body causes anaemia, it also prevents the multiplication of microorganisms and subsequently the advancement of the disease. For example, in African countries where malaria is endemic, it was found that most of the rural populations were chronically anaemic (Kent et al., 1994). Furthermore, when iron rich food supplements were given to these people as a means to alleviate anaemia, many of them developed malaria and died. Therefore, it can be said that the physiological mechanism of iron withholding has permitted mankind to survive in rather unsuitable environments.

According to Stuart-Macadam (1985) chronic anaemia caused by either infectious disease or a nutritional iron deficiency has been shown to cause pathological changes such as cribra orbitalia and/or porotic hyperostosis in 50 – 75% of patients. In this study, cribra orbitalia was not observed on any of the crania which was highly unusual considering that malaria is endemic and infectious bacterial diseases are high in these communities. In addition, the appearance of other skeletal indicators of chronic non-specific diseases such as sub-periosteal lesions is low. These lesions were primarily isolated on the distal portion of a single tibia, which suggests that they were more likely caused by trauma than infectious disease.

As previously discussed, the administering of antibiotics and other medicines had little effect on the eradication of infectious disease in the community, because of a lack of change in social and environmental conditions. However, it is possible that the availability of antibiotics may have played a role in the prevalence of skeletal lesions.

At the rural clinics, a dose of antibiotics was possibly a routine procedure with regard to the treatment of bacterial infections. According to Ross, (1966:305) in known cases of gonorrhoea in rural communities, "2.4 mega units of long-acting penicillin were given to ensure that concomitantly acquired syphilis [was] adequately dealt with." Therefore, it can be assumed that antibiotics would destroy all the various types of bacteria present in the body and not just the ones that contributed to the manifestation of the disease. Furthermore, treatment for particular bacteria/parasites would prevent the microbe from completing its life cycle. In doing so, the body (and skeleton) would not have to respond to later phases of a disease and hence would not develop skeletal lesions. Angel (1981) also suggested that the "full expression of disease caused by treponemes, mycobacteria and many cocci" in the skeleton is prevented by the use of antibiotics.

In summary, the administering of antibiotics and other medicines would have prevented the development of cribra orbitalia and sub-periosteal lesions on the skeletal remains from Venda. However, due to both the poor condition of their environment and the fact that malaria was endemic, these people would have been easily re-infected by microorganisms. Thus, chronic anaemia, which was observed in the population by Lubbe (1971b), may have been an adaptive response to continual re-infection despite the presence of medical treatment. Other possible explanations for a low incidence of cribra and other skeletal lesions include the poor preservation of juvenile remains and the death of individuals from acute viral diseases such as gastroenteritis and/or typhoid.

With regard to specific diseases, osteomyelitis can be considered the most common. In this study, four of the 97 adults had possible signs of osteomyelitis, but only two of these cases were confirmed. In both of these cases, the individuals had secondary osteomyelitic infections. One case was found in a person with possible leprosy and the other in an individual who had multiple femoral fractures.

Osteomyelitis is caused by the bacterium *Staphylococcus aureus* and is found most often in rural areas with low socio-economic status, poor sanitation, and a tropical environment (Ortner and Putschar, 1981). The appearance of secondary osteomyelitis among the skeletal remains from the rural areas in Venda is a clear indication that environmental conditions were poor. Other incidences of osteomyelitis in South African skeletal samples have been found at the 20th century rural farming community of Maroelabult and the Iron Age population of Schroda; at both of these sites only one individual had osteological manifestations of the disease (Hanisch, 1980; Steyn et al., 2002). Therefore, the incidence of osteomyelitis found in the rural Venda is slightly higher than that observed in other South African skeletal samples. The possible reasons for this may be differential preservation of skeletal remains and/or a higher incidence of pathogens (bacteria and parasites) within the Venda communities.

Less than 2% of the rural Venda communities showed signs of cranial and/or facial trauma. This is considerably lower than in contemporary urban black South African groups, in which 5 to 15% of the individuals showed signs of trauma to the face (F.W. Rösing, unpublished). The discrepancy between these two groups may be due to a higher level of interpersonal violence in the urban communities (Angel, 1976). According to researchers from the Hans Synckers Institute, the occurrence of violence and crime were relatively minimal at Tshikundamalema when compared to more urban areas (Van Staden, 1982; Van Nieuwenhuizen and Oosthuizen, 1984). Similarly, interpersonal violence was also found to be uncommon at the rural community of Maroelabult (Steyn et al., 2002).

Although relatively uncommon, traumatic incidences did occur in these rural communities. In Venda, postcranial fractures were observed in approximately 6.0% of the population. The most severe case was of a middle-aged male who had been hit and killed by a train. On the skeletal remains, perimortem fractures were observed on the cranium, pelvis, femora, tibiae, and fibulae. In a man over 50 years of age, compound bi-lateral fractures were noted on the femora. This second individual had survived the event, but he would have needed extensive medical care and assistance from friends and/or relatives. Both of these cases provide information regarding the stresses (train accident) and benefits (medical care) of modern life in Venda.

With regard to degenerative diseases, the occurrence of vertebral osteophytes, schmorl nodes and osteo-arthritis was minimal, when compared to skeletal samples who had experienced intense physical labour such as mineworkers from Koffiefontein and American slaves from South Carolina (Rathbun, 1987; L'Abbé et al., 2003). Although it is not possible to associate general spinal degeneration with a particular activity, it has been noted that most Venda adults (male and female) engaged in some type of routine physical labour such as tilling the fields, harvesting crops, carrying water/wood and herding cattle during their lifetime (e.g., Stayt, 1931; Brighton et al., 1985).

7.3.3. Dental health

Little information is available on the dental health of the rural Venda, which may indicate that it was not a serious problem in the various communities. In a study on disease patterns, Loubser (1974) observed that only 2% of recorded complaints at a local clinic involved dental problems. This is a rather low frequency when compared to other diseases from the same time period such as flu (28%), alimentary canal infections (13%) and fungal infections of the skin (9%). In Tshikundamalema, dental disease was found to be low with regard to caries but high for gingivitis and periodontitis (Pretorius, 1985; Van Staden, 1988). The higher incidence of the latter two diseases can be directly associated with poor dental hygiene (Larsen, 1997).

According to Pretorius (1985), dental facilities were not available in Venda to treat periodontal disease. No fillings, dental crowns or dentures were found in association with any of the skeletal remains, which also indicates an absence of dental treatment and possibly facilities in the region.

Factors that affect dental health in populations are genetics, oral hygiene, diet and fluoride concentrations in drinking water and food. The contributions of genetics and oral hygiene to dental health could not be assessed in this study. It can be assumed that oral hygiene was practiced, but the method or frequency of this practice is not known. However, the possible effect that diet and fluoride concentrations had on the incidence of dental caries was examined and addressed.

The traditional diet of the rural Venda is described as being high in carbohydrates but low in fat. Two meals are eaten a day of which the bulk is a thick maize porridge that is either self-ground or store bought. A side dish is always served with the porridge and may contain meroho (wild green leaves), meat, peanuts and/or beans. Fish, eggs and fruit are eaten less regularly than meat or vegetables. A favourite drink of the Venda is home brewed beer, which is made from maize or sorghum, and is drunk daily. Recently, the consumption of store bought maize has increased due to a decrease in the practice of subsistence agriculture by many families. Other goods bought at supermarkets include refined flour, sugar, coffee, tea, and soft drinks (Crous and Borchardt, 1986; Vorster et al., 1994).

The introduction of refined goods into a population has been shown to deteriorate dental health (e.g., Turner, 1979; Powell, 1991; Rose et al., 1991). Albeit minimal, an increase in dental caries was observed in the skeletal sample from rural Venda when compared to other South African skeletal samples (both prehistoric and historic) who did not have access to refined maize or sugar. However, the incidence of dental caries was much lower in the rural Venda than urban black South African communities who subsist solely on food purchased from a supermarket.

Similar results had been seen in Central African foragers and subsistence farmers, such that the farmers who had access to refined flour and sugars were shown to have a significantly higher incidence of dental caries than the forager group (Walker and Hewlett, 1990). Likewise in a study on South African groups, Morris (1992) observed a higher frequency of dental caries in the modern Griqua population than prehistoric hunting and gathering populations such as those from Riet River and Kakamas. This discrepancy has been attributed to the fact that the former group had access to processed foods whereas the latter groups did not. Therefore, it can be assumed that diet is most likely the strongest contributor to the intensity of dental caries in a population (Turner, 1979).

Another factor that may have affected the low incidence of dental caries in the rural Venda is the high content of fluoride found in both meroho and home brewed beer (Rautenbach, 1986; Janse van Rensburg and Pitout, 1989). It has been suggested that adult males and females consumed between 3.54 and 5.32 mg of fluoride a day, even though the fluoride content of the drinking water was low (0.05 mg). In a series of tests conducted on the fluoride content of food and drink in Venda, both Rautenbach (1986) and Janse van Rensburg and Pitout (1989) noted high fluoride levels in meroho and home brewed beer. This additional fluoride would have been absorbed by the dental enamel and may have provided additional resistance to tooth decay. The only other foods that are known to contain a high content of fluoride are tea and "softboned fish, such as canned sardines and salmon" (Silverstone et al., 1981:229).

The incidence of periapical abscesses was minimal and appears to have been more closely associated with dental attrition than dental caries. However, it should be noted that many abscesses remain unnoticed during macroscopic examination, because few of these infections develop a fistula and drain into the oral cavity. The administering of antibiotics may also have reduced the severity of abscesses.

Since the rural population of Venda had no access to dental treatment, teeth could have been lost by wilful extraction, periodontal disease, or trauma. In 1930, Stayt (1931) noticed that dental extraction was the only available cure for a diseased tooth. This observation is supported by the positive relationship found between dental caries and AMTL for the molar teeth in this study. However, a high percentage of AMTL was also observed in the central and lateral incisors and may be associated with periodontitis, wilful extraction or both. Even though periodontal disease was not assessed in this study, a considerable number of people at Tshikundamalema had advanced stages of the disease (Pretorius, 1985).

In summary, the consumption of processed maize and sugar was most likely the reason for a higher frequency of dental caries in this group when compared to other populations with similar lifestyles. With the continual replacement of natural foods by refined goods from the supermarket, the incidence of dental caries in the rural communities can be expected to increase to levels that have been observed in contemporary urban black South African populations.

7.4. Population Affinity

The complex history of the Venda people is centered around inter-ethnic trade alliances that focused on controlling the exportation of gold, copper and ivory via the east coast of Mozambique (e.g., Loubser, 1988, 1990). Trade alliances in the Soutpansberg region post-date earlier Shona trade networks such as those at Mapungubwe (AD 1220 – 1290), but are contemporaneous with the initial period of decline of Great Zimbabwe (approximately AD 1475) (Mitchell, 2002). For simplicity, only two time periods are discussed in this section which were critical to the development of the Venda culture and ideology.

It has been suggested that around AD 1500, a group of Shona chiefs migrated into the Soutpansberg region and settled in the Nzhelele Valley (Loubser, 1988). The purpose behind this migration was to establish smaller and perhaps more lucrative trade networks in metals and alloys on the east coast. These Shona chiefs initiated alliances with the local Sotho-Tswana inhabitants regarding trade and inter-marriage among the ruling class such that by the late 15th century a new ethnic identity and language had emerged. The later generations of this alliance referred to themselves as the *BaVenda* (Stayt, 1931). It has been shown that Shona and Sotho-Tswana practices had a considerable influence on Venda traditions and language (e.g., Huffman and Hanisch, 1987; Loubser, 1989, 1990; Huffman, 1996). During this time of political and economic change, many Sotho-Tswana commoners decided to adopt the language and practices of the Venda so as to avoid raids on their property by the ruling class (Loubser, 1988).

In the 17th and 18th century, political disharmony resulted in a decentralization of the Great Zimbabwe empire (e.g., Loubser, 1988; Huffman, 1996; Mitchell, 2002). During the middle of the 17th century, Singo (Rozwi) chiefs migrated into the Soutpansberg region with the same intentions as their predecessors, which was to establish new trade networks in gold, copper and ivory with the east coast. Upon arrival in the Soutpansberg region, the Singo successfully banished the earlier Venda rulers, took control of the trade in the region, and established a powerful trading empire at Dzata (AD 1680 – 1750). For reasons that are not clear, the Singo adopted the language and traditions of their conquered predecessors. In their attempts to establish political legitimacy in the region, they suggested that they were the true Venda and had migrated to the area from an unknown country. They also implied that they had brought civilization and power to the primitive Ngona people, which was the name given to the inhabitants of the Soutpansberg region upon their arrival (Loubser, 1989, 1990).

Over time, the political myths of the Singo became incorporated into the oral traditions of both their peers and subjects. In the early 20th century, one informant suggested that the people of Venda had migrated from a warm climate in which many rivers had emptied into a large expansion of water (Stayt, 1931; Wilson, 1969). Early ethnographers deduced that these people were most likely from the Great Lakes region of East Africa and had possibly migrated around AD 1500 to southern Africa (e.g., Lestrade, 1960;Wilson, 1969). In none of these ethnographic accounts are the possible reasons for migration from East to southern African mentioned. Stayt (1971) advocates a possible connection between East Africa and the Venda, but also suggests that it is highly speculative.

The results of the craniometric study show that the skeletal remains of the modern Venda are morphologically most similar to modern South African groups. These results are in accordance with archaeological and linguistic evidence that supports the idea of local development of the Venda in the Soutpansberg region. In addition, the outcomes of this study are in agreement with studies done by De Villiers (1968) and Jacobson (1982), which showed similarities in cranial and dental morphology among the various South African Negroid groups. However, it should be mentioned that in the multiple discriminant analysis the Venda had an equal chance of being misclassified as South African Negroids as they had of being correctly classified as Venda. This is indicative of a heterogeneous population (Pietrusewsky, 2000). Therefore, it is possible that another group (perhaps the Shona or Singo) contributed to the ancestry of the modern Venda.

Recently, Lane et al. (2002) demonstrated distinct genetic similarities between seven South African groups (Zulu, Xhosa, southern Sotho, Pedi, Tsonga and Venda), who are believed to have descended from a common East African ancestor approximately 3,000 – 5,000 years ago. These results lend credence to a very distant relationship of the Venda and many Bantu-speaking agricultural groups to East Africa. However, the genetic similarities between the Venda and other modern South African groups place in doubt the theory regarding the direct migration of the Venda people in AD 1500 from East to southern Africa.

On account of poor preservation of the skeletal remains, it was not possible to establish an ancestral association between the prehistoric population of K2 and the modern Venda. With regard to cranial and dental morphology, K2 and Venda are both similar to each other and to South African Negroids groups. Therefore, it is perhaps most prudent to place both K2 and the modern Venda into the broader category of South African Negroids.

In summary, the Venda ethnicity most probably emerged from an amalgamation of various groups (primarily Sotho – Tswana and Shona) that had a common interest in maintaining trade networks with the East Coast during the 15th century. On account of these diverse roots, this population cannot be considered biologically homogeneous even though they are culturally homogeneous. According to Loubser (1988), the people of Venda consider themselves to be a mixture of various groups but with a common language and tradition. This is clearly shown in their ethnic title the *BaVenda* , which means people of the world (Stayt, 1931).

Chapter 8 – Conclusion

The logistics of this project were complex. It demanded a high sensitivity of the researcher to the needs of the various families while maintaining the goals of the project. During the exhumations, several issues such as immediate reburials, poor memory of family members, false graves and poor preservation of skeletal remains contributed to sample bias. The most critical of these factors was the poor preservation of both early 20th century graves and juveniles between the ages of 3 and 15 years. Unusually good preservation of the later 20th century burials led to a considerable number of individuals from this period being included into the sample. At the end of the excavations, it was clear that this sample was the largest to be analysed from the region of Venda and most likely represented the later part of the 20th century.

The primary objective of this thesis was to create a demographic profile and to record and describe the incidence of pathology observed on the skeletal remains of the modern Venda. With these criteria and additional information regarding the prevalence of various diseases within the rural communities during the 20th century, it was possible to establish a general health profile of this rural population.

According to ethnographic and medical sources, the environmental and social conditions of the rural Venda villages were comparable to those of developing nations (e.g., Stayt, 1931; Van der Waal, 1977; Van Nieuwenhuizen and Oosthuizen, 1984; Van Staden, 1988). General living conditions were poor such that people lived in relatively overcrowded conditions and had no access to running water or electricity. As can be expected, the poor living conditions instigated the proliferation of bacteria and parasites in the environment which in turn contributed to high rates of infections. However unlike developing nations, malnutrition was not prominent in the rural Venda villages except during periods of severe drought. A possible explanation for this may be the abundance and diversity of food that can be grown in the area.

The demographic profile obtained from the skeletal remains appeared to fit the profile of a developing nation such that infant mortality was high and adult mortality increased dramatically after 45 years of age. However, the skeletal pathology findings did not coincide with the description of a population that experienced continual attacks from either bacteria and/or parasitic infections. There are several possible explanations for this discrepancy and include the administration of medication which would have arrested the development of the disease, poor preservation of skeletal remains, and deaths resulting from acute infectious diseases. Therefore, it can be said that western influences such as medical care and medicine may have improved the health and possibly longevity of an individual within a rural Venda community. However, the poor physical and social environment prevented general improvements in community health.

Dental health of the rural Venda was poorer than other populations with a similar lifestyle, and this discrepancy may be primarily attributed to diet and fluoride concentrations in food and drink. The introduction of western foods such as processed maize and sugar is most likely responsible for a higher incidence of dental caries in the population. However, the rate of dental caries in the rural Venda was much less than urban black South African populations. Two possible reasons for this may be the primary reliance of urban groups on processed flour and sugar and/or a high concentration of fluoride found in meroho and home brewed beer, which may have provided additional resistance to decay in the rural communities. Since no evidence of cosmetic dentistry such as fillings, dental crowns, and dentures was observed on the skeletal remains, it could be assumed that diseased teeth were extracted.

The secondary objective of this study was to assess the origins of the Venda by using both craniometric and odontometric techniques. The results of this study show that the morphological features of the Venda are most similar to general South African Negroid populations. These results support a local development theory of the Venda people, and are in agreement with earlier morphological studies conducted on South African populations (De Villiers, 1968; Jacobson, 1982).

The future of the 21st century Venda does not look positive. Inadequate living conditions and poor education in many rural communities in Venda and throughout South Africa have led to a rapid increase in HIV and infectious diseases such as tuberculosis. By 2010, approximately 5 to 7 million South Africans are expected to have died of AIDS related illnesses such as cholera, tuberculosis and gastroenteritis (Whiteside and Sunter, 2000). Without proper education, changes in lifestyle, and structural improvements to rural communities, these diseases will continue to have devastating effects on the longevity and health of black South African populations.

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Appendix A

Abbreviations:

NAN – Nandoni

Villages

BUD – Budeli

MUL – Mulenzhe

DID – Dididi

TSHIL – Tshilangoma

MAC – Machivandihala Agricultural College

MUT – Mutoti

MPEG – Mpego

Grave number (1 – 1000): Each grave was given a number that corresponded both to the order in which that grave was identified and the position of the grave on a survey map.

Dentition:

Adults

I1 – First incisor

I2 – Second incisor

C – Canine

P1 – First premolar

P2 – Second premolar

M1 – First molar

M2 – Second molar

M3 – Third molar

Juveniles

di1 – deciduous first incisor

di2 - deciduous first incisor

dic – deciduous canine

dim1 – deciduous first molar

dim2 – deciduous second molar

Definitions:

Guvha : a cement ledge that encircles the hut. It is common for children less than 5 years of age to be buried in the guvha of their mother's cooking hut.

Donga: a ditch.

Individual Skeletal Reports

1. NANBUD012. DOD (Date of Death): 1998

Burial location/position: Underneath the guvha of a single room hut in the Mulenzhe village, a woman identified the grave of her child, NANBUD012. Since an anthill had disturbed the grave, it was not possible to identify the grave pit. The child was found inside the anthill, in an upright position and his head had faced northwest. A piece of cloth, waterproof pants, a blanket, and some miscellaneous clothing had been found with the remains.

Family Information: The mother indicated that the child had been a boy. He was born in March of 1998 and had died in October of 1998.

Preservation: Due to the termite activity, preservation of the remains was poor. The skull, mandible, eight deciduous tooth germs, claviculae, scapulae, humeri, radii, ulnae, femora, tibiae and fibulae were recovered with varying degrees of preservation. The claviculae, radii, ulnae, and fibulae had extensive postmortem damage. The sacrum, pelvis, vertebral bodies, neural arches and ribs were not recovered.

Sex: Due to the young age of the individual and poor preservation, sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. Deciduous tooth germs for the upper central incisors, upper canines, lower central incisors and lower canines were found. From this evidence, it was suggested that the individual had been ± 6 months of age.

Dentition: Only 8 germ teeth were found.

Pathology/Trauma: No pathology or trauma was observed.

Conclusion: The remains were those of a reportedly male individual who had been ± 6 months old. No pathology or trauma had been observed on the remains.

2. NANBUD054. DOD: 1967

Burial location/position: The grave of NANBUD054 was identified inside the hut structure and underneath the dung floor. Four medium sized rocks demarcated the location of the grave. These rocks had been placed in a straight line from east to west and measured 1.45 m in length. Underneath the dung floor, the grave pit had an elongated oval shape and measured 1.6m in length, 0.85 m in breadth, and 1.2 m in depth. The individual had been placed in an extended supine position with the right hand resting on the abdomen. No grave goods were found.

Family Information: Family members indicated that the individual had been a girl of about 18 years of age.

Preservation: Condition of the remains was good. In the cranium, only the right parietal and both rami of the mandible had postmortem damage. All the bones were present, except for the right ulna and two thoracic vertebrae. Postmortem damage was observed on the claviculae, scapulae, left ulna, radii, ribs, pelvis, sacrum and the bones of the hands and feet.

Sex: A high forehead, round skull vault, small mastoids, and sharp orbital margins were observed. The sciatic notch was of an average width, the sub-pubic angle was intermediate and some development of the pre-auricular sulcus was noted. These features suggest that the individual may have been female.

Age: Dental eruption and the closure of the epiphyses were used to estimate age. The cranial synchondrosis was unfused. The elbow joint was fused, the hip (head of the femur) was partially fused and the shoulder (head of the humerus) and knee (distal epiphyses of the femur) were unfused. From this information, it was established that the individual had been between 15 and 16 years of age.

Dentition: Neither the upper nor lower third molars had erupted. No antemortem tooth loss was observed. The upper right canine had been lost postmortem. No dental wear, dental caries or enamel hypoplasias were observed. A slight discolouration was noted on the upper right first and second incisor.

Stature: Due to the young age of this individual, stature was not estimated.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were of a possible female individual who had been between 15 and 16 years of age. Dental health was excellent and no dental wear, caries, or enamel hypoplasias were observed. In addition, no trauma or pathology was present.

3. NANBUD061. DOD: 1968

Burial location/position: The grave of NANBUD061 was situated on a grassy slope, approximately 4 m southwest of a single hut in the Mulenzhe village. The grave was demarcated by a large, oval shaped cairn, which measured 2.3 m in length and 2.15 m in width. The grave pit was oval in shape and measured 2.1 m in length, 0.57 m in breadth, and 90 cm in depth. The individual had been wrapped in a blanket, placed in an extended supine position and his head was orientated towards the north. No grave goods were found.

Family Information: Family members indicated that the individual had been a male of 86 years.

Preservation: Condition of the remains was poor. Only fragments of the skull and 23 loose teeth were found. Of the long bones, only the shafts of the femora and tibiae were recognizable. Other bones were present but had been fragmented into small pieces and were no longer identifiable.

Sex: A fragment of the occipital bone was present and a pronounced external occipital protuberance was observed. Likewise, the long bone shafts, which included the femora and tibiae, were robust in appearance. From this evidence, albeit scanty, it was suggested that the individual had been male.

Age: Dental wear was moderate on the molar teeth. The anterior teeth were heavily worn. From the skull fragments, it was observed that the sagittal suture had been obliterated and the coronal suture was open. From these features, it was suggested that the individual had been between 30 and 60 years of age.

Dentition: Due to the absence of both the maxilla and mandible, it was not possible to determine antemortem or postmortem loss. No carious lesions were observed. An enamel hypoplastic lesion was noted on the upper right first incisor.

Stature: Due to the poor preservation of the remains, stature was not determined.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male individual who had been between 30 and 60 years of age. No trauma or pathology was observed.

4. NANBUD075. DOD: 1967

Burial location/position: The grave of NANBUD076 was identified at the southern end of the Budeli village and 15 m east of a single room hut. Stones outlined the grave dressing, which was 2.6 m in length and 1.8 m in depth. On the surface of the grave, 12 non – diagnostic potsherds, 13 diagnostic potsherds, and a plastic toothbrush were found. Beneath the grave dressing, the grave pit was oval in shape and measured 1.84 m in length, 0.55 m in breadth, and 1.5 m in depth. The individual had been buried in an extended supine position with the right hand on the abdomen and the head pointing towards the north. No grave goods were found, except for remnants of a blanket.

Family Information: Family members indicated that the individual had been a man of 58 years of age.

Preservation: Condition of the remains was poor. Only fragments of the skull, mandible, and 10 teeth were recovered. The long bones were recovered but the proximal and distal ends of these bones had been damaged. Fragments of the pelvis and ribs were retrieved, but no claviculae, scapulae, vertebrae, hands, or feet were found.

Sex: A prominent external occipital protuberance and narrow sciatic notch were observed. The deltoid tuberosities of the humeri were robust in appearance. From this evidence, it was suggested that the individual had been male.

Age: No dentin was exposed on any of the molar teeth. The lambdoidal suture was partially fused. From this minimal evidence, it was determined that the person had been between 25 and 35 years of age.

Dentition: The upper right C, P1, and M1, the upper left C, P1, P2, and M3, and the lower right C, M1, and M3 were recovered. The lower right I1 and I2, and lower left I1, I2, and C had been lost antemortem. Dental caries was present on the occlusal surface of the upper left M2 and the lower right M3. No enamel hypoplasias were observed.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male between 25 and 35 years of age. No trauma or pathology was observed.

5. NANBUD076. DOD: 1965

Burial location/position: Family members identified the remains of NANBUD076 on one of the northernmost stands in the Budeli village, approximately 15m from the east of a single room hut and on the edge of a ploughed field. The grave was demarcated by several medium sized stones, which had been placed in the shape of a circle. The outlines of this structure measured 2.6 m in length and 1.8m in width. Twelve non-diagnostic potsherds, thirteen diagnostic potsherds, and a plastic toothbrush were found on the surface of the grave. Underneath the grave dressing, an elongated oval grave pit was exposed and measured 1.8m in length, 39 cm in breadth, and 1.5 m in depth. The individual had been buried in an extended supine position with the right hand on the pelvis and the head orientated toward the east. No grave goods were found.

Family Information: The family indicated that the individual had been male.

Preservation: Condition of the remains was extremely poor. Only fragments of the skull, 17 teeth and the long bone shafts were recovered. No ribs, vertebrae, pelvis, hands or feet were found.

Sex: The external occipital protuberance was prominent, and the long bones shafts appeared robust. From this evidence, albeit minimal, it was suggested that the person had been male.

Age: Both the coronal and sagittal sutures were completely open, and no dentin was exposed on any of the molar teeth. From these features, it was approximated that the individual might have been between 25 and 35 years of age.

Dentition: The entire upper right arcade, the upper left I1, P2, and M3, the lower right P1 and M3, and the lower left P1, P2, M1, M2, and M3, were recovered. No carious or enamel hypoplastic lesions were noted.

Stature: Stature was not determined due to the poor condition of the remains.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male between 25 and 35 years of age. Dental health was excellent. No trauma or pathology was observed.

6. NANBUD082. DOD: 1962

Burial location/position: Family members identified the grave of NANBUD082 on the northern side of a stand in the Budeli village. The grave dressing consisted of loose stones that had been packed into an oval shape and measured 2.4 m in length and 1.8 m in width. The grave pit had an elongated shape, which measured 1.8 m in length, 80cm in width, and 66 cm in depth. The deceased had been wrapped in a blue blanket, buried lying on her side in a flexed position and the head had been orientated towards the west. No grave goods were found.

Family Information: The family members indicated that the individual had been a female of 61 years.

Preservation: Condition of the remains was poor. Several pieces of the skull, five teeth, claviculae, scapulae, all the long bones, and the pelvis were found, but most of these remains were not suitable for analysis. No ribs, vertebrae, hands or feet were recovered.

Sex: The sciatic notch was narrow (a male characteristic), and the femoral the head diameter was small, 41 mm (a female characteristic). From this evidence, it was not possible to determine whether the person had been male or female.

Age: All of the cranial sutures were open. Dental attrition was severe, and slight osteophytic growth was observed on the left acetabulum. From this evidence, albeit scanty, it was suggested that the individual had been between 40 and 60 years of age.

Dentition: The upper left C, P1, P2, M1, and M2 were recovered. A carious lesion was noted on the occlusal surface of the upper left first molar. On account of the dental wear, the presence or absence of enamel hypoplasia was not scored.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a female between 40 and 60 years of age. No trauma or pathology was observed.

7. NANBUD084. DOD: 1979

Burial style/position: Family members identified the grave of NANBUD084 on the western end of property approximately 7 m from their garage in the Budeli village. A large granite slab, which measured 2.1 m in length and 90 cm in width, demarcated the grave. The grave pit was rectangular in shape and measured 2.4 m in length, 1.6 m in breadth, and 1.76 m in depth. The individual had been placed in a coffin, in a supine position, and his head was orientated toward the east. A blue and white blanket had been wrapped around the coffin. Grave goods such as cattle bones, clothing, animal skins, and blankets were found inside and outside the coffin.

Family Information: Family members said that the individual had been a male of 77 years.

Preservation: The skeletal remains were in an excellent condition. The facial bones had postmortem damage, but the cranial vault, maxilla, and mandible were intact. All the long bones and some fragments of the pelvis were recovered. No vertebrae, ribs, or sacrum were found.

Sex: A low forehead, elongated skull vault, and ramal flexure were observed in the cranium. The femoral head diameter was wide, 47 mm. These features indicate a male.

Age: All of the dentition was severely worn. Osteoarthritis was noted on the joint of the left knee. This person had most likely been over 50 years of age.

Dentition: The lower right and left M3's had been lost antemortem, and the upper right I1, I2, and C had been lost postmortem. A carious lesion was observed on the occlusal surface of the upper left M2.

Stature: Stature was calculated by using femur length and tibia length with Lundy's stature formulae for male South African Negroid. Estimated stature was 167.04 cm ± 2.371.

Trauma/Pathology: Osteoarthritis was observed on the left knee joint. Mild eburnation was recorded on the distal aspect of the left femur. In addition, bone erosion was observed on the articular surface of the left patella. On the right tibia, a long, spindly bone growth (similar in appearance to a spur) was found on the shaft of the bone and may have resulted from a traumatic injury.

Conclusion: The remains were those of a male who had been over 50 years of age. He had been approximately 167.04 cm tall. The left knee joint had signs of osteoarthritis.

8. NANBUD085. DOD: 1965

Burial location/position: The grave of NANBUD085 was identified by family members to be located about 1m east of a large Jackalberry tree and 20m northwest of the nearest hut on the eastern edge of the Budeli village. The grave had been demarcated by a single rock, which had been placed at the western end of the grave. Underneath the grave dressing, an oval shaped grave pit, which measured 1.7 m in length, 60 cm in breadth, and 80 cm in depth, was exposed. The remains had been poorly preserved and thus it was not possible to determine the exact burial position. No grave goods were found.

Preservation: The condition of the remains was extremely poor. Only 21 loose teeth and the femoral shafts were recovered.

Family Information: Family members indicated that this grave had belonged to a boy who had been 13 years of age.

Sex: Sex was not determined due to the poor preservation of the remains.

Age: All of the teeth had moderate to severe wear. From this evidence, albeit scanty, it was suggested that the person had been over 50 years of age.

Dentition: Thirty loose teeth were recovered which include the upper right I1, I2, C, PM1, PM2, M1, M2, and M3, the upper left I2, C, PM1, PM2, M1, M2 and M2, the lower right I1 I2, C, PM1, PM2, M1, M2, and M3, and the lower left I1, I2, C, PM1, PM2, M2, and M3. The upper right I1 and I2 had been intentionally filed into V-shaped points. Carious lesions were noted on the occlusal surfaces of the upper right M3 and lower left I2. All of the teeth had heavy calculus deposits.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of an adult who had been over 50 years of age. The upper right central and lateral incisor had been intentionally filed. No additional information is available, because the skeletal remains were poorly preserved.

9. NANBUD091. DOD: 1998

Burial style/position: A Venda woman identified the grave of her baby, NANBUD091, outside a single room hut in the Mulenzhe village. No grave dressing was observed. The baby was found inside a white plastic hospital bag, which had been wrapped in a blanket. No other grave goods were found.

Family Information: The mother indicated that the baby had been a girl and that she had died shortly after birth.

Preservation: Condition of the skeletal remains was excellent. The cranium, mandible, 10 tooth germs, scapulae, all the long bones, ribs, several phalanges, a few vertebral bodies and neural arches, and portions of the sacrum and pelvis were recovered.

Sex: Due to the young age of the individual, sex could not be determined from the osteological remains.

Age: None of the tooth germs had developed roots, and the mandibular symphysis was unfused. From these features, it was suggested that the infant had been less than 6 months old.

Dentition: 10 tooth germs had been found and included the upper central and lateral incisors, the upper canines, and the lower central and lateral incisors.

Pathology/Trauma: No trauma or pathology was observed.

Conclusion: The remains were those of an infant who had been less than 6 months of age. No trauma or pathology was observed.

10. NANBUD114. DOD: 1996

Burial location/position: The grave of a male infant, NANBUD114, had been located underneath the guvha of a hut by his mother. The remains were found approximately 47 cm beneath the surface. The grave pit was irregular in shape and measured 32 cm in length and 57 cm in width. The remains had been placed in a white hospital bag, which had been wrapped in a white cloth. The exact position of the remains was not determined. No grave goods were found.

Family Information: The mother indicated that the infant had been a boy and that he had died shortly after birth on the 17th of March 1996.

Preservation: The condition of the remains was excellent. The cranium, mandible, scapulae, vertebrae (vertebral bodies and neural arches), ribs, pelvis (ilium, ischium, pubis), all the long bones and several phalanges were recovered.

Sex: Due to the young age of the individual, sex could not be determined from the osteological evidence.

Age: The mandibular symphysis was unfused, which indicates that the infant had been less than 6 months of age.

Dentition: No teeth were recovered.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those reportedly of a male child who, according to his mother, had died shortly after birth. No trauma or pathology was noted.

11. NANBUD116. DOD: 1995

Burial location/position: A Venda woman identified the grave of her child, NANBUD116, under a cement 'guvha' that was located on the northern side of a rectangular house in the Budeli village. The grave pit was oval in shape and measured 35 cm in length, 15 cm in width, and 85 cm in depth. The child had been placed in an upright position and the head had been orientated toward the west. Two blankets were found inside the grave. One of these blankets had been placed on the bottom of the grave and the other had been wrapped around the child. Several pieces of clothing were also found.

Family Information: The mother said that the child had been a girl and had been crawling.

Preservation: Condition of the remains was good. The cranium, mandible, scapulae, ribs, vertebrae (vertebral bodies and neural arches), the long bones (excluding the tibiae) and several phalanges were found.

Sex: Due to the young age of the individual, sex could not be determined from the osteological evidence.

Age: Dental eruption as well as development of the vertebral bodies was used to estimate age. The lower central and lateral incisors had partial root development but had not erupted. The mental symphysis was also unfused. Neural arches of the cervical, thoracic, and lumbar vertebrae had fused with each other but none had fused to the centrum. From this evidence, it was suggested that the infant had been ± 6 months of age.

Dentition: Eight tooth germs were recovered which included all the incisors.
Trauma/Pathology: No trauma or pathology was observed.
Conclusion: The remains were possibly those of a 6 - month old female.

12. NANMAC 135. DOD: 1964

Burial location/position: The individual had been interned in a rectangular grave on the southern side of the Madzivhandila Agricultural College, next to the grave of NANMAC136. Positioned in a N/S direction, the grave was 1.62 m in length, 86 cm in width and had a depth of 73 cm. The body had been placed on its left side in a flexed position with the head orientated towards the east. Underneath the body, remnants of a plastic sheet and several blankets were found. There were no other grave goods.
Family Information: Family members indicated that the individual had been an old man.
Preservation: The condition of the skeletal remains was relatively poor. The cranium and mandible were well preserved. However, the proximal and distal ends of all the long bones and the pelvis had postmortem damage. The ribs, vertebrae, hands and feet were not be recovered.
Sex: A prominent supraorbital torus, sloping forehead, large, elongated mastoids and ramal flexure were observed and are indicative of a male individual.
Age: All the cranial sutures were obliterated. Dental wear was moderate to heavy on the molar teeth. From these features, it was suggested that the person had been over 50 years of age.
Stature: Stature was not determined due to the poor preservation of the remains.
Dentition: The upper right I1 and M3, the upper left M2, the lower right and left I1 & I2, and the lower left C and M3 had been lost antemortem. None of the teeth had been lost postmortem. Carious lesions were observed on the occlusal surface of the upper right M2, upper left C, upper left PM1, and the lower left M2. Periapical abcesses were noted on the upper left P1, lower left M1 and M2. No enamel hypoplastic lesions were noted.
Trauma/Pathology: Excluding periapical abcesses, no signs of disease or trauma were observed.
Conclusion: The remains were of a male over 50 years of age. Dental health had been poor. No other signs of trauma or pathology were observed.

13. NANMAC136. DOD: 1964

Burial location/position: NANMAC136 was exhumed on the southern end of Madzihandila Agricultural College, and had been situated next to NANMAC135. A cement slab, which was 1.7m long, 2.54 m wide, and approximately 50 cm high, demarcated the grave. The grave pit had been retangular in shape and measured 1.5m in length, 72 cm in width with a depth of 62 cm. The individual was placed in flexed position on her left side. Beneath the body, a plastic sheet was found. No grave goods were present.

Family Information: Family members indicated that the individual had been an old woman of 80 years.

Preservation: The condition of the remains was poor. The maxilla and mandible were complete, but only fragments of the cranium were recovered. Extensive postmortem damage was observed on the proximal and distal ends of all the long bones as well as the ribs, vertebrae, hands and feet.

Sex: Sex was not determined from the osteological evidence due to the poor preservation of the remains.

Age: All the teeth had moderate to severe dental wear. From this, it was suggested that the person had been over 50 years of age.

Stature: Due to poor preservation, stature was not determined.

Dentition: The upper left P2, M1, M2 and M3, the lower right M3, the lower left M1 and M3 had been lost antemortem. None of the teeth were lost postmortem. Carious lesions were found on the upper right C and M1, the upper left P1, and the lower right and left P2 and M2. A periapical abscess was noted on the buccal side of the lower left M2. The presence or absence of enamel hypoplasia was not recorded due to extensive dental wear.

Trauma/Pathology: Excluding dental disease, no trauma or pathology was observed.

Conclusion: The remains were possibly those of a female over 50 years of age. Dental health was poor, but no trauma or pathology was observed.

14. NANMAC137. DOD: Before 1968

Burial location/position: On the western part of the Madzwandila Agricultural College and in front of the main entrance to the building, family members pointed out the grave of their deceased relative, NANMAC137. A pile of 42 stones marked the grave, which measured 2.30 m in length and 1.56 m in width and had been oriented in a NW/SE direction. The grave pit was oval in shape and measured 1.33 m in length, 70 cm in width, and 1.32 m in depth. The individual had been placed in a semi-flexed position with his head orientated toward the southwest. Five undecorated potsherds and half of an oval shaped undecorated bowl were recovered with the remains.

Family Information: Family members said that the individual had been a male of 108 years.

Preservation: Condition of the remains was extremely poor. Postmortem damage was observed on the cranium, claviculae, scapulae, sacrum, pelvis and the proximal and distal ends of all the long bones. Vertebrae, ribs, hands, and phalanges of the hands and feet were not be recovered.

Sex: The femoral head diameter was wide (44 mm). This is indicative of a male.

Age: Severe dental wear was noted on the upper and lower incisors. On the molar teeth, dental attrition was moderate such that only patches of the dentin had been exposed. From these results, albeit minimal, it was suggested that the person had been between 40 and 60 years of age.

Stature: Stature was estimated by using the physiological length of the tibia. The estimated for this person had been 164.2 cm ± 2.78.

Dentition: Both upper M3's and the lower left M3 had been lost antemortem. No carious or enamel hypoplastic lesions were observed.

Trauma/Pathology: A healed fracture was noted on the coracoid process of the right scapula. **Conclusion**: The remains were those of a male who had been between 40 and 60 years of age and was approximately 164.2 cm tall. A healed fracture was observed on the coracoid process of the right scapula.

15. NANBUD144. DOD: 1996

Burial style/position: No information on this grave was available.

Family Information: The mother indicated that the infant had been male and that he had died shortly after birth.

Preservation: Condition of the remains was excellent. The cranium (fragments), mandible, scapulae, vertebrae (vertebral bodies & neural arches), ribs, long bones (except for the fibulae), pelvis and phalanges were present.

Sex: Due to the young age of the individual, sex could not be determined from the osteological remains.

Age: The mandibular symphysis was unfused. From this evidence, it was suggested that the infant had been less than 6 months of age.

Dentition: No teeth were recovered.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male infant less than 6 months of age. No trauma or pathology was observed.

16. NANMUT144. DOD: 1967

Burial location/position: Family members identified the grave of an adult on the southwestern side of the DWAF (Department of Water Affairs and Forestry) camp. A cement grave slab, which measured 2.2m in length and 1.3m in width, and an oval shaped headstone marked the location of grave. The grave pit was rectangular in shape and measured 1.84m in length, 80cm in width and 1.24m in depth. The individual had been wrapped in a red blanket and buried in a supine position. The left hand had been placed on the abdomen. Seven non-diagnostic potsherds were found with the remains.

Family Information: The family indicated that the individual had been a male of 38 years.

Preservation: Condition of the remains was poor. The maxilla, mandible and several phalanges were well preserved. However, the cranium, long bones and pelvis had extensive postmortem damage. No scapulae, ribs, vertebrae, hand or foot bones were recovered.

Sex: The sciatic notch was wide. The menton had a round and gracile appearance. From this evidence, it was tentatively suggested that the individual had been female.

Age: No dentin had been exposed on the molar teeth. From this evidence, it was suggested that the individual had been over 30 years of age.

Stature: Stature was not determined due to the poor condition of the long bones.

Dentition: The upper right I2, both upper P2's, and both lower I1's had been lost antemortem. None of the teeth were lost postmortem. No carious lesions were observed. The molar teeth exhibited an abnormal wear pattern in that the upper M3, had more wear than either the upper M1 or M2. This unusual wear pattern may have been caused by a shift in dental occlusion due to antemortem loss of both upper P2.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor condition of the remains.

Conclusion: The remains were possibly those of a female over 30 years of age.

17. NANMUT145. DOD: 1965

Burial location/position: Family members identified the grave of NANMUT145 on the southwestern side of the DWAF (Department of Water Affairs and Forestry) residence camp and just below a soccer field. No formal grave dressing was found. The grave pit had a rectangular shaped and measured 1.7m in length, 70cm in width and 1m in depth. The individual had been wrapped in a gray blanket. The body had been placed on the right side in a flexed position. It was not possible to determine the orientation of the cranium. At least a hundred copper and aluminum bangles, ten diagnostic and 15 non-diagnostic potsherds were found with the remains.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the maxilla, mandible and the shafts of lower limb bones were recovered. No bones associated with the cranium, scapulae, ribs, vertebrae, humeri, radii, ulnae, sacrum, pelvis, and the hands and feet were found.

Sex: Sex could not be determined from the available osteological evidence. The presence of wire and copper bracelets are suggestive of a female.

Age: All the teeth had severe attrition. From this evidence, it was tentatively suggested that the person had been over 50 years of age.

Stature: Stature was determined due to poor preservation of the remains.

Teeth: All upper incisors, canines and the lower second and third molars had been lost antemortem. The upper right P2, upper left M1, M2, and M3 were lost postmortem. Carious lesions were recorded on the upper right M2 and on the lower right C. Due to severe dental attrition, enamel hypoplastic lesions were not be scored.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were those of a female individual who had been over 50 years of age.

18. NANMUT150. DOD: 1944

Burial location/position: Family members identified the grave of NANMUT150 approximately 900m southwest of the DWAF labour camp and 150m southwest of the grave of NANMUL149.

Several medium sized rocks, which had been constructed into an oval shaped mound, demarcated the grave. The entire structure measured 2.3m in length and 1.52m in width. Eight non-diagnostic potsherds and one diagnostic potsherd were collected from the surface of the grave. Underneath the grave dressing, an elongated oval grave pit was exposed and measured 1.75m in length, 55cm in breadth and 1.05m in depth. The individual had been buried face down. No grave goods were found.

Family Information: Not available.

Preservation: Condition of the remains was good. The cranium and all the postcranial bones were recovered. However, the humeri, radii, ulnae, sacrum, pelvis, ribs, vertebrae and right tibia had moderate to extensive postmortem damage.

Sex: A round skull vault, high forehead, small mastoids and straight mandibular ramus were observed. The sub-pubic angle and sciatic notch were wide, and the femoral head diameter was small (37 mm). These features indicate a female.

Age: The cranial synchrondosis had fused. None of the teeth showed signs of wear, and no vertebral osteophytes were observed. The person may have been between 25 and 35 years of age.

Stature: Stature was estimated using the physiological length of the femur and tibia in conjunction with Lundy's stature formula for female South African Negroids. Stature was estimated at 157.6 ± 2.497 cm.

Teeth: None of the teeth had been lost antemortem. A carious lesion was observed on the occlusal surface of the lower right P2. No enamel hypoplastic lesions were found.

Trauma/Pathology: There were no signs of pathology or trauma on the remains.

Conclusion: The remains were those of a female between 25 and 35 years of age. She had been approximately 157cm tall. No trauma or pathology was observed.

19. NANMUT152. DOD: Unknown

Burial location/position: Family members identified the grave of NANMUT152 on the northwestern side of a small hill, which was south of the single quarters residence camp. Several stones had been scattered over the grave, which measured 2.66m in length and 1.90m in width. Underneath the grave dressing, a rectangular shaped grave pit was found and measured 1.50m in length, 52cm in width and 1.25m in depth. The skeleton had been placed in a flexed position. A large spoon and several pieces of copper and iron bangles were found with the remains.

Family information: Not available.

Preservation: The remains were in a poor condition. Fragments of the cranium, claviculae, humeri, radii, ulnae, femora, tibiae and fibulae were recovered. No scapulae, ribs, vertebrae, pelvis, sacrum, or hands and feet were retrieved.

Sex: A high forehead, round skull vault and small mastoid process were observed. The shafts of the femora had a gracile appearance. These characteristics are suggestive of a female.

Age: All the cranial sutures were open. None of the teeth showed signs of wear. From this evidence, it was suggested that the individual had been between 25 and 35 years of age.

Stature: Due to the poor preservation of the long bones, stature was not determined.

Dentition: The upper right central incisor and lower second molars had been lost antemortem. The upper right second incisor was lost postmortem. Periapical abscesses were observed in both the maxilla and the lower right M2. A carious lesion noted on the occlusal surface of the lower left M3. There were no enamel hypoplastic lesions.

Trauma/Pathology: Excluding dental abscesses, no trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 25 and 35 years of age. No trauma or pathology was observed.

20. NANMUT153. DOD: Unknown

Burial position/location: Family members identified the grave of NANMUT153 on the northwestern part of a small hill, which was south of the single quarters residence camp. Several loose stones, which had been packed into an oval shape, marked the location of the grave. The grave measured 2.52m in length and 2.61m in width. Underneath the grave dressing, a rectangular shaped grave pit was exposed and measured 2.11m in length, 92cm in breadth and 1.10m in depth. Fragments of human remains were found in association with ten diagnostic potsherds, 38 non-diagnostic potsherds, six iron keys, one iron object, three pieces of glass and several miscellanous pieces of iron.

Family Information: The family members indicated that the grave belonged to an old man of 96 years of age.

Preservation: The remains were in an extremely poor condition. Fragments of the mandible, humeri, femora, tibiae and 19 teeth were recovered.

Sex: Sex could not be determined from the available osteological evidence.

Age: All the teeth had moderate to severe wear. It was tentatively suggested that the individual had been more than 40 years of age.

Stature: Stature was not determined due to the poor preservation of the remains.

Dentition: The upper right I1, I2, C, P1, P2, M2 and M3, the upper left I1, P1, P2, M1 and M2, the lower right I1, I2, C, P1, and the lower left I1, M1 and M2 were recovered. The lower left M3 had been lost antemortem. A carious lesion was also noted on the lingual surface of the upper right P1. Since the teeth had been worn, it was not possible to assess for the presence or absence of enamel hypoplastic lesions.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were those of an adult over 40 years of age.

21. NANMUT157. DOD: UNKNOWN

Burial location/position: Members of the community identified the grave of NANMUT157 on a slope north of the Luvhuvhu River, 1.6 km from the dam wall and 30 m north of the grave of NANMUT155. The oval shaped grave dressing had been constructed of irregular stones and measured 2.28 m in length and 1.40 m in width. A pocketknife, key, two non-diagnostic potsherds and a fragment of a knobkierie were found underneath the stones. The grave pit had been oriented in an E/W direction and measured 1.22 m in length, 50 cm in breadth and 1.05 m in depth. The individual had been placed on the left side in a flexed position. His head had pointed north. No grave goods were found in association with the remains.

Family information: Not available.

Preservation: Condition of the remains was extremely poor. Extensive postmortem damage was observed on the cranium, right clavicula, scapulae, humeri, radii, ulnae, femoria tibiae, fibulae, and hands and feet. The left clavicula, ribs, vertebrae, sacrum, and pelvis were not recovered.

Sex: A prominent browridge, robust temporal line and large mastoids were observed. The femoral head diameter was wide, 46 mm. These features indicate a male.

Age: All the cranial sutures were obliterated. Moderate wear was observed on all the teeth. From this evidence, it was suggested that the individual had been between 45 and 60 years of age.

Teeth: Most of the mandibular teeth (right and left I1 – P1) and all of the maxillary teeth were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Stature: Stature was estimated by using the physiological length of the femur with Lundy's stature formula for male South African Negroids. Stature for this person was estimated at 164.5 ± 2.777.

Trauma/Pathology: The presence or absence of trauma or pathology was not observed due to the poor preservation of the remains.

Conclusions: The remains were possibly those of a male between 45 and 60 years of age. He had been approximately 165 cm tall.

22. NANMUT160. DOD: 1961

Burial location/position: NANMUT160 was part of a grave cluster that included NANMUT159, NANMUT161, NANMUT162, and NANMUT 163. All of these graves were situated approximately 100 m west of the northern footprint of the dam wall. The grave dressing of NANMUT160 had constructed from loose stones and measured 2m in length and 1.58 m in breadth. Three glass medicine bottles, one left shoe, two metal buttons, twelve non-diagnostic potsherds and miscellaneous glass fragments were collected from the graves surface. The grave pit was oval in shape and measured 1.86 m in length, 63cm in breadth and 1.10 m in depth. The individual had been placed in a supine position. The right hand had been positioned on the abdomen and the head orientated towards the east.

Family information: Family members indicated that the individual had been a female of 81 years.

Preservation: Condition of the remains was extremely poor. Six teeth and fragments of the cranium claviculae, humeri, radii, ulnae, femora, tibiae, and fibulae were found. No, scapulae, ribs, vertebrae, pelvis, sacrum, hands or feet were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: Signs of heavy wear were observed on all six teeth. The dentin was fully exposed, and the dental crowns were virtually non-existent. It was tentatively suggested that the person had been over 50 years of age.

Dentition: The upper right P1, M1, and M3, the upper left P1, the lower right P1, and the lower left C had been recovered. No carious lesions were observed. The presence or absence of enamel hypoplastic lesions was not scored due to the heavy dental wear.

Stature: Stature was not determined.

Pathology/Trauma: Since the condition of the remains was poor, the presence or absence of trauma or pathology was not assessed.

Conclusion: According to family members, the remains were possibly those of a female over the age of 50 years.

23. NANMUT163. DOD: 1968

Burial location/position: Family members identified NANMUT163 approximately 100 m west of the northern footprint of the dam wall and in association with five other graves, which included NANMUT159, NANMUT160, NANMUT161, and NANMUT162. The oval shaped grave dressing of NANMUT163 had been constructed of loose stones, which measured 2.98 m in length and 2.3 m in breadth. A large upright rock (possibly serving as a headstone) was found at the western end of the grave. The grave pit had a rectangular shape and measured 2.2m in length, 77 cm in breath, and 1.2 m in depth. The individual had been wrapped in a blanket and placed in a supine position. The left arm was placed on top of the abdomen, and the head was orientated towards the east. A clear plastic sheet lined the bottom of the grave. One solid copper bangle, five copper wire bracelets, one shell, one rubbing stone, one tin cup, 54 diagnostic potsherds, and 47 non – diagnostic potsherds were found in association with the remains. No family members were present at the gravesite.

Family information: Not available.

Preservation: Condition of the remains was poor. The cranium was relatively complete. Only fragments of the scapulae, long bones, ribs, vertebrae, sacrum, pelvis, hands and feet were recovered.

Sex: A high forehead, round skull vault, sharp orbital margins, small mastoids and absence of ramal flexture were observed. These features indicate a female.

Age: All the cranial sutures were obliterated. Moderate dental wear was observed on the molar teeth. From these features, it was estimated that the individual had been between 40 and 60 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right I1, I2, and PM2, and the upper left I1, I2, C, and PM2 were lost postmortem. The medial side of the left first molar had a carious lesion. Heavy deposits of calculus were found around the cementoenamel junction (CEJ) of upper and lower premolars and molars. No enamel hypoplastic lesions were noted.

Stature: On account of the poor preservation of the remains, stature was not estimated.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were those of a female between 40 and 60 years of age.

24. NANMUT169. DOD: 1965

Burial location/position: Family members identified the grave of NANMUT169 in the north-western corner of the DWAF administration block and approximately 700m from an abandoned road that used to lead to the single quarters camp. Several loose stones were used to mark the location of the grave, which measured 3.30m in length and 1.50m in breadth. Nine diagnostic potsherds, nine non-diagnostic potsherds, three fragments of a shoe, one coin, three shirt buttons, and an axe head were recovered from the surface of the grave. Beneath the grave dressing, an elliptical shaped grave pit was found and measured 1.84m in length, 64cm in breadth, and 90 cm in depth. The individual had been buried in a supine position with the head orientated toward the north. A chain and some coffin fragments were found in association with the skeleton.

Family information: The individual had been killed in a train accident. Family members indicated that the person had been a male of 96 years.

Preservation: Condition of the skeletal remains was fair. All the bones were recovered. Extensive postmortem damage was observed on the cranium, ribs, vertebrae and pelvis.

Sex: The sciatic notch narrow, and the femoral head diameter large, 47 mm. These features indicate a male.

Age: The pubic symphyseal morphology was between a phase 6 and a phase 7 (30 – 39 years). Minimal to moderate dental wear was observed on the molars. Some osteophytic growth was noted on C6 and C7. From the above evidence, it was suggested that person had been between 30 and 40 years of age.

Dentition: None of the teeth had been lost antemortem. The upper central incisors, the lower right I1, I2, C, PM1, PM2, and the lower left I1 and I2 were lost postmortem. No carious lesions or enamel hypoplastic lesions were observed.

Stature: Stature was estimated by using the maximum length of the humerus with Lundy's stature formula for male South African Negroids. Estimated stature for this individual was 165.2 ± 3.834.

Trauma/Pathology: Perimortem trauma was noted in the cranium, pelvis, femora, tibiae and fibulae. Two separate fractures were observed on the cranium. The first had traversed from the frontal bone to the left parietal bone. The second had traveled from the right parietal bone to the occipital bone. Both the atlas (C1) and the vertebral body of C7 had fractures. The pelvis had been crushed. Two fractures were observed on the right femur; the first fracture was directly beneath the femoral head and the second was at the level of the mid-shaft. The left femur, tibiae, and fibulae also had fractures at the level of the mid-shaft.

Conclusion: The remains were those of a male between 30 and 40 years of age. He was approximately 165 cm tall. According to his relatives, he had died in a train accident.

25. NANMUT172. DOD: 1962

Burial location/position: Family members identified the grave of NANMUT172 on the north-western side of the DWAF administration block and approximately 700m south of an abandoned road that led to the single quarters camp. Several loose stones had been placed in a circle around the grave, which measured 3.20m in length and 1.58m in width. Three diagnostic potsherds and four non-diagnostic potsherds were found on the grave's surface. The grave pit was shaped like an elongated oval and measured 1.9m in length, 1 m in breadth, and 80cm in depth. The individual had been buried in a supine position with the head orientated toward the west.

Family information: The family indicated that the individual had been a male of 75 years.

Preservation: Condition of the remains was good. All the bones were recovered. However, the cranium, ribs, vertebrae, sacrum and pelvis had considerable postmortem damage.

Sex: The supraorbital torus was prominent. The sciatic notch was narrow and the femoral head diameter large (47 mm). These features indicate a male individual.

Age: All the cranial sutures had been obliterated. Moderate dental wear without dentin exposure was noted on the molars. Vertebral osteophytes were observed on both the cervical and lumbar vertebrae. From this evidence, it was tentatively suggested that the individual had been between 45 and 55 years of age.

Dentition: The upper canines, lower right I2, and lower left C, P1, and P2 had been lost antemortem. The upper I1, I2, the lower I1, the lower left I2 and the lower left M2 were lost postmortem. Carious lesions were recorded on the occulsal surface of the upper right

M2, upper left M2, lower right P2, M1, M2, and M3. No enamel hypoplastic lesions were observed.

Stature: Stature was estimated by using the physiological length of the femur and tibia with Lundy's formula for male South African Negroids. Estimated stature for this person was 171.4 cm ± 2.371.

Trauma/Pathology: Vertebral osteophytes were observed on the cervical (degree 2), thoracic (degree 1), and lumbar (degree 3) vertebrae. The vertebral body of L4 had a single schmorl node. On the right forearm, an unusual square shaped piece of bone, which extended from the ulna across to the radius, was observed. The aetiology for this bone growth is not known, but it is possible that injury to the periosteum of either the radius or ulna initiated osteoblastic activity in the area.

Conclusion: The remains were those of a male between 45 and 55 years of age. He had been approximately 171 cm tall.

26. NANMAC177. DOD: 1960

Burial location/position: Family members identified the grave of NANMAC177 on a slope near the Luvhuvhu River, which was approximately 150 m south of the main building of the agricultural college. The grave dressing was outlined by loose stones and measured 2.4 m in length and 1.7 m in width. Wire bracelets and 12 non-diagnostic potsherds were found on the surface of the grave. The grave pit had a rectangular shape and measured 1.88 m in length, 94 cm in breadth, and 98 cm in depth. The body had been placed in a flexed position with the head orientated towards the south. A copper wire bracelet was found on the left femur. No other grave goods were present.

Family information: Not available.

Preservation: The remains were in a fair condition. The cranium was complete. The scapulae, ribs, long bones and pelvis had extensive postmortem damage. The vertebrae, hands, and feet were not recovered.

Sex: A high forehead and round cranial vault were observed. The sciatic notch was wide. These features indicate a female.

Age: The cranial synchondrosis was partially fused. All the teeth had minimal to moderate wear. Minute patches of dentin were exposed on the upper molars. From this evidence, it was suggested that the individual had been between 25 and 35 years of age.
Stature: Stature was estimated using the physiological length of the tibia in conjunction with Lundy's stature formulae for female South African Negroids. Stature for this person had been estimated at 158.9cm ± 2.78.
Dentition: The lower right M3 and lower left M1, M2, and M3 had been lost antemortem. None of the teeth were lost postmortem. The upper right M2, lower right C, M1, and M2 had carious lesions. Linear enamel hypoplasias were observed on the upper and lower incisors and the lower canines.
Trauma/Pathology: No traumas or pathology were noted.
Conclusions: The remains were those of a female between 25 and 35 years of age. She had been approximately 159 cm tall. Carious lesions were common, and enamel hypoplasias were found on the upper and lower incisors and the lower canines.

27. NANMAC178. DOD: 1951

Burial location/position: Family members identified the grave of NANMAC178 on a small foothill next to the grave of NANMAC179 and approximately 150 m south of the main building of the agricultural college. The grave pit was oval in shape and measured 99 cm in length, 73 cm in breadth, and 1.14 m in depth. The body had been placed on the left side in a flexed position with the head orientated towards the south. No grave goods were present.
Family information: The family members indicated that the individual had been a male between 70 and 80 years of age.
Preservation: The remains were in a poor condition. Six teeth, fragments of the cranium and long bones were recovered. No vertebrae, ribs, sacrum, pelvis, fibulae, hands or feet were found.
Sex: Sex could not be determined from the osteological evidence.
Age: All six teeth had moderate to heavy wear. From this scanty information, it was suggested that the individual could have been between 30 and 60 years of age.
Stature: Due to the poor preservation of the remains stature was not determined.

Dentition: Only the upper right I1, I2, and C, and the upper left M1, M2, and M3 were recovered. The lower right I1, I2, and C had been lost antemortem. No carious lesions or enamel hypoplastic lesions were observed.
Trauma/Pathology: Slight sub-periostal growth was noted on the distal tibiae.
Conclusion: The remains were possibly those of a male between 30 and 60 years of age. Sub-periosteal lesions were observed on the distal tibiae.

28. NANMAC181. DOD: 1930

Burial location/position: Family members identified the grave of NANMAC181 in a thicket of naboom approximately 50 m east of a road leading to the northern gate of the Madzwhandila Agricultural College. Loose stones outlined the grave, which measured 2.2m in length and 1.75 m in width. In the center of the grave, a broken ceramic pot and a rusted metal washbasin were found. Beneath the grave dressing, an oval shaped grave pit was exposed and measured 1.71 m in length, 50 cm in width, and 1.3 m in depth. The individual had been wrapped in a blanket. The body had been placed on the left side in a flexed position with the head orientated towards the east. Excluding the blanket, no grave goods were present.
Family information: Family members indicated that the individual had been a male of approximately 40 years.
Preservation: The entire skeleton was found, but all the remains had extensive postmortem damage.
Sex: A square menton and ramal flexure were observed. The femoral head diameter was large, 47mm. These features indicate a male.
Age: Dental wear was slight to moderate. Small patches of dentin were exposed on the molar teeth. It was suggested that the person had been over 30 years of age.
Stature: On account of the poor preservation of the remains, stature was not determined.
Dentition: The lower incisors, canines, right first and second premolars had been lost antemortem. The entire maxilla had been lost postmortem. No caries or enamel hypoplasias were observed.
Trauma/Pathology: The presence of absence of trauma or pathology was not assessed.
Conclusion: The remains were those of a male over 30 years of age.

29. NANBUD190. DOD: 1985

Burial style/position: Information is not available.

Family information: Not available.

Preservation: Condition of the remains was poor. Ten teeth, the cranium, scapulae, long bones and pelvis were found but had considerable postmortem damage. No claviculae, sacrum, vertebrae, hands or feet were recovered.

Sex: The external occipital protuberance was well pronounced, the sciatic notch narrow and the femoral head diameter wide (46 mm). These features indicate a male.

Age: Moderate dental wear was observed on the molars. The left elbow had signs of osteoarthritis. From this evidence, it was suggested that the person had been between 35 and 45 years of age.

Dentition: Only the upper right I2, C, P1, and P2, the upper left I2, the lower right M1 and M2, and the lower left P1, M1, and M2 were recovered. Heavy calculus deposits were noted on all the teeth. No carious or enamel hypoplastic lesions were present.

Stature: Stature was estimated by using the maximum length of the radius with Lundy's stature formulae for male South African Negroids. Estimated stature for this person was 171.17 cm ±. 3.543.

Trauma/Pathology: The left elbow showed signs of mild osteoarthritis.

Conclusion: The remains were possibly those of a male between 35 and 45 years of age. He had been approximately 170 cm tall. Mild osteoarthritis was noted on the left elbow.

30. NANMUT195. DOD: UNKNOWN

Burial location/position: The grave of NANMUT195 was located at the dam basin approximately 400 m from a perennial stream. Several loose stones had been used to construct a grave dressing. A single upright stone had been placed at the northern end of the grave. Among these loose stones, a few small bottles, non – diagnostic potsherds, two car tyres and a plastic comb were found. Beneath the grave dressing, the grave pit was rectangular in shape and measured 1.78 m in length, 45 cm in width, and 1.10 m in depth. A brown blanket had been wrapped around the body, which lay in a flexed position with the head orientated northwest.

Family information: Not available.

Preservation: All the skeletal remains were recovered and were in an excellent condition. Some postmortem damage was observed on the ribs.

Sex: A high forehead, sharp orbit margins, and small mastoids were observed. The sciatic notch, and sub-pubic angle were wide, and the femoral head diameter was small (41 mm). These features indicate a female.

Age: All the cranial sutures, except for the lamboidal and sphenoid sutures were obliterated. Dental wear minimal on the molar teeth such that none of the dentin had been exposed. However, the incisors and canines were heavily worn. Slight vertebral osteophytes were noted on the cervical vertebrae. From this evidence, it was suggested that the individual had been between 35 and 45 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right I1, I2 and the upper left I1, I2, and C had been lost postmortem. Carious lesions were observed on the occlusal surface of both the upper left P1 and the lower left P2. No enamel hypoplasias were found.

Stature: Stature was estimated from the physiological length of the femur and tibia in conjunction with Lundy's stature formula for female South African Negroids. Estimated stature was 164.12 cm ± 2.497.

Trauma/Pathology: Distinct asymmetry with regard to the shape of the neural arches and vertebral processes was observed on T6, T7, T8, T9 and T10. In addition, the lateral aspects of the vertebral bodies of T8, T9 and T10 were wedged shaped. The transverse processes of T11 and T12 were unusual such that they twisted backwards on the left side and twisted forward on the right side.

When the vertebrae were aligned with each other, it was possible to trace a curve in the spine. The curve started at T8, bent sharply to the right at T10 and continued in this manner until L5. This abnormal curve in the spine is indicative of idiopathic scolosis. Aufderheide and Rodriquez – Martin (1998) suggested that this is an inherited disease that can occur anytime between birth and adolescents.

Conclusion: The remains were possibly those of a female between 35 and 45 years of age. She had been approximately 165 cm tall. It is possible that she had suffered from idiopathic scoliosis.

31. NANMUL197. DOD: 1985

Burial location/position: Family members identified the grave of NANMUL197 approximately 7m east of the Tshamukavhuli perennial stream in the Mulenzhe village. A small mound of loose stones marked the grave and measured 3.04m in length, 1.92m in width and 45cm in height. Twenty-seven non-diagnostic potsherds and eight decorated potsherds were found among these stones. Underneath the grave dressing, the grave pit was rectangular in shape and measured 2.4m in length, 1.3m in width and 1 m in depth. The body had been buried in a supine position with the head orientated towards the north. Two blankets, nails and wooden fragments, which had belonged to a coffin, were recovered with the remains.

Family information: The family indicated that the individual had been a female who had been over 75 years old.

Preservation: All the bones had been recovered and were in a good condition, except for the ribs and pelvis and ribs, which had considerable postmortem damage.

Sex: Small mastoids, sharp orbital margins, no external occipital protuberance and no ramal flexure were observed. The sciatic notch was indeterminate in size, the sub-pubic angle was wide, and the femoral head diameter was smallish (41 mm). These features tentatively suggest a female.

Age: Most of the cranial sutures were partially or fully obliterated, except for the lambdoidal suture which was open. The dentin was completely exposed on the molar teeth. The 1^{st} rib had ossified to the manubrium. From this evidence, it was suggested that the individual had been over 50 years of age.

Stature: Stature was estimated using the physiological length of the femur and tibia in conjunction with Lundy's stature formula for female South African Negroids. Estimated stature was 161.5 cm ± 2.371.

Dentition: The lower left M2 had been lost antemortem. Both the upper central and lateral incisors had been lost postmortem. The upper right P1 had a carious lesion on the occlusal surface. Since calculus deposits were heavy, the presence or absence of enamel hypoplastic lesions was not scored.

Trauma/Pathology: Vertebral osteophytes were noted on three of the vertebrae (one cervical and two thoracic) (degree 2).

Conclusion: The remains were those of a female over 50 years of age. She had been approximately 162 cm tall. Mild vertebral osteophytes were observed.

32. NANMUL202. DOD: 1964

Burial location/position: Family members identified the grave of NANMUL202 approximately 10 m south of a ploughed field and 70m southwest of the last single-room hut in the Mulenzhe village. Several loose stones had been packed small mound on top of the grave and measured 3.05m in length and 2.08m in breadth. Three non-diagnostic and two diagnostic potsherds were recovered from the grave's surface. Beneath the grave dressing, the grave pit was rectangular in shape and measured 1.7m in length, 58 cm in width and 1.2 m in depth. The body had been placed on the left side in a flexed position with the head orientated towards the north. No grave goods were found.

Family information: Family members indicated that the individual had been a female of 64 years.

Preservation: The condition of the remains was fair. The cranium, scapulae, pelvis, vertebrae, and ribs were fragmented. The long bones, hands and feet were complete, except for the right radius, right tibia, both fibulae and the right calcaneus.

Sex: Small mastoids, a round skull vault, and a wide sciatic notch were observed. The femoral head diameter was narrow, 41mm. These features indicate a female.

Age: The cranial sutures were obliterated. Dental wear was moderate. The costocartilage of the 1st rib had ossified to the manubrium. From this evidence, it was suggested that the individual had been over 50 years of age.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 154.03 cm ± 2.497.

Dentition: The upper left I1, I2, and M2, the lower right M2 and M3, and the lower left M1 and M2 had been lost antemortem. The upper right C, M2, and M3 and the lower central incisors were lost postmortem. A carious lesion was noted on the distal side of the upper right P1, the medial side of the upper left P1, and the occlusal surface of the upper left M3. No enamel hypoplasias were observed.

Trauma/Pathology: C3 – C6 had eburnation of the apophyseal joints of the vertebrae. The vertebral bodies of C3-C6 had advanced osteophytes (degree 3). Severe osteophytes (degree 3) were also observed on four thoracic vertebrae and four lumbar vertebrae. Osteoarthritis was found on the left elbow joint.

Conclusion: The remains were those of a female over 50 years of age. She had been approximately 154cm tall. Osteoarthritis was noted on the left elbow, and advanced vertebral osteophytes were observed on the spine.

33. NANMUL203. DOD: 1965

Burial location/position: Family members identified the grave of NANMUL203 approximately 10 m south of a ploughed field and 70m southwest of the last single-room hut in the Mulenzhe village. Several large stones had been packed on top of the grave, which measured 2.5m in length and 2.1m in width. Two non-diagnostic potsherds were found on the grave's surface. The grave pit had a rectangular shape that measured 1.87m in length, 67cm in breadth and 1.18m in depth. The individual had been wrapped in a blanket, placed in a supine position and the head had been orientated towards the south. No grave goods were found.

Family information: Family members indicated that the individual had been a male of 74 years.

Preservation: The condition of the remains was fair. All the bones had been recovered. However, the cranium, scapulae, ribs, vertebrae, pelvis right humerus, left femur, both fibulae had postmortem damage.

Sex: A low forehead, narrow sciatic notch and relatively robust long bones were observed. These features indicate a male.

Age: Dentin was exposed on all the teeth. Advanced vertebral osteophytes were observed. From this evidence, albeit minimal, it was suggested that the individual had been over 50 years of age.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 170cm ± 2.371.

Dentition: The upper right M2, the upper left M1, the upper left M2, the lower right M1, M2 and M3 and the lower left M1, M2 and M3 had been lost antemortem. A carious lesion was observed on the upper left M3. Both the upper right P2 and lower right C had periapical abscesses. The presence of enamel hypoplasia was not assessed due to the heavy dental wear.

Trauma/Pathology: Mild eburnation was observed on the apophyseal joints of C3, C4 and C5. Vertebral osteophytes were also noted on C3 – C7 (degree 2), T11 – T12 (degree 4), and two lumbar vertebrae (degree 4).

Conclusion: The remains were those of a male over 50 years of age. He had been approximately 170cm tall. Vertebral osteophytes were observed in the cervical, thoracic and lumbar regions.

34. NANMUL222. DOD: 1966

Burial location/position: Family members identified the grave of NANMUL222, within a thicket of bushes near the Tshamukavhuli stream on the western side of the Mulenzhe village.

Several stones outlined the grave, which measured 2.25 m in length, 1.25 m in width, and 15 cm in height. The grave pit was rectangular in shape and measured 1.94 m in length, .66 m in breadth, and 1.4 m in depth. The individual had been placed in a supine position with the hands resting on the abdomen. The head was orientated towards the south. The sole of a left shoe was found in association with the remains.

Family information: Family members indicated that the individual had been an old man.

Preservation: The condition of the remains was poor. Only fragments of the cranium, humeri, femora, tibiae, and pelvis were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: Dental wear was moderate on all the teeth. However, only the dentin on the anterior teeth had been exposed. From the evidence, albeit minimal, it was suggested that the individual had been between 30 and 40 years of age.

Dentition: Eighteen teeth were recovered and included the upper right I2, C, P1, P2, and M1, the upper left I2, C, P1, P2, M1, and M2, the lower right P2, M1, and M3, and the lower left C, P2, M1, and M2. Carious lesions were recorded on the occlusal surface of the upper first molars, upper left third molar and lower right first molar. Linear enamel hypoplasias were found on the lower second incisors, lower canines and the upper left canine.

Stature: Stature was not determined due to the poor preservation of the remains.

Pathology/Trauma: No trauma or pathology was observed on the remains.

Conclusion: The remains were possibly those of a male between 30 and 40 years of age. Carious lesions were observed on the molars, and enamel hypoplasias were most prominent on the lower second incisors and canines. No pathology or trauma was observed.

35. NANMUL261. DOD: 1983

Burial location/position: Family members identified the grave of NANMUL261 near several single room huts and 3m from the cattle kraal in the Mulenzhe village. Large rocks, which had been packed into an oval shape, marked the location of the grave that measured 3.2m in length and 1.9m in width. On the western end of this structure, a rock had been placed upright – perhaps to serve as a headstone. No grave goods were found on the surface. The grave pit was rectangular in shape and measured 2.3mm length, 91cm in breadth and 1.5m in depth. The individual had been covered in a white plastic hospital bag, wrapped in a blanket and placed into a coffin. The coffin had also been covered with a blanket.

Family information: Family members indicated that the individual had been male of 58 years.

Preservation: Condition of the remains was good. All the bones were recovered with minimal postmortem damage

Sex: A low forehead, large mastoids, smooth orbital margins and ramal flexure were noted in the cranium. The sciatic notch was narrow, and the femoral head diameter was wide, 44mm. These features indicate a male.

Age: All the cranial sutures were obliterated. Dental wear was moderate on all the teeth. Vertebral osteophytes were noted on the cervical vertebrae. From this evidence, it was suggested that the person had been between 40 and 60 years of age.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 161.6cm ± 2.371.

Dentition: The upper right I1, I2, C, P1, P2, M1, upper left I1 and I2, lower right I2, C, P1, P2, M3 and lower left M3 had been lost antemortem. None of the teeth were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Trauma/Pathology: A healed fracture was noted in the mandible. A surgical wire had been placed between the right mandibular ramus and the mandibular body.

Conclusion: The remains were those of a male between 40 and 60 years of age. He had been approximately 162 cm tall. A healed fracture was observed in the mandible.

36. NANMUL267. DOD: 1984

Burial location/position: Family members identified the grave of NANMUL267 approximately 10 m-northwest of a donga that separated the Baragsi village from the Mulenzhe village. Large stones, which had been packed in an oval shape, marked the location of the grave and measured 3.12m in length and 1.85m in width. A bed frame with two legs was found on the surface of the grave. The grave pit measured 2.50m in length, 1.05m in width and 1.70m in depth. The individual had been wrapped in a blanket and placed in a coffin. The right hand had been placed on the abdomen and the head orientated towards the south. No grave goods were found.

Family information: Family members indicated that the individual had been a male of 72 years.

Preservation: The remains were in a fair condition. Extensive postmortem damage was noted on the cranium, claviculae, ribs, right ulna, right radius, sacrum and pelvis. The remaining bones were recovered with minimal postmortem damage.

Sex: A prominent browridge, sloping forehead, elongated skull vault, and robust menton were observed. The sciatic notch was narrow, and the femoral head diameter was wide (48mm). These features indicate a male.

Age: All the cranial sutures had been obliterated. All the teeth had moderate dental wear. Vertebral osteophytes were observed on both the cervical and lumbar vertebrae. From these features, it was suggested that the individual had been over 40 years of age.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 176.41 cm ± 2.371.

Dentition: The upper central incisors had been lost antemortem. The upper left I2, C and the lower left C and PM2 were lost postmortem. No carious lesions were observed. The presence or absence of enamel hypoplasias were not scored due to heavy calculus deposits on the teeth.

Trauma/Pathology: This person had bony lesions in the cranium that were possibly related to *facies leprosa.* Absorption (or atrophy) of the maxilla, antemortem loss of the upper central incisors and destruction of the bony palate were observed. None of these lesions had remodeled. In addition, two lesions that are suggestive of osteomyelitis were also noted. The first lesion was found on the upper right humerus around the insertion site for the tendon of the deltoid muscle. This lesion was on the anterior-lateral aspect of the bone, had an elongated shape, sharp edges and was destructive in appearance. Adhesive from a bandage was observed over the lesion, which suggests that the infection had been active at the time of death. The second lesion was recorded on the distal aspect of the left femur. The anterior and posterior aspect of the femur had an enlarged appearance due to the irregular deposition of sub-periosteal bone. Towards the middle of the lesion, a small cloaca was observed. The proximal aspect of the left femur had a normal appearance.

Conclusion: The remains were those of a male over 40 years of age. He had been approximately 178 cm tall. He may have been afflicted with leprosy and secondary osteomyelitis.

37. NANMUL268. DOD: 1984

Burial location/position: Family members identified the grave of NANMUL268 in a mielie field on the eastern boundary of the Mulenzhe village. Several stones outlined the grave, which measured 3m in length and 2.2 m in width. Five coins, a plastic bead, and one drinking pot were found on the surface of the burial. The grave pit was rectangular in shape and measured 2.3 m in length, 87 cm in width, and 1.6 m in depth. The individual had been wrapped in three blankets and placed in a coffin. Six shirts, pants and a leather belt were found associated with the remains.

Family information: Family members indicated that the individual had been a male of 38 years.

Preservation: Condition of the remains was fair. The cranium, femora and tibiae were complete. Considerably postmortem damage was observed on the remaining long bones and the pelvis. No scapulae, ribs, sacrum, vertebrae, hands or feet were found.

Sex: A low forehead, large mastoids and ramal flexure were observed. The sciatic notch was narrow, and the femoral head diameter was wide, 44 mm. These features indicate a male.

Age: The coronal, sagittal, and lambdoidal sutures were partially obliterated. Moderate dental wear was observed on all the teeth. From these features, it was estimated that the person had been between 25 and 45 years of age.

Dentition: None of the teeth had been lost antemortem. The upper left I1 and I2 were lost postmortem. No calculus deposits were present. A carious lesion was observed on the lingual surface of the upper right M2. No enamel hypoplastic lesions were noted.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 163.34 cm ± 2.371.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a male between 25 and 45 years of age. He had been approximately 163 cm tall. No trauma or pathology was observed.

38. NANMUL275. DOD: Unknown

Burial location/position: NANMUL275 had been buried in a plough field approximately 10m from his house. Loose stones, which had been packed into an oval shaped, marked the location of the grave and measured 2.6m in length and 1.8m in breadth. Several grave goods were found on the surface of the burial and included a hand saw, 2 old boots, 3 glass bottles, fragments of a bicycle tyre, wire fragments, 3 non – diagnostic potsherds, and a 20c coin. The grave pit was oval in shape and measured 1.2 m in length, 38 cm in breadth, and 1.25 m in depth. The individual had been wrapped in a blanket and placed in a sitting position. The upper body rested against the western wall of the grave pit, the arms were flexed, the legs were extended and the head was orientated towards the east. No other grave goods were recovered.

Family information: The family members indicated that the individual had been a male of 90 years.

Preservation: Condition of the remains was fair. The cranium was well preserved. However, only the long bones shafts and fragments of the scapulae, ribs, vertebrae, hands and feet were recovered.

Sex: A low forehead, blunt orbital margins, a pronounced temporal line, a distinct external occipital protuberance, ramal flexure, and gonial eversion were noted. These features are suggestive of a male person.

Age: Most of the cranial sutures were obliterated. All the teeth were heavily worn. From these features, it was suggested that the individual had been over 50 years of age.

Dentition: The upper right M2 and M3, the upper left M3, the lower right P2 and M1, and the lower left I1 and M1 had been lost antemortem. The upper right I1, I2, and C were lost postmortem. Carious lesions were observed on the occlusal surface of the upper left M2, lower right M2 and M3, and lower left M2 and M3. Since dental wear was heavy, the presence or absence of enamel hypoplasia was not scored.

Stature: On account of the poor preservation of the remains, stature was not determined.

Trauma/Pathology: Osteoarthritis was observed on the right mandibular condyle and fossa. This is indicative of temporomandibular joint disease (TMJ), which has various aetiologies that include "developmental disturbance, birth injuries, infections from the middle ear, primary inflammation of the joint and a breakdown of the masticatory system"(Auferheide and Rodriguez-Martin 1998:400).

Conclusion: The remains were those of a male over 50 years of age. Osteoarthritis was observed on the right mandibular condyle and fossa.

39. NANMUL279. DOD: 1965

Burial location/position: Family members identified the grave of NANMUL279 underneath a large Marula tree in the northwestern corner of an empty stand in the Mulenzhe village. Loose stones lined the grave, which measured 2.98 m in length, 1.32m in width and 40 cm in height. No grave goods were found on the surface. The grave pit was oval in shape and measured 1.85 m in length, 55 cm in width, and 1.22 m in depth. The individual had been placed on several blankets in a supine position. The right arm had been placed across the pelvis and the head orientated towards the north. No grave goods were found.

Family information: Family members indicated that the individual had been a female of 84 years.

Preservation: Condition of the remains was poor. The cranium, scapulae, ribs, vertebrae, most of the long bones and pelvis had considerable postmortem damage. No hands or feet were found.

Sex: A high forehead and round skull vault was observed. The sciatic notch was wide, and the femoral head diameter was small, 39 mm. These features indicate a female.

Age: All the teeth were worn close to their roots. From this evidence, it was suggested that the individual had been over 50 years of age.

Teeth: The lower premolars and molars had been lost antemortem. The lower right C and the left I2 were lost postmortem. Eight teeth were recovered and included the upper right I1 and I2, the lower right I1 and I2, and the lower left I1 and C. A carious lesion was noted on the lingual side of the upper right I1.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 157.3 cm ± 2.497.

Trauma/Pathology: The vertebral bodies of three thoracic vertebrae had fused (degree 4). The left clavicle had fused to the acromion of the associated scapula. This may have been related to a traumatic injury or osteoarthritis.

Conclusion: The remains were those of a female over 50 years of age. She had been approximately 158 cm tall. The left clavicle had fused to the acromion of the associated scapula, and may be related to a traumatic injury or osteoarthritis.

40. NANMUL282. DOD: 1975

Burial location/position: Family members identified the grave of NANMUL282 on the eastern side of a single room in the Mulenzhe village. The infant had been buried near the cement guvha. No grave goods were found. The grave pit was oval in shape and measured 51cm in length, 35 cm in breadth, and 30 cm in depth. Two blankets, a shirt, a sweater and a pair of socks were found with the skeletal remains.

Family information: Family members indicated that the individual had been a female of 1 year.

Preservation: Condition of the remains was poor. Only a right femur, the pelvis, a radius, and an ulna were recovered.

Sex: Sex could not be determined due to the young age of the individual

Age: Age could not be determined due to poor preservation of the remains.

Dentition: No teeth were recovered.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possible those of a female infant.

42. NANMUL284. DOD: 1995

Burial location/position: Family members identified the infant grave of NANMUL284 in the guvha of a single room hut in the Mulenzhe village. Approximately 30 cm into the guvha, a round grave pit was identified and measured 32 cm in length and 27 cm in breadth. The infant had been wrapped in a white plastic hospital bag and a blanket. A placenta clip and a hospital bracelet were found with the remains.

Family information: The family members indicated that the infant had been female and had died shortly after birth.

Preservation: Condition of the remains was fair. The cranium, a single tooth germ, the right clavicle, scapulae, humeri, radii, ulnae, ribs, vertebral bodies, vertebral arches, iliac, femora, tibiae, fibulae, and three phalanges were recovered.

Sex: Due to the young age of the individual, sex could not be determined.

Age: The diaphyseal length of the femur was 44mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were those of a fetus (6 ½ lunar months).

Teeth: Only one tooth germ was found.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a fetus (6 ½ lunar months).

43. NANMUL286. DOD: 1967

Burial location/position: On the western side of the Mulenzhe village (600m north of the road leading to the Lufhale River) a cluster of six graves were found beneath a large tree grape. Among these graves, family members identified the burial of NANMUL286. Several loose rocks had been packed above the grave, which measured 2.9m in length and 1.8m in width.

Beneath the rocks, the grave pit was rectangular in shape and measured 1.9m in length, 44cm in width and 1.55m in depth. The person had been buried in a supine position. Four coffin handles were found in association with the remains. No grave goods were present.

Family information: Not available.

Preservation: Condition of the remains was good. The cranium, long bones, most of the vertebrae, hands and feet were recovered intact. Postmortem damage was observed on the scapulae, ribs, sacrum, and pelvis.

Sex: A low forehead, prominent browridge, elongated skull vault and ramal flexure were noted in the cranium. The sciatic notch was narrow. These features indicate a male.

Age: The pubic symphyseal morphology was a phase 6 (30-35). Few vertebral osteophytes were observed on the vertebral column. All the teeth had moderate to severe dental wear. From this evidence, it was tentatively suggested that the individual had been between 30 and 40 years of age.

Dentition: The upper right M2 and M3 and the upper left P2 and M1 had been lost antemortem. The upper right I1, upper left I1 and I2, the lower right C, and the lower left I1 and M1 were lost postmortem. A carious lesion was observed on the medial surface of the lower left M2. Since heavy dental wear was noted on the anterior teeth, the presence or absence of enamel hypoplasia was not scored.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 172.9 cm ± 2.271.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a male between 30 and 40 years of age. He had been approximately 173 cm tall. No trauma or pathology was observed.

44. NANMUL288. DOD: 1960

Burial location/position: Family members identified the burial of NANMUL288 among a cluster of six graves found beneath a large tree grape. The tree was located approximately 600m north of the road leading to the Lufhale River and on the western side of the Mulenzhe village. No formal grave dressing was present. Approximately 80cm beneath the surface, twenty-five teeth and fragments of a blanket were found.

Family information: Family members indicated that the individual had been a female.

Preservation: Condition of the remains was poor. Only the dentition was recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: None of the molar teeth had wear. The third molars had erupted. From this scanty evidence, it was suggested that the individual had been between 20 and 30 years of age.

Dentition: The upper right I1, I2, C, P1, and M3, the upper left I1, I2, C, P1, M1, M2, and M3, the lower right I1, C, P1, P2, M1, M2, and M3, and the lower left I2, P1, P2, M1, M2 and M3 were recovered. Linear enamel hypoplasias were observed on the upper incisors and canines and the lower right canine. None of the teeth had dental caries.

Conclusion: The remains were possibly those of a female individual who had been between 20 and 30 years of age. Linear enamel hypoplasias were found on the upper incisors, upper canines and the lower right canine.

45. NANMUL298. DOD: 1927

Burial location/position: Family members identified the grave of NANMUL298 on a small hill approximately 30m east of the Lufhale River in the Mulenzhe village. A pile of loose stones marked the location of the grave, which measured 2.7m in length and 1.3m in width. Twelve bangles, fifteen non-diagnostic potsherds and one spiral wire bracelet were found on top of the burial. The grave pit was oval in shape and measured 1.2m in length, 79cm in breadth and 94cm in depth. The body had been placed on the left side in a flexed position. The head was orientated towards the south. No grave goods were found with the remains.

Family information: Family members indicated that the individual had been a female over the age of 60.

Preservation: Condition of the remains was good. The cranium, scapulae, and long bones were found intact. Extensive postmortem damage was observed on the ribs, vertebrae, pelvis, sacrum, hands and feet.

Sex: A high forehead, round skull vault, small mastoids, gracile supraorbital torus and an absence of ramal flexure were noted. The sciatic notches were wide, and the femoral head diameter was small, 40 mm. These features indicate a female.

Age: All the cranial sutures were open except for the coronal and sagittal sutures, which were partially fused. All the molars had minimal wear. No vertebral osteophytes were observed. From this evidence, it was tentatively suggested that the individual had been between 25 and 35 years of age.

Dentition: The lower right premolar and both lower third molars had been lost antemortem. None of the teeth were lost postmortem. Two supernumerary mandibular premolars were recorded. Carious lesions were noted on the occlusal surfaces of both the lower second and supernumerary premolars, the lower left first premolar and the lower left first molar. No enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 156 cm ± 2.789.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a female between 25 and 35 years of age. She had been approximately 156 cm tall. Several carious lesions were found among the lower premolars and molars.

46. NANMUL314. DOD: 1993

Burial location/position: A mother identified the infant grave of NANMUL314 in the guvha of a single room hut in the Mulenzhe village. Approximately 50cm into the guvha, an oval shaped grave pit was exposed and measured 20cm in length and 15 cm in breadth. The infant had been wrapped in a white plastic hospital bag and placed in a standing position. The head was orientated towards the north. An umbilical clip and a hospital bracelet were found with the remains.

Family information: The family members indicated that the infant had been a female who died shortly after birth.

Preservation: Condition of the remains was good. Pieces of the cranium were recovered along with the left scapula, humeri, ulnae, seven vertebral bodies, 14 neural arches, the left iliac blade, the left ischium, femora, and tibiae. The claviculae, right scapula, radii, parts of the sacrum, fibulae, and hand and foot bones were not found.

Sex: Sex could not be determined from the osteological remains.

Age: The diaphyseal length of the femur was 55 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were those of a fetus (8 lunar months).

Dentition: No tooth germs were found.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a fetus (8 lunar months).

47. NANMUL322. DOD: 1998

Burial location/position: Family members identified the grave of NANMUL322 approximately 1.5m from the southeastern side of a single room hut in the Mulenzhe village. The grave pit was oval in shape and measured 1.32m in length, 80 cm in breadth and 72 cm in depth. The individual had been wrapped in a blanket and placed in a coffin. The head was orientated towards the west.

Family information: Family members indicated that the infant had been a female.

Preservation: Condition of the remains was excellent. Pieces of the cranium were found along with the scapulae, long bones, ribs, vertebrae, pelvis, hands and feet.

Sex: Sex could not be determined due to the young age of the individual.

Age: A dental eruption chart and development of the vertebral column were used to estimate age. The upper deciduous central incisors were partially erupted and the lower deciduous central incisors were fully erupted. No other teeth had erupted. In the vertebral column, the neural arches were fused to each other but had not fused to their associated centrums. From this evidence, it was suggested that the individual had been 9 ± 3 months of age.

Teeth: The deciduous upper central incisors, the lower central incisors and two molar tooth germs were found.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female who had been 9 ± 3 months old. No trauma or pathology was observed.

48. NANMUL335. DOD: 1968

Burial location/position: A mother identified the grave of her child NANMUL335 on the southern bank of the Levhuvhu River (approximately 300 m from the flow of the river and 800 m upstream from the Mulenzhe/Levhuvhu river bridge). Two large rocks marked the grave. The grave pit was oval in shape and measured 48cm in length, 76cm in breadth and 70cm in depth. The infant had been placed on the left side in a flexed position. The head had been orientated toward the east.

Family information: Family members indicated that the child had been a male.

Preservation: Condition of the remains was poor. Fragments of the skeleton, twelve deciduous teeth and four tooth germs were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. The upper deciduous incisors, upper canines and lower incisors had erupted. The upper first molars, lower canines and first molars were partially erupted. The lower second molars had not erupted. From this eruption sequence, it was suggested that the individual had been 18 ± 6 months of age.

Dentition: The upper right incisor had been lost antemortem. Both upper canines were lost postmortem. No dental wear, carious lesions or enamel hypoplastic lesions were observed.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a male who had been 18 ± 6 months of age.

49. NANMUL336. DOD: 1963

Burial location/position: Family members identified the grave of NANMUL336 about 50m south of the Post Office in the Mulenzhe village. No formal grave dressing was found. The grave pit was rectangular in shape and measured 1.7m in length, 50cm in breadth and 1.1m in depth. The individual had been buried in a supine position with the head orientated northeast. Twelve diagnostic and fifteen non-diagnostic potsherds were found in association with the remains.

Preservation: Condition of the remains was excellent. All the bones were recovered. Slight postmortem damage was noted on the cranium, ribs, pelvis and sacrum.

Sex: A high forehead, round skull vault, sharp supra-orbital margins and an absence of ramal flexure was noted. The sub-pubic angle was wide, the inferior pubic ramus was thin and gracile, and the sciatic notch was wide. The femoral head diameter was narrow (35 mm). These features indicate a female.

Age: Unfortunately, the pubic symphysis, auricular surface, and the sternal ends of the ribs had been damaged postmortem and could not be used to estimate age. The cranial synchondrosis was fused, and all the cranial sutures were open. No vertebral osteophytes were observed. The molar teeth had minimal wear. From this evidence, it was suggested that the individual had been between 25 and 35 years of age.

Dentition: There was no antemortem or postmortem tooth loss. Carious lesions were recorded on the occlusal surfaces of the upper right M2 and lower left M3. No enamel hypoplasias were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 148.3 cm ± 2.497.

Trauma/Pathology: No signs of trauma or pathology were observed.

Conclusion: The remains were those of a female between 25 and 35 years of age. She had been approximately 149 cm tall. No trauma or pathology was observed.

50. NANMUL337. DOD: 1964

Burial location/style: Family members identified the grave of NANMUL337 about 50 m from the Post office in the Mulenzhe village. No formal grave dressing was present. The grave pit was rectangular in shape and measured 1.56m in length, 50cm and 1.40m in depth. The individual had been placed in a supine position with the right arm on the chest and the left arm on the abdomen. No grave goods were present.

Family information: Family members indicated that the individual had been a female of 96 years.

Preservation: Condition of the remains was good. The cranium, claviculae, right humerus, radii, left ulna, vertebrae, sacrum, right os coxae, femora, tibiae, fibulae, hands and feet were recovered. The scapulae, ribs, left humerus, right ulna, left os coxae, and left calcaneus were not found.

Sex: A high forehead, round skull vault, small mastoids, sharp supra-orbital margins and a small external occipital protuberance were observed. The sub-pubic angle was wide, and the femoral head diameter was narrow (40 mm). These features indicate a female.

Age: The pubic symphyseal morphology was between a phase 8 and 9. Moderate to severe vertebral osteophytes were observed in the cervical, thoracic and lumbar regions. Heavy dental wear was noted on all the teeth. From this evidence, it was suggested that the individual had been over 50 years of age.

Dentition: All the lower premolars and molars had been lost antemortem. The upper left I1 and I2, the lower right I1, and the lower left I1 and I2 were lost postmortem. On account of the heavy dental wear, the presence or absence of dental caries or enamel hypoplasia was not scored.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 156.3 cm ± 2.497.

Trauma/Pathology: A compressed fracture had occurred at the level of the eighth thoracic vertebra. None of the other vertebrae had compressed fractures. Vertebral osteophytes were noted on C2-C6 (degree 3), T1-T12 (degree 3), and L1-L4 (degree 3). The fifth lumbar had fused to the sacrum. A Schmorl node was observed on the superior aspect of T8. Sub-periosteal bone growth was observed on the distal end of the right tibia.

Conclusion: The remains were those of a female over 50 years of age. She had been approximately 156 cm tall. Severe vertebral osteophytes were observed throughout the spinal column, and the 8^{th} thoracic vertebrae had a compressed fracture. Sub-periosteal bone growth was noted on the distal end of the right tibia.

51. NANMUL344. DOD: 1973

Burial position/location: Family members identified the infant grave of NANMUL344 on the eastern side of a single room hut in the Mulenzhe village. The infant had been buried inside the guvha of the hut. Approximately 50 cm into the guvha, an oval shaped grave pit was exposed and measured 70 cm in length and 35cm in breadth. The infant had been wrapped in white plastic hospital bag, a cream coloured jersey and a blue blanket.

Family information: Family members indicated that the infant had been female.

Preservation: Condition of the remains was good. Pieces of the cranium along with two tooth germs and all the postcranial bones were recovered.

Sex: Sex could not be determined from the osteological remains.

Age: The mandibular symphysis was unfused. From this evidence, it was suggested that the individual had been less than 6 months of age.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female who had been less than 6 months of age.

52. NANMUL349. DOD: 1986

Burial location/position: Family members identified the infant grave of NANMUL349 in a single room hut in the Mulenzhe village. Approximately 50 cm into the guvha, an oval shaped grave pit was found that measured 80 cm in length and 30 cm in breadth. The body had been wrapped in a white plastic hospital bag and placed in a coffin. No grave goods were found.

Family information: Family members indicated that the infant had been a female who had died shortly after birth.

Preservation: Condition of the remains was fair. Pieces of the cranium along with claviculae, scapulae, ribs, humeri, a left radius, a right ulna, right femur, one neural arch, an iliac blade, tibiae, and fibulae were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: The mandibular symphysis was unfused. The diaphyseal length of the femur was 67 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were possibly those of a full term infant (9 ½ lunar months).

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female infant (9 ½ lunar months).

53. NANTSHIL359. DOD: 1994

Burial location/position: No information is available.

Family information: Family members indicated that the infant had been a female and had died shortly after birth.

Preservation: Condition of the remains was fair. Fragments of the cranium, one germ tooth, claviculae, left scapula, right humerus, left radius, ulnae, 14 ribs, 20 vertebral bodies, 17 pairs of neural arches, both pubic bones, both iliac bones, femora, tibiae and fibulae were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: The diaphyseal length of the femur was 77mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were those of a full term infant.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of female infant who had died shortly after birth.

54. NANMUL366. DOD: 1975

Burial location/position: Family members identified the grave of an infant, NANMUL366 in the guvha of a single room hut in the Mulenzhe village. The grave was demarcated by a medium sized rock. Approximately 47 cm into the guvha, an oval grave pit was exposed and measured 82 cm in length and 64 cm in breadth. The body had been wrapped in a blanket and placed on an orange piece of plastic. No grave goods were found.

Family information: Family members indicated that the child had been a male.

Preservation: Condition of the remains was poor. Only six deciduous teeth and seven tooth germs were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. The upper deciduous incisors had erupted. The deciduous molars were partially erupted. From this evidence, it was suggested that the individual had been 18 ± 6 months of age.

Dentition: Six deciduous teeth including the upper right di1 and di2, upper left dm1, lower right dm1 and dm2, and the lower left dm2 were found. Seven tooth germs including two permanent central incisors, two permanent lower canines, and three permanent lower incisors were also recovered. No carious or enamel hypoplastic lesions were observed on any of the teeth.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male who had been 18 ± 6 months of age.

55. NANMUL374. DOD: 1984

Burial location/position: Family members identified the grave of NANLMUL374 on the southern end of the stand in the Mulenzhe village and behind a series of single room huts. A cement slab and several medium sized stones had been placed on top of the grave, which measured 3.1 m in length and 1.6 m in width. A teapot, a clay bowl, a door latch and part of a chain were found on the surface of the grave. Underneath the grave dressing, a the grae pit was rectangular in shape and measured 2.42 m in length, 80 cm in breadth, and 2.45 m in depth. The body had been placed in a supine position. Several articles of clothing, an ABB Tobacco bag, and seven coins were found in association with the remains. Family members insisted on an immediate reburial.

Family information: Family members indicated that the individual had been a male of 74 years.

Preservation: Condition of the remains was fair. Autopsy marks were noted on the cranium. The claviculae, scapulae, ribs, vertebrae (three cervicals, three thoracics, four lumbars), long bones, sacrum, pelvis, as well as hands and feet were recovered.

Sex: Large mastoids, a square/robust menton and ramal flexure were noted. The sciatic notch was narrow, and the femoral head diameter was wide, 48 mm. These features indicate a male.

Age: All the teeth had severe dental wear. A few osteophytes were observed on the lumbar vertebrae. From this evidence, it was suggested that the individual had been between 40 and 60 years of age.

Teeth: The upper right I1, I2, M1, and M2, the upper left I1, I2, M1, and M3, the lower right I1, I2, C, and M2, and the lower left I1, I2, P2, M1, and M2 had been lost antemortem. Both upper canines and the lower left canine were lost postmortem. The upper left second molar had carious lesions on both the occlusal and buccal surfaces. The presence or absence of enamel hypoplasia was not scored.

Stature: The length of the humerus was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 172.3 cm ± 3.834.

Trauma/Pathology: Vertebral osteophytes were observed on L4 and L5 (degree 2). The remaining vertebrae had been poorly preserved and were not suitable for analysis.

Conclusion: The remains were those of a male between 40 and 60 years of age. He had been approximately 173 cm tall. Mild vertebral osteophytes were observed on the lumbar vertebrae.

56. NANMUL375. DOD: UNKNOWN

Burial location/position: Community members identified the grave of NANMUL375 in the Mulenzhe village. Several loose stones had been placed on top of the grave, which measured 2.6m in length and 1.2m in width. No grave goods were found. The grave pit was rectangular in shape and measured 2m in length, 66 cm in width, and 1.60 m in depth. The individual had been wrapped in a green blanket and placed inside a coffin. His head was orientated towards the west. Three shirts, a belt and a pair of pants were found in association with the remains.

Family information: Not available.

Preservation: Condition of the remains was fair. The cranium, scapulae, right clavicle, ribs, humeri, right radius, ulnae, vertebrae, sacrum, pelvis, tibiae, fibulae, hands and feet were recovered.

Sex: A slight browridge, sloping forehead, blunt supra-orbital margins, large mastoids, an external occipital protuberance, and ramal flexure were observed. The sciatic notch was narrow, and the femoral head diameter was large (47 mm). These features indicate a male.

Age: The cranial sutures were obliterated, and the dentin was exposed on all the molar teeth. The cervical and lumbar regions had advanced vertebral osteophytes (degree 3). From this evidence, it was suggested that the individual had been over 50 years of age.

Dentition: The upper left M1, lower right I1, I2, C, and lower left I1 and I2 had been lost antemortem. The upper left I2 and lower left C were lost postmortem. Carious lesions were recorded on the upper right I2, P1, upper left I1, P1, P2 and M2, and the lower M1's. The presence or absence of enamel hypoplastic lesions was not scored.

Stature: The length of the humerus was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 166.9 cm ± 3.834.

Trauma/Pathology: Healed multiply fractures were observed on the femora. The fracture on the right femur had occurred just below the femoral neck, and on the left femur at the level of the mid-shaft. Large calluses had formed around both fracture sites and several cloacae were noted within these calluses. The presence of cloacae implies an infection in the bone (osteomyelitis) and suggests that these may have been open fractures, which are fractures that have been exposed to the external environment. Although the individual survived the event, he would have needed extensive care and support from the community.

Conclusion: The remains were those of a male over 50 years of age. He had been approximately 167 cm tall. Healed multiple compound fractures were noted on both femora.

57 NANMUL393. DOD: 1998

Burial location/position: Family members identified the infant grave of NANMUL393 in the guvha of a cooking hut in the Mulenzhe village. Upon removal of a section of the guvha, an oval shaped grave pit was exposed that measured 50 cm in length and 27cm in breadth. The infant had been buried in a white plastic hospital bag. The head was orientated in a north-south direction. No grave goods were present.

Family information: Family members indicated that the infant had been a female and had died shortly after birth.

Preservation: Condition of the remains was excellent. Pieces of the cranium along with one tooth germ, claviclae, scapulae, humeri, radii, ulnae, femora, tibiae, 15 neural arches, four vertebral bodies, 18 ribs and 11 phalanges (from both the hands and feet) were found inside the white plastic hospital bag.

Sex: Sex could not be determined.

Age: The diaphyseal length of the femur was 54 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were possibly those of a fetus (7 ½ to 8 lunar months).

Trauma/Pathology: No traumas or pathology were observed.

Conclusion: The remains were possible those of a female fetus (7 ½ to 8 lunar months).

58. NANMUL398. DOD: 1999

Burial location/position: Family members identified the infant grave of NANMUL398 in the guvha of a cooking hut in the Mulenzhe village. Approximately 58cm into the guvha, an oval shaped grave pit was found and measured 70cm in length and 32cm in width. The individual had been wrapped in a blue blanket and was in an upright position. The head had orientated towards the north. No grave goods were found.

Family information: Family members indicated that the infant had been a female of 13 months.

Preservation: Condition of the remains was excellent. Fragments of the cranium, claviculae, scapulae, ribs, humeri, radii, ulnae, sacrum, pelvis, femora, tibiae, fibulae, the left calcaneus, 22 neural arches, 11 vertebral bodies, and phalanges (from both the hands and feet) were recovered.

Sex: Sex could not be determined from the osteological evidence

Age: The mandibular symphysis was partially fused. The palatine suture was unfused. The upper central incisors had started to erupt. From this evidence, it was suggested that the individual had been 9 +/- 3 months of age.

Teeth: All the deciduous tooth germs were present.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female who had been 9 ± 3 months of age.

59. NANMUL405. DOD: 1990

Burial location/position: Family members identified the infant grave of NANMUL405 on the southwestern side of a single room hut in the Mulenzhe village. Approximately 10cm into the guvha, the grave pit was found and measured 80cm in length and 43cm in breadth. The infant had been wrapped in a white plastic hospital bag and a green jersey.

Family information: Family members indicated that the infant had been a male and had died shortly after birth.

Preservation: Condition of the remains was fair. Only the humeri, a radius, an ulna, two iliac blades, femora, and tibiae were found.

Sex: Sex could not be determined from the osteological.

Age: The diaphyseal length of the femur was 46 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were possibly those of a fetus (7 to 8 lunar months).

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possible those of a male fetus (7 to 8 lunar months).

60. NANMUL407. DOD: 1992

Burial location/position: Family members identified the infant grave of NANMUL407 in the guvha on the southwestern side of a single room hut in the Mulenzhe village. The grave pit was oval in shape and measured 50 cm in length and 30 cm in breath. The body had been wrapped in a white plastic hospital bag and two blankets. The entire bundle was orientated in a north-south direction.

Family information: Family members indicated that the infant had been a female and had died shortly after birth.

Preservation: Condition of the remains was good. Pieces of the skull along with the claviculae, scapulae, seven ribs, several neural arches, humeri, ulnae, radii, femora, tibiae, and fibulae were present.

Sex: Sex could not be determined from the osteological evidence.

Age: The mandibular symphysis was unfused. From this evidence, it was suggested that the infant had been less than 6 months of age.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female who had been less than 6 months old.

61. NANMUL428. DOD: 1987

Burial location/position: Family members identified the grave of a child in the guvha of a single room hut in the Mulenzhe village. Approximately 10cm into the guvha, an oval shaped grave pit was found and measured 66 cm in length and 27 cm in breadth was exposed. The infant had been wrapped in a pink and white dress, and the body had placed on blanket.

Family information: Family members indicated that the child had been a female of 1 year.

Preservation: Condition of the remains was poor. Only fragments of the cranium, right femur, right tibia, right ulna, the right radius, and several ribs were recovered.

Sex: Sex could not be determined from the osteological remains.

Age: It was not possible to estimate age from the osteological evidence.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female infant.

62. NANMUL450. DOD: 1960

Burial position/location: Family members identified three graves (NANMUL449, NANMUL450, and NANMUL451) in a ploughed field on the eastern side of the Mulenzhe relocation area and approximately 40 m south of a road that leads to the old

Musanda. Several loose stone marked the grave of NANMUL450, which measured 2.0 m in length and 1.1 m in breadth. Four legs of a chair, two metal buckles, and one metal object were found on the surface of the grave. The grave pit had an elongated oval shape and measured 1.62m in length, 68 cm in breadth, and 50 cm in depth. The body had been placed in a supine position with the arms flexed across his chest. The head was orientated towards the north. A thick copper bracelet was found on the left arm.

Family information: Family members indicated that the individual had been a male of 70 years.

Preservation: Condition of the remains was poor. Fragments of the cranium, claviculae, scapulae, ribs, vertebrae, long bones, pelvis, hands, and feet were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: All the cranial sutures were obliterated. The dentin had been exposed on all the teeth. From this evidence, it was suggested that the individual had been over 50 years of age.

Dentition: The upper left first, second and third molars, and the lower second and third molars had been lost antemortem. The upper central incisors and lower lateral incisors were lost postmortem. The entire crown of the lower left P1 had been destroyed by dental caries. The presence or absence of enamel hypoplasia was not scored due to dental attrition.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to poor preservation of the remains.

Conclusions: The remains had been possibly those of a male over 50 years of age.

63. NANMUL451. DOD: 1955

Burial position/location: Family members identified three graves (NANMUL449, NANMUL450, and NANMUL451) in a ploughed field on the eastern side of the Mulenzhe relocation area and approximately 40 m south of a road that leads to the old Musanda. A pile of stones marked the location of the grave of NANMUL451 and measured 1.2 m in length and 1 m in breath. A fragmented tin cup, a teaspoon, and two potsherds were found on the surface of the grave. The grave pit was oval in shape and measured 1.21 m in length, 38 cm in breadth and 86 cm in depth. The body had been placed in a supine position with the head orientated northwest. No grave goods were found.

Family information: Family members indicated that the individual had been a male of 15 years.

Preservation: Condition of the remains was extremely poor. Only sixteen teeth (both permanent and deciduous) and two germ teeth were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. All the deciduous teeth had erupted and had considerable wear. Of the permanent dentition, the upper and lower M1 had erupted and the lower right I1 and I2 were partially erupted. From this evidence, it was suggested that the child had been 7 ± 2 years of age.

Dentition: No carious and no enamel hypoplastic lesions were observed on any of the teeth.

Trauma/Pathology: The presence or absence of any trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a male who had been 7±2 years of age.

64. NANMUL454. DOD: 1965

Burial location/position: Family members identified the grave of NANMUL454 in an open field north of the Mulenzhe health clinic. Several irregular shaped stones marked the location of the grave. A few potsherds were found on top of the grave. The grave pit was rectangular in shape and measured 1.7m in length, 62cm in breadth and 1.6m in depth. A piece of glass, a few potsherds and some unidentified pieces of metal were found in association with the remains.

Family information: Family members indicated that the individual had been a female over 50 years of age.

Preservation: Only the femora shafts were recovered from the grave.

Sex: Sex could not be determined from the osteological evidence

Age: The remains were those of an adult.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: According to family members, the remains were those of a female who had been over 50 years of age.

65. NANMUL455. DOD: 1948

Burial location/position: Family members identified the infant grave of NANMUL455 in an open field north of the Mulenzhe health clinic. Several loose stones had marked the location of the grave. The grave pit was oval in shape and measured 1.8m in length, 1.2 m in breadth and 1 m in depth. No grave goods were found.

Family information: Family members indicated that the infant had been a female.

Preservation: Condition of the remains was poor. Only 22 tooth germs and one deciduous tooth were recovered.

Sex: Sex could not be determined from the osteological remains.

Age: Age was determined from a dental eruption chart. Since the deciduous lower canine had erupted, it was suggested that the individual had been 18± 6 months of age.

Dentition: Of the 22 tooth germs, twelve were deciduous and ten were permanent. The twelve deciduous tooth germs included four second molars, four first molars, and four either first or second premolars. The permanent tooth germs included four canines, two upper central incisors, one upper lateral incisor, and three lower incisors.

Conclusion: The remains were possible those of a female who had been 18 ± 6 months of age.

66. NANMUL456. DOD: 1949

Burial location/position: Family members identified the grave of NANMUL456 in an open field northeast of Mulenzhe village. Several loose stones, which had been packed into oval shape, marked the location of the grave, which measured 2.9m in length, 2.1m in breadth and 30cm tall. A mattress spring, a bottle, a piece of iron, and a few potsherds were found on top of the grave. The grave pit measured 1.4 m in length, 80 cm in breath and 1.2 m in depth. The individual had been wrapped in a brown blanket and placed in a flexed position at the bottom of the burial. The head had been orientated to the north.

Family information: Family members indicated that the individual had been a male of 80 years.

Preservation: Condition of the remains was extremely poor. Only fragments of the cranium, long bones, hands, and feet were recovered. The claviculae, scapulae, sacrum, pelvis, ribs, and vertebrae had not been found.

Sex: The femoral head diameter was large, 46 mm. This feature indicates a male.

Age: All the cranial sutures were open. Minimal dental wear was observed on the molars. From this evidence, it was tentatively suggested that the individual had been between 25 and 35 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right I1 and I2 and the lower right M1, M2, and M3 were lost postmortem. No carious lesions were recorded. Due to time constraints, the presence or absence of enamel hypoplasia was not scored.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 176.9 cm ± 2.777.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a male between 25 and 35 years of age. He had been approximately 177 cm tall. No trauma or pathology was observed.

67. NANMUL457. DOD: 1956

Burial position/location: Family members identified the grave of NANMUL457 near a non-perennial stream northeast of the Mulenzhe village. Several medium size stones, which had been packed into an oval shape, marked the location of the grave, which measured 2.7m in length, 1.6m in width and 40cm high. Several potsherds and a glass bottle were found on the surface of the burial. The grave pit was rectangular in shape and measured 1.85m in length, 60cm in width and 1.2m in depth. A brown blanket covered the body, which had been placed in a supine position with the right hand on the abdomen.

Family information: Family members indicated that the individual had been a male of 91 years.

Preservation: Condition of the remains was poor. Extensive postmortem damage was observed on the cranium, humeri, radii, ulnae, femora, tibiae and fibulae. The claviculae, scapulae, vertebrae, ribs hands and feet were not recovered.

Sex: The femoral head diameter was wide, 47mm. This feature indicates a male.

Age: All the cranial sutures were obliterated. The molar teeth had moderate wear. From this evidence, it was suggested that the individual had been over 50 years of age.

Dentition: The lower incisors and canines had been lost antemortem. The lower premolars were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a male over 50 years of age. No trauma or pathology was observed.

68. NANMUL458. DOD: 1965

Burial location/position: Family members identified the grave of NANMUL458On the eastern side of the Mulenzhe relocation area, 350m west of Gwalala (a perennial stream) and 600 m south of a road that leads to the old Musanda,. An oval shaped structure made from large and medium size stones marked the location of the grave and measured 2.4 m in length, 1.8 m in width, and approximately 10 cm. Eight diagnostic potsherds and a tin plate were recovered from the surface of the grave. The grave pit had an elongated oval shape and measured 1.9m in length, 57 cm in breadth and 1.4 m in depth. The individual had been placed in a supine position. His head was pointed northwest.

Family information: Family members indicated that the individual had been a male of 35 years.

Preservation: Condition of the remains was extremely poor. Only twenty-eight teeth were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: Minimal amounts of dental wear were observed on the molar teeth. From this evidence, albeit scanty, age was estimated to have been between 20 and 40 years of age.

Dentition: Only the upper left P1 and P2, and the lower right I1 and I2 were not recovered. No carious lesions or enamel hypoplastic lesions were observed.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.
Conclusion: The remains were possibly those of a male who had been between 20 and 40 years of age.

69. NANMUL459. DOD: 1956

Burial position/location: Family members identified the grave of NANMUL459 on the eastern side of the Mulenzhe relocation area, west of the Gwalala perennial stream and south of the road leading to the old Musanda. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.5 m in length, 1.9 m in width, and approximately 20 cm high. Eleven non-diagnostic potsherds, ten diagnostic potsherds, one porcelain fragment, two fragments of animal bones, two 2c coins, thirteen 1c coins, three iron objects from a bed frame and a bed spring were found on top of the grave. The grave pit had an oval shape and measured 2.1 m in length, 70 cm in breadth and 1.2 m in depth. The body had been placed in a supine position with the head orientated towards the north.
Family information: Family members indicated that the individual had been a male of 55 years.
Preservation: Condition of the remains was fair. Extensive postmortem damage was observed on the claviculae, scapulae, ribs, humeri, ulnae, sacrum, vertebrae, pelvis, fibulae, hands and feet. However, the cranium, radii, femora, tibiae and foot bones were intact
Sex: A prominent browridge, low forehead, large mastoids and blunt supra-orbital margins were observed. The sciatic notch was narrow, and the femoral head diameter was large, 49mm. These features indicate a male.
Age: The cranial sutures were partially obliterated. Patches of dentin were exposed on the molar teeth. From this evidence, it was suggested that the individual had been between 40 and 60 years of age.
Dentition: The upper right P1 and M1, upper left PM1 and M3, and the lower left M2 had been lost antemortem. The upper right I1 and lower left I1 were lost postmortem. Carious lesions were recorded on the upper right P2 and M3, the upper left P2 and M2, and the lower right P1 and P2. No enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 184.1 cm ± 2.371.

Trauma/Pathology: No trauma or pathology was observed.

Conclusions: The remains were those of a male between 40 and 60 years of age. He had been approximately 184 cm tall. No trauma or pathology was observed.

70. NANMUL460. DOD: 1963

Burial location/position: Family members identified the grave of NANMUL460 near to a ploughed field on the southeastern side of the Tshiendulu koppie. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.5m in length and 1.6m in breadth. A wood pestle, 19 diagnostic potsherds, and 40 non-diagnostic potsherds were recovered from the surface of the grave. The grave pit was oval/rectangular in shape and measured 2m in length, 50 cm in breadth and 1.2m in depth. The body had been placed in a flexed position with the head orientated towards the north. Fragments of a ceramic mug were found in association with skeletal remains.

Family information: Family members indicated that the individual had been a female of 80 years.

Preservation: Condition of the remains was good. The cranium, left clavicle, scapulae, humeri, radii, ulnae, sacrum, pelvis, ribs, vertebrae, femora, tibiae, fibulae, hands, and feet were recovered.

Sex: A high forehead, round skull vault, small mastoids, sharp supra-orbital margins, and the absence of ramal flexure were noted. The femoral head diameter was small, 38mm. From these features, it was suggested that the individual had been female.

Age: The sternal end of the fourth rib was between a phase 3 and 4. Dental wear was moderate on the molars, and vertebral osteophytes were minimal. From this evidence, it was estimated that the individual had been between 30 and 40 years of age.

Dentition: The lower right I1 and M2, and the lower left M2 had been lost antemortem. The upper right I2, M2, and M3, the upper left I1 and I2, the lower right I2, and the lower left I1 were lost postmortem. A carious lesion was recorded on the lower left M1. No enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 155.2 cm ± 2.497.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a female between 30 and 40 years of age. She had been approximately 155.2cm tall. No trauma or pathology was observed.

71. NANMUL461. DOD: Before 1960's

Burial Position/Style: Family members identified the grave of NANMUL461 next to a ploughed field on the southeastern side of the Tshiendulu koppie. Loose stones were used to outline the grave, which measured 2.70 m in length and 1.50 m in breadth. Forty non-diagnostic potsherds and 56 diagnostic potsherds were recovered from the surface of the grave. The grave pit was oval/rectangular in shape and measured 2.10 m in length, 60 cm in breadth and 1.10 m in depth. The body had been placed in a flexed position with the head orientated towards the north. Several potsherds were found in association with the remains.

Family information: Family members indicated that the individual had been a male of 58 years.

Preservation: The remains were in an excellent condition. All the bones were represented. The left scapula, sacrum, and left os coxae had slight postmortem damage.

Sex: A low forehead, large mastoid processes, prominent temporal line, blunt supra-orbital margins, and ramal flexure were observed. The sciatic notch was narrow, and the femoral head diameter was large, 43 mm. These features indicate a male.

Age: The sternal end of the fourth rib was between a phase 3 and 4. The molars had minimal dental wear. From this evidence, it was suggested that the individual had been between 25 and 40 years of age.

Dentition: None of the teeth had been lost antemortem. Carious lesions were recorded on the upper right I1, upper left M3, lower left P1, and lower left M1. A periapical abscess was observed on the lower left P1. There were no enamel hypoplasias.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 161 cm ± 2.371.

Trauma/Pathology: Mild sub-periosteal lesions were noted on the distal tibiae.

Conclusion: The remains were those of a male 25 and 40 years of age. He had been approximately 161 cm tall. Mild sub-periosteal lesions were observed on the distal tibiae.

72. NANMUL467. DOD: 1962

Burial location/position: Family members identified the grave of NANMUL467 approximately 250m southwest of the Mulenzhe health clinic and near a few abandoned huts. Loose stones, which had been packed into a round shape, marked the location of the grave and measured 1.55 m in length and 1.39 m in breadth. Thirty-one non-diagnostic potsherds were recovered from the surface of the grave. The grave pit was oval in shape and measured 1.12 m in length, 67cm in breadth and 1.29 m in depth. Fragments of a blanket were recovered.

Family information: Family members indicated that the child had been a female of 7 years.

Preservation: Condition of the remains was poor. Only 14 teeth, 16 tooth germs and fragments of the humeri and femora were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. All the deciduous teeth had erupted.

Roots had begun to develop on the tooth germs of the permanent first molars. From this evidence, it was suggested that the child had been between 4 and 7 years of age.

Dentition: Of the deciduous teeth, only the upper left di1, lower right di1, di2, dc, and the lower left di2 and dc were lost postmortem. The permanent germ teeth included two upper central incisors, two upper lateral incisors, three canines (two upper and one lower), six premolars, and three first molars. No carious or enamel hypoplastic lesions were observed.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of female between 4 and 7 years of age.

73. NANMUL468. DOD: 1961

Burial location/position: Family members identified the grave of NANMUL468 which was approximately 200m southwest of the Mulenzhe clinic. Medium to large size stones marked the location of the grave, which measured 1.5m in length and 1.1m in width. The grave pit had an elongated oval shape and measured 1.2m in length, 55cm in width and 86cm in depth. Preservation of the remains was poor and the burial position was not determined. No grave goods were found.

Family information: Family members indicated that the individual had been a female.

Preservation: Condition of the remains was poor. Only nine permanent teeth along with fragments of the cranium and long bones were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: No dental wear was observed. The upper M3's had no root development. From this evidence, albeit scanty, it was suggested that the individual had been between 15 and 18 years of age.

Teeth: The upper right arcade and the lower jaw were not recovered. The lower left I1, upper left I1, I2, C, PM1, PM2, M1, M2 and M3 were found. No carious or enamel hypoplastic lesions were recorded.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a female between 15 and 18 years of age.

74. NANMUL469. DOD: 1957

Burial location/position: Family members identified the grave of NANMUL469 approximately 15 m west of the clinic road in the Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the grave and measured 2.84 m in length, 1.74 m in breadth and 20 cm high. The grave pit was oval in shape and measured 1.65 m in length, 64 cm in breadth and 1.42 m in depth. The body had been placed in a supine position with the head orientated towards the east. A copper belt buckle had been found in association with the remains.

Family information: Family members indicated that the individual had been a male of 50 years.

Preservation: Condition of the remains was poor. The cranium, nine loose teeth, ribs, vertebrae, sacrum, pelvis, and all long bones were recovered. However, most of these bones had extensive postmortem damage and were not suitable for analysis. No hands or feet were found.

Sex: The femoral head diameter was wide, 44mm. This feature indicates a male.

Age: No vertebral osteophytes were observed. Small pockets of dentin were exposed on the molar teeth. From this evidence, it was suggested that the individual had been between 30 and 50 years of age.

Teeth: The upper right M1, M2, and M3, the lower right M1, M2 and M3 and the lower left M3 were recovered. No carious or enamel hypoplastic lesions were noted.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 173.5 cm ± 2.777.

Trauma/Pathology: Sub-periosteal lesions were observed on the distal end of the left femur, tibia, and fibula.

Conclusion: The remains were possibly those of a male individual between 30 and 50 years of age. He had been approximately 173cm tall. Sub-periosteal lesions were noted on the distal end of the left femur, tibia, and fibula.

75. NANMUL471. DOD: Before 1962

Burial location/position: Family members identified the grave of NANMUL471 in a small cemetery approximately 100m south of a soccer field in the Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.4m in length and 1.35m in width. Eight diagnostic and twenty-three non-diagnostic potsherds were found on top of the grave. The grave pit was oval in shape and measured 1.2m in length, 56cm in breadth and 1m in depth. The body had been placed on the left side in a flexed position with the head orientated towards the north. No grave goods were found in association with the remains.

Family information: Family members indicated that the individual had been a female of 98 years.

Preservation: Condition of the remains was extremely poor. Extensive postmortem damage was noted on cranium, claviculae, scapulae, sacrum, pelvis, long bones, hands and feet. No vertebrae or ribs were recovered.

Sex: The femoral head diameter was small (36 mm). This feature indicates a female.

Age: All the cranial sutures were open. Dental wear was minimal and no dentin had been exposed on any of the teeth. From this evidence, it was suggested that the individual had been between 20 and 40 years of age.

Dentition: The lower right I2 and left M1 had been lost antemortem. The upper right I1, I2, upper left C, M3, and lower left I1, I2 and PM2 were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Stature: Stature was not determined.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to poor preservation of the remains.

Conclusion: The remains were possible those of a female between 20 and 40 years of age.

76. NANMUL472. DOD: Before 1962

Burial location/position: Family members identified the grave of NANMUL472 in a small cemetery approximately 100m south of a soccer field in the Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 3m in length and 1.45m in width. Twenty-one potsherds and parts of a small electric motor were found on the surface of the burial. The grave pit was elongated in shape and measured 1.5m in length, 56cm in breadth and 1.0m in depth. The body had been placed on the left side in a flexed position with the head orientated towards the north. No grave goods were found in association with the remains.

Family information: Family members indicated that the individual had been a female of 110 years.

Preservation: Condition of the remains was poor. Only the cranium, humeri, radii, ulnae and femora were recovered.

Sex: The femoral head diameter was narrow (38 mm). This feature indicates a female.
Age: Most of the teeth had been lost antemortem. On the remaining teeth, dental wear was severe. From this evidence, it was suggested that the person had been over 50 years of age.
Dentition: The upper right I1, M1, M2 and M3, the upper left I1, PM2, M1 and M3, the lower right PM2, M1 and M3, and the lower left PM2, M1 and M3 had been lost antemortem. The lower central incisors were lost postmortem. No carious lesions were observed. The presence or absence of enamel hypoplasia was not scored.
Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 143.1 cm ± 2.789.
Trauma/Pathology: No trauma or pathology was observed.
Conclusion: The remains were possibly those of a female who had been over 50 years of age.

77 NANMUL473. DOD: Pre-1962

Burial location/position: Family members identified the grave of NANMUL473 in a small cemetery approximately 100m south of a soccer field in the Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.7m in length and 1.6m in width. The grave pit was oval in shape and measured 1.8m in length, 87cm in breadth and 1.13m in depth. The body had been placed in a supine position with the head orientated towards the north. No grave goods were present.
Family information: Family members indicated that the individual had been a female of 101 years.
Preservation: Condition of the remains was fair. Pieces of the cranium along with the humeri, radii, ulnae, pelvis, femora, tibiae, fibulae, and hands and feet were recovered. The claviculae, scapulae, sacrum, ribs and vertebrae were not found.
Sex: The femoral head diameter was narrow (39 mm). This feature indicates a female.
Age: Dental wear was severe on all the teeth. From this evidence, it was tentatively suggested that the individual had been over 50 years of age.

Dentition: The upper right first and second molars, the lower right first and third molars, and the lower left first molar had been lost antemortem. Only the upper first premolars, second premolars, and third molars, and the lower right first premolar were recovered. No carious or enamel hypoplastic lesions were observed on these teeth.

Stature: The physiological length of the femur and tibia was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 151.7 cm ± 2.371.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female individual over 50 years of age. She had been approximately 152cm tall.

78. NANMUL474. DOD: Pre-1962

Burial location/position: Family members identified the grave of NANMUL473 in a small cemetery approximately 100m south of a soccer field in the Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.7m in length and 1.6m in width. The grave pit was oval in shape and measured 1.8m in length, 87cm in breadth and 1.13m in depth. The body had been placed in a supine position with the head orientated towards the north. No grave goods were present.

Family information: Family members indicated that the individual had been a male of 53 years.

Preservation: Condition of the remains was poor. Extensive postmortem damage was observed on the cranium, humeri, ulnae, right radius, sacrum, femora, tibiae, hands and feet. The claviculae, scapulae, ribs, vertebrae, and fibulae were not found.

Sex: A small browridge, round skull vault, small mastoids and absence of ramal flexure were observed. The femoral head diameter was narrow (40 mm). These features indicate a female.

Age: No dental wear was observed on the molar teeth. From this evidence, it was tentatively suggested that the person had been between 20 and 40 years of age.

Dentition: None of the teeth had been lost antemortem or postmortem. No carious or enamel hypoplastic lesions were observed.

Stature: Due to the poor preservation of the remains, stature was not determined.
Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.
Conclusion: The remains were possibly those of a female between 20 and 40 years of age.

79. NANMUL475. DOD: Before 1962

Burial location/position: Family members identified the grave of NANMUL475 in a small cemetery approximately 100m south of a soccer field in the Mulenzhe village. Fifteen medium sized stones and fragments of iron and ceramic cookware had been placed on top of the grave, which measured 2.5m in length and 1.4m in width. The grave pit was oval in shape and measured 2.08m in length, 70cm in breadth and 1.7m in depth. The body had been placed on the left side in a flexed position. No grave goods were found.
Family information: Family members indicated that the individual had been a female of 36 years.
Preservation: Preservation of the remains was poor. Ten loose teeth along with fragments of the cranium, scapulae, ribs, vertebrae, sacrum, pelvis, long bones, fibulae, hands and feet were recovered.
Sex: The femoral head diameter was small, 37 mm. These features indicate a female.
Age: No dental wear was observed on the molars. From this evidence, it was suggested that the person had been between 20 and 40 years of age.
Dentition: Only the upper right I2, C, upper left C, lower right I1, I2, P1, P2 and M3, and the lower left I1 were recovered. No carious lesions were observed. Linear enamel hypoplasias were recorded on the upper and lower incisors and canines.
Stature: The physiological length of the femur and tibia was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 157.5 cm ± 2.371.
Trauma/Pathology: Excluding enamel hypoplasia, no trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 20 and 40 years of age. She had been approximately 158 cm tall. Linear enamel hypoplasias were recorded on the upper and lower incisors and canines.

80. NANMUL478. DOD: UNKNOWN

Burial location/position: Family members identified the grave of NANMUL478 approximately 120 m southwest of a small hill that had previously been the old Musanda of chief Ramovha's family. Loose stones outlined the shape of the grave, which measured 2.7 m in length and 1.4 m in width. The grave pit was also oval in shape and measured 1.9 m in length, 57 cm in breadth and 1.12 m in depth. The body had been wrapped in a blanket. Additional clothing and three glass beads were found in association with the remains.

Family information: Family members indicated that the individual had been an old woman.

Preservation: Condition of the remains was fair. Fragments of the cranium along with scapulae, ribs, vertebrae sacrum, pelvis, long bones, hands, and feet were recovered.

Sex: A high forehead, round skull vault, and sharp supra-orbital margins were observed. The sciatic notch was wide, and the femoral head diameter was ambiguous, 42 mm. The morphological features indicate a female.

Age: Severe dental wear was observed on the molars. Most of the cranial sutures were obliterated. From this evidence, it was tentatively suggested that the individual had been over 40 years of age.

Dentition: The upper left I1, P2, M1, M2, and M3, the lower right P2, M1, M2, and M3, and the lower left M1 and M2 had been lost antemortem. The upper right I1, C, P1, M2, and M3, and the lower left I1 were lost postmortem. A carious lesion was observed on the distal side of the lower central incisor. A periapical abscess was noted on the upper right first molar. The presence or absence of enamel hypoplasia was not recorded due to severe dental attrition.

Stature: The physiological length of the femur and tibia was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 157.28 cm ± 2.371.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female over 40 years of age. She had been approximately 157 cm tall. No trauma or pathology was observed.

81. NANMUL485. DOD: 1956

Burial location/position: Family members identified the grave of NANMUL485 in the corner of a plough field and east of the Mulenzhe village. There was no grave dressing. The grave pit was oval in shape and measured 1.8 m in length, 40 cm in depth and approximately 90 cm in depth. The individual had been wrapped in a blanket and placed in a supine position. The head was orientated towards the north. There were no grave goods.

Family information: Family members indicated that the individual had been a male of 72 years.

Preservation: Condition of the remains was poor. The cranium was well preserved. However, only fragments of the scapulae, ribs, vertebrae, long bones, hands, and feet were recovered.

Sex: A sloping forehead, large mastoids, and ramal flexure were noted in the cranium. These features are indicative of a male.

Age: All the cranial sutures were obliterated. Moderate dental wear was noted on the molars. Advanced vertebral osteophytes (degree 3) were recorded on the cervical vertebrae. From this scanty evidence, it was suggested that the person had been between 40 and 60 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right M3, upper left I2 and M3, the lower right I1, I2, and C, and the lower left I1 and I2 were lost postmortem. Carious lesions were observed on the occlusal surfaces of the upper left M1 and lower left M2. There were no signs of enamel hypoplasias.

Stature: The length of the humerus was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 152.8 cm ± 3.834.

Trauma/Pathology: Vertebral osteophytes were recorded on C3, C4 and C5 (degree 3).

Conclusion: The remains were possibly those of a male between 40 and 60 years of age. He had been approximately 153 cm tall.

82. NANMUL486. DOD: 1961

Burial location/position: Family members identified the remains of NANMUL486 in a plough field on the eastern side of Mulenzhe village. Several loose stones outlined the grave, which measured 1.6 m in length and 1.2 m in width. On top of the burial, 17 diagnostic and 24 non – diagnostic potsherds were found. The grave pit was oval in shape and measured 1.03 m in length, 57 cm in breath and 80 cm in depth. The individual had been placed in a supine position with the head orientated towards the east. The forearms had been placed over the chest. No grave good were recovered.

Family information: Family members indicated that the infant had been a female.

Preservation: Condition of the remains was extremely poor. Seven deciduous teeth along with fragments of the cranium, ribs, vertebrae, and pelvic bones were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. All the deciduous incisors had erupted. No root development was observed on the tooth germs of the lower canine and first molar. From this evidence, it was suggested that the individual had been 1-year ± 4 months.

Dentition: No dental caries, enamel hypoplasias or dental wear were observed on any of the deciduous teeth.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusions: The remains were possibly those a female who had been approximately 1-year ± 4 months old.

83. NANMUL492. DOD: 1951

Burial location/position: No information is available.

Family information: Family members indicated that the individual had been a male of 60 years.

Preservation: Condition of the remains was extremely poor. Only fragments of the cranium, claviculae, humeri, radii, ulnae, femora, tibiae, and fibulae were recovered.

Sex: Gonial eversion and ramus flexure were observed in the mandible. These features are suggestive of a male.

Age: Moderate dental wear was observed on the teeth. From this evidence, it was tentatively suggested that the person had been over 30 years of age.

Dentition: The lower right third molar had been lost antemortem. Only six loose teeth were recovered and included the central incisor, canine, second premolar, first molar, second molar and third molar. No carious or enamel hypoplastic lesions were observed.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possible those of a male who had been older than 30 years of age.

84. NANMUL493. DOD: Pre – 1930

Burial location/position: Family members identified the grave of NANMUL493 in a ploughed field approximately 120m west of the Gwalala perennial stream and east of the Mulenzhe village. Several loose rocks, thirteen metal bracelets, several wire bracelets, a fragment of glass, seven diagnostic and fourteen non-diagnostic potsherds had been placed on top of the grave, which measured 2.04m in length and 1.39m in width. The grave pit was oval in shape and measured 1.62m in length, 55cm in breadth and 1m in depth. The body had been placed on the left side in a flexed position with the head orientated towards the north. No grave goods were found.

Family information: Family members indicated that the individual had been a female of 38 years.

Preservation: Condition of the remains was poor. Only the maxilla, two mandibular teeth (left I2 and left P1), the femora, tibiae, fibulae, and several foot bones were recovered.

Sex: The femoral head diameter was narrow, 40 mm. This feature tentatively indicates a female.

Age: Dental wear was minimal on all the teeth. From this evidence, it was suggested that the person had been between 20 and 40 years of age.

Dentition: None of the maxillary teeth had been lost antemortem. However, the upper right lateral incisor and third molar were lost postmortem. Carious lesions were recorded on the medial side of the upper central incisors. No enamel hypoplasias were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 159.4 cm ± 2.497.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a female between 20 and 40 years of age. She had been approximately 159 cm tall.

85. NANMUL494. DOD: Pre – 1930

Burial location/position: Family members identified the grave of NANMUL494 in a ploughed field approximately 120m west of the Gwalala perennial stream and east of the Mulenzhe village. Several rocks had been used to mark the location of the grave, which measured 2.14m in length and 1.55m in width. The grave pit was oval in shape and measured 1.8m in length, 60cm in width and 1 m in depth. The individual had been placed on the left side in a flexed position with the head orientated north. Two copper bangles were found in association with the remains.

Family information: Family members indicated that the individual had been a female of 90 years.

Preservation: Condition of the remains was poor. Pieces of the maxilla and mandible along with the scapulae, scapulae, ribs, vertebrae, sacrum, long bones and foot bones were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: Dental wear was moderate and no dentin was exposed on the molars. From this information, it was tentatively suggested that the person had been between 30 and 50 years of age.

Dentition: Twelve teeth were recovered and included the upper right P1, P2, M1 and M2, lower right P1, P2, M1, M2 and M3, and lower left M1, M2, and M3. No carious or enamel hypoplastic lesions were observed.

Stature: The physiological length of the tibia was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 159.7 cm ± 3.056.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a female between 30 and 50 years of age. She had been approximately 159 cm tall.

86. NANMUL495. DOD: 1963

Burial location/position: Family members identified the grave of NANMUL495 in a ploughed field approximately 120m west of the Gwalala perennial stream and east of the Mulenzhe village. Loose stones, a hundred non-diagnostic potsherds, 16 diagnostic potsherds and an oxidized pocketknife had placed on top of the grave, which measured 2.24m in length and 1m in width. The grave pit was oval in shape and measured 1.8m in length, 74cm in breadth and 1.2m in depth. The individual had been placed in a supine position with the head orientated towards the north. No grave goods were found with the remains.

Family information: Family members indicated that the individual had been a male of 55 years.

Preservation: Condition of the remains was poor. Fragments of the cranium, claviculae, scapulae, ribs, vertebrae, humeri, radii, ulnae, sacrum, pelvis, fibulae and foot bones were recovered. The left femur and tibiae were intact.

Sex: The diameter of the head of the left femur was narrow, 37.5 mm. This feature indicates a female.

Age: Age could not be determined from the osteological evidence.

Dentition: No teeth were recovered.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 155.7 cm ± 2.497.

Trauma/Pathology: The presence or absence of trauma was not assessed.

Conclusions: The remains were possibly those of an adult female who had been approximately 156 cm tall.

87. NANMUL496. DOD: 1962

Burial location/position: Family members identified the grave of NANMUL496 in a ploughed field approximately 120m west of the Gwalala perennial stream and east of the Mulenzhe village Loose stones, which had been packed into an oval shaped mound, marked the location of the grave and measured 2.96m in length and 1.25m in width. Beneath the grave dressing, a rectangular shaped burial pit was exposed, which measured 1.88m in length, 62cm in breadth and 1.05m in depth. The individual had been wrapped in a blanket and placed in a supine position with the right forearm on the abdomen. The head was orientated towards the north.

Family information: Family members indicated that the individual had been a female of 40 years.

Preservation: Condition of the remains was fair. All the long bones were recovered intact. Postmortem damage was noted on the cranium, vertebrae (9 thoracic and 5 lumbar), ribs, sacrum, and pelvis. No scapulae were found.

Sex: A low forehead, and distinct supraorbital torus were observed. The sciatic notch was narrow, and the femoral head diameter was large, 45mm. These features indicate a male.

Age: All the cranial sutures were open. Dental wear was moderate such that patches of dentin were observed on the molars. Vertebral osteophytes were observed throughout the spinal column. From this evidence, it was suggested that the person had been between 40 and 60 years of age.

Dentition: No antemortem or postmortem tooth loss was observed. No carious or enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 163.2 cm ± 2.371.

Trauma/Pathology: The vertebral bodies of T8 and T9 had fused (degree 4). Four thoracic vertebrae had moderate to severe vertebral osteophytes (degree 3). Schmorl nodes' were present on T11 and T12. Moderate vertebral osteophytes (degree 3) were observed on L1-L5.

Conclusion: The remains were possibly those of a male between 40 and 60 years of age. He was approximately 163 cm tall. Advanced vertebral osteophytes were observed in the thoracic and lumbar region.

88. NANMUL518. DOD: Unknown

Burial location/position: Members from the Shangaan community identified the grave of NANMUL518 near the "borrow" pit area, past the old Musanda and on the eastern side of Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the grave, which measured 2.4 m in length and 1.2 m in width. Several grave goods were found on top of the grave and include a metal lock box, a teaspoon, a fork, a tin cup, two bullet shells, a key, a corkscrew, six iron bolts, four iron nuts, a lock, five bottle fragments, a knife, scissors, nails, a wheel from a toy car, fragments of shoes, various iron objects, 18 diagnostic and 24 non-diagnostic potsherds. The grave pit had an oval shape that measured 1.45 m in length, 67 cm in breadth and 92 cm in depth. The body had been placed in a flexed position with the head orientated towards the north.
Family information: Family members indicated that the individual had been an adult male.
Preservation: Condition of the remains was good. Except for a portion of the maxilla, all the bones were recovered.
Sex: A low forehead, large mastoids, blunt supra-orbital margins, and ramal flexure were observed. The sciatic notch was narrow, and the femoral head diameter was small, 42 mm. These features indicate a male.
Age: The cranial sutures were open. Most of the teeth were lost postmortem. Of the two molar teeth present, both had large patches of exposed dentin. From this evidence, it was suggested that the person had been between 40 and 60 years of age.
Dentition: Only the upper right C, P1, P2, M1, and the lower right M1 were recovered. The lower right M2 and M3 had been lost antemortem. No carious lesions were observed. The presence or absence of enamel hypoplasia was not assessed.
Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 162.2 cm ± 2.371.

Trauma/Pathology: Abnormal bone growth was noted around the vertebral bodies of T8 and T9 and their associated ribs facets (6 and 7). This is possibly a case of traumatic arthritis.

Conclusions: The remains were possibly those of a male between 40 and 60 years of age. He had been approximately 162 cm tall. Signs of traumatic arthritis were recorded in the mid-thoracic region.

89. NANMUL519. DOD: 1962

Burial location/position: Members from the Shangaan community identified the grave of NANMUL519 near the "borrow" pit area, past the old Musanda and on the eastern side of Mulenzhe village. The grave dressing had been constructed of looses stone and measured 2.75 m in length, 1.9 m in width, and 35 cm high. A glass medicine bottle with the label "poison" and several red and green coloured potsherds were found on top of the burial. The grave pit was oval in shape and measured 1.7m in length, 40 cm in breadth and 1.70 m in depth. The individual had been buried in a supine position with the head orientated towards the north. The right forearm had been placed on the abdomen.

Family information: Family members indicated that the individual had been a male over 50 years.

Preservation: Condition of the remains was poor. Extensive postmortem damage was observed on the cranium, humeri, radii, ulnae, femora, tibiae, and fibulae. The claviculae, scapulae, ribs, vertebrae, sacrum, pelvis, hands or feet were not recovered.

Sex: A low forehead, blunt supra-orbital margin, and a distinct external occipital protuberance were observed. The femoral head diameter was wide, 44mm. These features indicate a male.

Age: Age could not be determined from the osteological evidence.

Dentition: Only the upper right first and second premolars were present. The upper right M1 and M2, the upper left I1, I2, C, and PM1 had been lost antemortem. No carious or enamel hypoplastic lesions were observed.

Stature: Stature was not estimated due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not observed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a male who had been over 50 years of age.

90. NANMUL520. DOD: UNKNOWN

Burial style/position: The grave of NANMUL520 was identified by members of the community near the "borrow" pit area, past the old Musanda and on the eastern side of Mulenzhe village. Loose stones, which had been packed into an oval shape, marked the grave and measured 1.9 m in length and 1.4 m in width. Four diagnostic potsherds and 25 non-diagnostic potsherds were recovered on top of the grave. The grave was oval in shape and measured 1.03 m in length, 56 cm in breadth and 66 cm in depth.
Family information: Family members indicated that the grave had belonged to a child.
Preservation: Condition of the remains was poor. Ten deciduous teeth along with fragments of the cranium, claviculae, scapulae, ribs, pelvis, and long bones were recovered.
Sex: Sex could not be estimated from the osteological evidence.
Age: A dental eruption chart was used to estimate age. Except for dm2, all the deciduous teeth had erupted. From this evidence, it was suggested that the child had been between 2 and 3 years of age.
Dentition: No carious or enamel hypoplastic lesions were recorded.
Trauma/Pathology: The presence or absence of trauma and pathology was not assessed.
Conclusion: The remains were possibly those of a child between 2 and 3 years of age.

91. NANMUL521. DOD: 1955

Burial location/position: Family members identified the grave of NANMUL521 near the "borrow" pit area, past the old Musanda and on the eastern side of Mulenzhe village. Large to medium sized rocks, which had been packed into an elongated oval shape, marked the location of the grave and measured 3.06m in length and 1.9m in width. The grave pit had an elongated oval shape and measured 1.80m in length, 50cm in width and 900cm in depth. The individual had been placed in a supine position with the right hand on the abdomen. The head had been orientated towards the east. Fragments of a red and green coloured bowl were found in association with the remains.

Family information: Family members indicated that the individual had been a female of 75 –80 years.

Preservation: Condition of the remains was excellent. All the bones were recovered and had minimal postmortem damage.

Sex: A high forehead, round skull vault, small mastoids, sharp supra-orbital margins and no ramal flexture were observed. The sciatic notch was wide and the femoral head diameter was small, 41mm. These features indicate a female.

Age: All the cranial sutures were obliterated. All the teeth had moderate to severe wear. Signs of advanced osteoarthritis were observed in the vertebral column. From this evidence, it was suggested that the person had been over 50 years old.

Dentition: The upper right M1, M2 and M3, the upper left C and M1, the lower right P1, P2 and M1, and the lower left I1 and M3 had been lost antemortem. The upper right I1, I2 and C, the upper left I1, I2, M2 and M3 and the lower right C and P2 were lost postmortem. Periapical abscesses were noted on the upper right M3 and upper left I1. No carious lesions were observed. The presence or absence of enamel hypoplasia was not assessed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 162.2 cm ± 2.497.

Trauma/Pathology: Vertebral osteophytes were moderate in the cervical and thoracic vertebrae (degree 2) and severe in the lumbar vertebrae (degree 3).

Conclusion: The remains were possibly those of a female over 50 years of age. She had been approximately 162 cm tall. Moderate to severe osteophytes were observed on the spinal column.

92. NANDID527. DOD: +/- 1960's

Burial location/position: Family members identified the grave of NANDID527 on the northern slope of the plateau overlooking the river. This site was approximately 200m west of the abandoned Mulenzhe/Dididi road and 100m south of the Lufale River. Medium to small rocks, which had been packed into an oval shape, marked the location of the grave and measured 1.93m in length and 1.30m in width. Seven non-diagnostic potsherds were found on the grave dressing. The grave pit measured 1.2m in length, 60cm in width and 1m in depth. The individual had been wrapped in a blanket and placed in a flexed position.

Family information: Family members indicated that the individual had been a female of 39 years.

Preservation: According to the family, the grave had been robbed a few weeks after the burial. Several body parts had been taken from the grave and were allegedly used for ritual medicine. Only the scapulae, ribs, vertebrae, pelvis, fibulae, patella, and foot bones were recovered.

Sex: The sciatic notch and sub-pubic angle were wide, and the sacrum was flat and broad (110 mm). These features indicate a female.

Age: No vertebral osteophytes were present. The pubic symphyseal morphology was a phase 3 (22-24). From this evidence, it was suggested that the person had been between 20 and 30 years of age.

Trauma/Pathology: No signs of trauma or pathology were observed.

Conclusions: The remains were possibly those of a female between 20 and 30 years of age.

93. NANDID529. DOD: 1961

Burial location/position: Family members identified the grave of NANDID529 on the northern slope of the plateau overlooking the river. The site was approximately 200m west of the abandoned Mulenzhe/Dididi road and 100m south of the Lufale River. The grave pit measured 1.53m in length, 88cm in breadth and 1.10 in depth. The individual had been placed on his right side in a flexed position on his right side. Three copper buttons, one plastic buttons and a potsherd were found with the remains.

Family information: Family members indicated that the individual had been a male of 88 years.

Preservation: According to the family, the grave had been robbed a few weeks after the burial. Several body parts had been taken from the grave and were allegedly used for ritual medicine. Only the claviculae, left scapula, left humerus, sacrum, pelvis, and right calcaneus were recovered.

Sex: A prominent deltoid tuberosity was observed on the left humerus. The sciatic notch had an ambiguous shape, and the diameter of the humeral head was wide (44 mm). These features indicate a male.

Age: The morphology of the right auricular surface was a phase 5 (40-45) and the left auricular surface was a phase 7 (50-59). Vertebral osteophytes were present on the cervical and lumbar vertebrae. The fifth lumbar vertebrae had fused to the sacrum. From this evidence, it was suggested that the individual had been between 40 and 60 years of age.

Stature: The length of the humerus was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 173.6 cm ± 3.834.

Trauma/Pathology: Vertebral osteophytes were severe in the cervical region (degree 4), minimal in the thoracic region (degree 0 – 1), and moderate in the lumbar region (degree 3).

Conclusion: The remains were possibly those of a male between 40 and 60 years of age. He had been approximately 173 cm tall.

94. NANTSHIL551. DOD: 1993

Burial location/position: Family members identified the infant grave of NANTSHIL551 in the guvha of a hut in Tshilangoma. The burial was found on the southwestern side of the hut. The grave pit measured 44 cm in length, 40 cm in width and 35 cm in depth. The body had been placed in an upright position with the head orientated northeast. A blanket, plastic nappie, a night dress, two knitted caps, two knitted socks and one white pill were found with the remains.

Family information: Family members indicated that the infant had been a male and had died two weeks after birth.

Preservation: Condition of the remains was poor. Only fragments of the cranium, petrous bone, mandible, clavicle, two ribs, a tibia, and a fibula were recovered.

Sex: Sex could not be determined from the osteological remains.

Age: The mandibular symphysis was unfused. From this evidence, it was suggested that the infant had been less than 6 months old.

Dentition: No teeth were recovered.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male infant less than 6 months old.

95. NANTSHIL553. DOD: 1991

Burial location/position: Family members identified the child grave of NANTSHIL553 in the guvha of a hut in Tshilangoma. The burial was found on the southwestern side of the hut. The grave pit measured 43 cm in length, 42 cm in width and 77 cm deep. The body had been placed upright with the head orientated towards the west. The infant had been wrapped in a white plastic hospital bag and two blankets. Two pairs of pyjamas, two dresses, a pair of flannel pants, a jersey, two pairs of underwear and a knitted cap were found with the remains.

Family information: Family members indicated that the child had been a female of 4 years.

Preservation: Condition of the remains was poor. Fragments of the cranium along with nine teeth, one upper limb bone, 14 neural arches, 15 vertebral bodies, nine rib fragments, iliac blades, femora, and tibiae were recovered. No claviclae, scapulae, radii, ulnae, ischia, pubii, fibulae, hands or feet were found.

Sex: Sex could not be estimated from the osteological remains.

Age: A dental eruption chart was used to estimate age. Excluding the second molars, all the deciduous teeth had erupted. No root developent was observed on the permanent first molar tooth germs. From this evidence, it was suggested that the child had been 2 years ± 8 months old.

Dentition: No dental caries or enamel hypoplasias were observed.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female child who had been approximately 2 years ± 8 months old.

96. NANTSFIL560. DOD: 1985

Burial location/position: Family members identified the child grave of NANTSHIL560 in the guvha of a hut in Tshilangoma. The grave pit was oval in shape and measured 70 cm in length, 30 cm in width and 80 cm deep. The body had been placed in a supine position with the head orientated towards the east. The infant had been wrapped in a green blanket along with a knitted cap, three t-shirts and an additional three blankets.

Family information: Family members indicated that the child had been a female of 2 years

Preservation: Condition of the remains was poor. Only thirteen teeth (both deciduous and tooth germs), femora, tibiae, and a fibula shaft were recovered along with several unfused long bone epiphyses.

Sex: Sex could not be determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. All the deciduous incisors had erupted. No root development was observed on the tooth germs for the deciduous canines, the first molars and the second molars. From this evidence, it was suggested that the individual had been 1-year ± 4 months of age.

Dentition: No dental caries or enamel hypoplasias were observed.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female who had been approximately 1-year ± 4 months old.

97. NANTSHIL561. DOD: 1993

Burial location/position: Family members identified the grave of NANTSHIL561 in the guvha of a cooking hut approximately 5 m west of the cooking fire. The grave pit was oval in shape and measured 45 cm in length, 35 cm in width and 80cm in depth. The infant had been wrapped in a blue and white blanket.

Family information: Family members indicated that the child had been a male of 2 years.

Preservation: Condition of the remains was poor. Fragments of the cranium along with 25 loose teeth (deciduous and tooth germs), scapulae, humeri, iliac blades, vertebrae, pubii, femora, tibiae, and fibulae were recovered. No claviculae, radii, ulnae, hands or feet were found.

Sex: Sex could not be estimated from the osteological evidence.

Age: A dental eruption chart was used to estimate age. All the deciduous incisors and first molars had erupted. The deciduous canines and second molars had partially erupted.

No root development was observed on the permanent tooth germs. From this evidence, it was suggested that the child had been between 18 and 24 months old.

Teeth: None of the teeth had been lost antemortem. Permanent tooth germs included two permanent upper central incisor, one lower incisor and four permanent molars. No dental caries or enamel hypoplasias were observed.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male infant who had been between 18 and 24 months old.

98. NANTSHIL562. DOD: 1993

Burial style/position: Family members identified the infant grave NANTSHIL562 on the eastern side of a single room hut. The grave pit was oval in shape and measured 28 cm in length, 30 cm in breadth and 68 cm deep. The body had been placed in an upright position. Several medium sized rocks were used to keep the infant in an upright position. The infant had been wrapped in a white plastic hospital bag and a green blanket. A plastic hospital bangle and two diaper pins were found with the remains.

Family information: Family members indicated that the infant had been a male of 1 year.

Preservation: Condition of the remains was fair. A left clavicle, left scapula, left humerus, left radius, left and right iliac bones, femora, tibiae, and fibulae were recovered along with 24 ribs, 47 neural arches (all unfused) and 20 vertebral bodies. No cranium, ulnae, ischia, pubii, hands, or feet were recovered.

Sex: Sex could not be determined from the osteological remains.

Age: All the neural arches of the vertebral spine were unfused. From this evidence, albeit tentative, it was suggested that the infant had been less than a year old.

Dentition: No teeth were recovered.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male who had been less than one year of age.

99. NANTSHIL563. DOD: 1997

Burial location/position: Family members identified the infant grave of NANTSHIL563 in the guvha of a cooking hut. The grave pit was round in shape and measured 25 cm in length, 23 cm in breadth and 30 cm in depth. The infant had been buried in a white plastic hospital bag. No grave goods were present.

Family information: Family members indicated that the infant had been a female and had died shortly after birth.

Preservation: Condition of the remains was poor. Only the ulnae, a radius, the distal portion of the humerus, an iliac blade, nine unfused neural arches and six phalanges were recovered.

Sex: Sex could not be determined from the osteological evidence.

Age: The diaphyseal length of the femur was 55 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were those of a fetus (6 ½ lunar months).

Teeth: No teeth were present.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a premature infant (6 ½ lunar months) who had died shortly after birth.

100. NANTSHIL564. DOD: 1997

Burial location/position: Family members identified the infant grave of NANTSHIL563 in the guvha of a cooking hut. The grave pit was round in shape and measured 25 cm in length, 23 cm in breadth and 30 cm in depth. The infant had been buried in a white plastic hospital bag. No grave goods were present.

Family information: Family members indicated that the infant had been a female and had died shortly after birth.

Preservation: Condition of the remains was good. Fragments of the cranium along with the claviculae, scapulae, humeri, radius, ulna, 21 ribs, 40 neural arches, 10 vertebral bodies, pelvis, femora, tibiae and several phalanges were found.

Sex: Sex could not be estimated from the osteological remains.

Age: The mandibular symphysis and neural arches were unfused. The diaphyseal length of the femur was 41.2 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were those of a fetus (6 ½ lunar months).

Dentition: No teeth were recovered.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a premature infant (6 ½ lunar months) who had died shortly after birth.

101. NANTSHIL567. DOD: 1997

Burial location/position: Family members identified the infant grave of NANTSHIL567 just outside a rectangular house in Tshilangoma. A cement and brick slab covered the grave and measured 92 cm in length and 85 cm in breadth. The grave pit had an oval shape and measured 90 cm in length and 40 cm in width. The body had been placed in an upright position. The infant had been wrapped in a blanket, two pairs of pants, two jerseys, four knitted caps, a material cap, a vest, underwear, a t-shirt, pyjamas, a dress, and two pairs of socks.

Family information: Family members indicated that the infant had been a female of 7 months.

Preservation: Condition of the remains was fair. Fragments of the cranium along with the claviculae, scapulae, humeri, ulnae, radius, iliac blades, 33 vertebral arches, 17 vertebral bodies femora, were recovered. No ribs, hands or feet were found.

Sex: Sex could not be estimated from the osteological evidence.

Age: A dental eruption chart was used to estimate age. The upper and lower central incisors had erupted. The other deciduous teeth (lateral incisors, canines and molars) had not erupted. From this evidence, it was suggested that the individual had been 9 ± 3 months of age.

Dentition: No carious or enamel hypoplastic lesions were observed.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female who had been approximately 9 ± 3 months of age.

102. NANMPEG595. DOD: UNKNOWN

Burial location/position: A cluster of four graves (including the grave of NANMPEG595) was found between the Mphego village and the Luvhuvhu River. A family representative identified the grave, but was unable to supply information regarding the person buried there. Several loose stones had been placed on top of the grave, which measured 2.9 m in length, 1.64 in width and 70 cm high. Several potsherds, scissors and a metal container were found on top of the burial. The grave pit was oval in shape and measured 1.3m in length, 0.5 m in breadth and 1.5 m in depth. The individual had been placed on the left side in a flexed position. A piece of cloth, a short chain and five plastic buttons were found with the remains.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the cranium, claviculae, scapulae, humeri, radii, ulnae, iliac blade, femora, tibiae, a fibula and several phalanges were recovered. The ribs, vertebrae, or sacrum were not found.

Sex: A low forehead and a robust menton were observed. The sciatic notch was narrow. These features tentatively indicate a male.

Age: Dental wear was moderate to severe. The dentin had been exposed on the anterior but not the posterior teeth. From this evidence, it was suggested that the individual had been over 40 years of age.

Dentition: The left first molars had been lost antemortem. None of the teeth were lost postmortem. Carious lesions were recorded on the occlusal surface of the upper right P2, the medial side of the upper right M2, on the medial side of the lower left I1, the occlusal surface of the lower left M2, the distal side of the lower right P2, and the buccal side of the lower right M2. No enamel hypoplastic lesions were observed.

Stature: Stature was not determined.

Trauma/Pathology: The presence or absence of trauma was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a male over 40 years of age.

103. NANMUT602. DOD: 1960's

Burial location/position: Family members identified the grave of NANMUT602 on the eastern side of the DWAF administration office. Several loose stones, a metal object and few non-diagnostic potsherds were found on top of the grave. The grave pit was oval/rectangular in shape and measured 1.8m in length, 80 cm in width and 1 m in depth. The body had been placed in a supine position with the head pointed northwest. The person had been wrapped in a brown and white blanket. Twelve diagnostic potsherds, 36 non-diagnostic potsherds and a few coffin nails were found in association with the remains.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the cranium, claviculae, scapulae, radii, ulnae, ribs, pelvis, vertebrae, left femur, and right fibulae were recovered. No hands or feet were found.

Sex: The sciatic notch was wide and the femoral head diameter was small, 41.5 mm. These features tentatively indicate a female.

Age: Dental wear was moderate on all the teeth. No dentin on the molar teeth had been exposed. No vertebral osteophytes were observed. From this evidence, it was tentatively suggested that the individual had been between 30 and 40 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right M2, upper left I1, I2, C, and PM1, the lower right I1, I2, and lower left I1 were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 161.2 cm ± 2.497.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 30 and 40 years of age. She had been approximately 161 cm tall.

104. NANBUD616. DOD: 1910 - 20

Burial location/position: The community identified the grave of NANBUD616 between three large trees in the Budeli village. Several loose stones outlined the grave, which measured 1.32 m in length and 1.53 m in width marked the location of the grave. Four wire bracelets and 14 potsherds were removed from the surface of the grave. The grave pit was oval in shape and measured 57 cm in length, 48 cm in width and 1.38 m in depth. The body had been placed in a flexed position with the head orientated south. Several wire bracelets were found in association with the remains.

Family information: Not available.

Preservation: Condition of the remains was extremely poor. Two molars along with fragments of the cranium, humeri, femora, tibiae and pelvis were recovered. The mandible, claviculae, scapulae, radii, ulnae, ribs vertebrae, sacrum, fibulae, hands and feet were not found.

Sex: Sex could not be determined from the osteological evidence. The wire bangles indicate a female.

Age: Minimal dental wear was observed on the molar teeth. From this it was tentatively suggested that the individual had been between 20 and 40 years of age.

Dentition: Only the upper left second molar and the lower right second molar were recovered. No dental caries was observed.

Stature: On account of the poor preservation of the remains, stature was not determined.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a female who had been between 20 and 40 years or age.

105. NANBUD617. DOD: 1910 – 20

Burial location/position: Members of the community identified the grave of NANBUD617 in an old field in the Budeli village. Several loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.11 m in length and 1.23 m in width. An axe blade and a piece of iron were found on top of the grave. The grave pit had an irregular shape, which measured 1.02 m in length, 80 cm in breadth and 1.28 m in depth. The body had been placed in a flexed position. In association with the remains were eighty-one cylindrical glass beads (which included 27 light blue beads, seven maroon beads, 10 light cream/brown beads, seven light pink beads, 15 dark blue beads, seven white beads, two black beads), a white ceramic spiral, a solid copper bangle, an iron padlock, and a cylindrical copper object (perhaps a bullet casing) were also found.

Family information: Not available.

Preservation: Condition of the remains was poor. Only the cranium, humeri, radii, and femora were recovered.

Sex: A high forehead, round skull vault, small mastoids, and sharp supra-orbital margins was observed. The femoral head diameter was small, 39 mm. These features indicate a female.

Age: Most of the cranial sutures were obliterated. All the teeth had heavy wear. From this evidence, it was suggested that this individual had been between 40 and 60 years of age.

Dentition: The lower incisors, lower right first molar, lower left second molar had been lost antemortem. The upper right I1, I2, M1, M2, and M3, the upper left I2, C, M2 and M3 were lost postmortem. Carious lesions were observed on the upper right P2, the upper left I2, the lower right P2, the lower right M3, and the lower left M2. Linear enamel hypoplasias were noted on the lower canines.

Stature: Stature was not determined.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 40 and 60 years of age.

106. NANBUD627. DOD: 1970

Burial location/position: Family members identified the grave of NANBUD627 next to a ploughed field and approximately 800 m west of the DWAF labour camp in the Budeli village. Large stones, which had been packed into an oval shape, marked the location of the grave and measured 2.7 m in length 1.6 m in width and 20 cm high. The grave pit was rectangular in shape and measured 1.7 m in length, 78 cm in breadth and 1.5 m in depth. The body had been placed on the left side in a flexed position with the head orientated northwest. No grave goods were present.

Family information: Family members indicated that the individual had been a female of 55 years.

Preservation: Condition of the remains was fair. The cranium along with fragments of the right clavicula, humeri, radii, ulnae, femora, tibiae and fibulae were recovered. The scapulae, ribs, vertebrae, sacrum, pelvis, hands, and feet were not found.
Sex: A high forehead, roundish skull vault and sharp supra-orbital margins were observed. Overall, the skeleton was gracile in appearance. These features tentatively indicate a female.
Age: All the cranial sutures had obliterated. Dental wear was moderate on all the teeth. From this evidence, it was suggested that the person had been over 50 years of age.
Teeth: None of the teeth had been lost antemortem. The upper right I1 and I2 and the upper left PM1 were lost postmortem. No carious or enamel hypoplastic lesions were observed.
Stature: Stature was not determined due to the poor preservation of the remains.
Trauma/Pathology: An abscess was observed on the mid-shaft of the right humerus, which may have been associated with osteomyelitis.
Conclusion: The remains were possibly those of a female who had been over 50 years of age. A tentative case of osteomyelitis was recorded.

107. NANBUD628. DOD: 1970

Burial location/position: Family members identified the grave of NANBUD628 next to a ploughed field and approximately 800 m west of the DWAF labour camp in the Budeli village. Large stones, which had been packed into an oval shape, marked the location of the grave and measured and measured 2.8 m in length, 1.8 m in width and 20 cm in height. The grave pit was rectangular in shape and measured 2.2m in length, 80 cm in breadth and 1.1 m in depth. The body had been placed on the left side with the head orientated towards the north. No grave goods were found.
Family information: Family members indicated that the individual had been a male between 60 -70 years of age.
Preservation: Condition of the remains was fair. The cranium and right femur were complete. Only fragments of the claviculae, humeri, radii, ulna, tibiae, and fibulae were recovered. The scapulae, vertebrae, ribs, hands and feet were not found.

Sex: A low forehead, blunt supra-orbital margins, large mastoids were observed. The femoral head diameter was wide, 44mm. These features indicate a male.

Age: All the cranial sutures were obliterated. Dental wear was severe on all the teeth. From this evidence, it was tentatively suggested that the individual had been over 50 years of age.

Dentition: The upper right I1, I2 and M1, the upper left I1, I2, C, P2, M1, M2 and M3 had been lost antemortem. The upper right C and M2 and the lower left P2, M1, M2, and M3 were lost postmortem. Several periapical abscesses were recorded among the upper premolar and molar teeth. A carious lesion was noted on the buccal surface of the lower right M3. The presence or absence of enamel hypoplasia was not assessed.

Stature: Stature could not be determined due to the poor preservation of the postcranial remains.

Trauma/Pathology: Excluding dental disease, no trauma or pathology was observed.

Conclusion: The remains were possibly those of a male over 50 years of age. Dental health was poor such that antemortem tooth loss and periapical abscesses were common.

108. NANBUD629. DOD: Post – 1944

Burial location/position: Not available.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the cranium, claviculae, pelvis, humeri, radii, ulnae, femora, tibiae, and fibulae were recovered. The ribs, vertebrae, sacrum, hands and feet were not found.

Sex: A low forehead, large mastoids, a distinct external occipital protuberance, gonial eversion and ramal flexure were observed. The femoral head diameter was large, 44.5 mm. These features indicate a male.

Age: Most of the cranial sutures were obliterated. Small patches of dentin were exposed on the upper and lower molars. From this evidence, it was suggested that the individual had been between 40 and 60 years of age.

Dentition: Only the upper right P1, P2, M1, M2, the lower right M1, M2, M3 and the lower left M1 were recovered. No carious or enamel hypoplastic lesions were observed.

Stature: Stature was not estimated due to the poor preservation of the remains.

Trauma/Pathology: The presence of absence of trauma or pathology was not assessed.
Conclusion: The remains were possibly those of a male between 40 and 60 years of age.

109. NANBUD630. DOD: 1968

Burial location/position: Family members identified the grave of NANBUD628 next to a ploughed field and approximately 800 m west of the DWAF labour camp in the Budeli village. Large stones, which had been packed into an oval shape, marked the location of the grave and measured 2.6 m in length and 2.6 m in width. The grave pit was rectangular in shape and measured 2.3 m in length, 80 cm in width and 1.1 m deep. The body had been placed in a supine position with the head orientated towards north. Metal handles, hinges and nails from the coffin were recovered but no grave goods were present.
Family information: Family members indicated that the individual had been a male between 40 - 50 years of age.
Preservation: Condition of the remains was fair. Fragments of the cranium along with the clavicula, pelvis, and long bones were recovered. The scapulae, vertebrae sacrum, ribs, hands, and feet were not found.
Sex: The femoral head diameter was large, 46 mm. This feature indicates a male.
Age: It was not possible to estimate age from the osteological evidence.
Teeth: Teeth were not found with the remains.
Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 172.7 cm ± 2.371.
Trauma/Pathology: No trauma or pathology was observed.
Conclusion: The remains were possibly those of an adult male.

110. NANBUD631. DOD: 1948

Burial location/position: Family members identified the grave of NANBUD628 next to a ploughed field and approximately 800 m west of the DWAF labour camp in the Budeli village. Large stones, which had been packed into an oval shape, marked the location of the grave and measured 2.3 m in length, 1.4 m in width and 25 cm in height. A mortar and pestle were also found on the surface of the grave. The grave pit was rectangular in shape and measured 2.6 m in length, 89 cm in breadth and 1.02 m in depth. The body had been wrapped in a blanket and placed in a coffin. No grave goods were found.

Family information: Family indicated that the individual had been a female.

Preservation: Condition of the remains was poor. Fragments of the cranium and pelvis along with the humeri, ulnae, femora, and tibiae were recovered. The claviculae, scapulae, radii, ribs, vertebrae, fibulae, hands and feet were not found.

Sex: The femoral head diameter was small, 36 mm. This feature indicates a female.

Age: Small pits of dentin were exposed on the molar teeth. From the above evidence, albeit minimal, it was suggested that the individual had been between 30 and 50 years of age.

Dentition: Only the upper right P1, M2, M3, the lower right I1, I2, C, P2, M1, M2 and M3, and the lower left M2 and M3 were recovered. The upper right C and M1, and the lower left P2 and M1 had been lost antemortem. Carious lesions were recorded on the distal surface of the upper right P1 and the lingual surface of the lower right M1. There were no enamel hypoplasias.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 166.7 cm ± 2.497.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 30 and 50 years of age. She had been approximately 167 cm tall. No trauma or pathology was observed.

111. NANBUD632. DOD: 1930

Burial location/position: Family members identified the grave of NANBUD632 on a slope and next to a ploughed field in the Budeli village. Several loose stones, which had been packed into an oval shape, marked the location of the grave and measured 1.9m in length and 1.4m in width. An headstone made from corrugated, an axe head, a wire cutter, a vice grip, a knife fragment, four hoe fragments, two iron pegs, one plastic comb, one iron saw blade, three potsherds, one fork, fragments of two cast iron pots, two iron pot handles, a file, a pair of scissors, a large screen and various other iron objects were found on the surface of the grave. The grave pit was oval in shape and measured 1.3m in length, 67cm in breadth and 1.28m in depth. The body had been placed on the right side in a flexed position with the head orientated towards the south.

Family information: Family indicated that the individual had been a male between 70 – 80 years of age.

Preservation: Condition of the remains was extremely poor. Only fragments of the cranium, humeri, femora and tibiae were recovered. The claviculae, scapulae, ribs, vertebrae, radii, ulnae, sacrum, pelvis, fibulae and hands and feet were not found.

Sex: Sex could not be determined from the osteological evidence.

Age: The remains belonged to an adult. Heavy calculus deposits were observed on the molars such that it was not possible to record dental wear.

Dentition: Only the upper left M1, M2 and M3 were recovered. The lower left I1, I2, C, M2 and M3 had been lost antemortem. No carious lesions were observed. The presence or absence of enamel hypoplasia was not scored.

Stature: Stature was not estimated.

Trauma/Pathology: The presence or absence of trauma was not assessed.

Conclusion: The remains were possibly those of an adult male.

112. NANMUL639. DOD: 1966

Burial location/position: Family members identified the grave of NANMUL639 in the southeast corner of the new Mulenzhe relocation area. Several loose stones, which had been packed into a rectangular shape, marked the location of the grave and measured 2.56 m in length, 1.08 m in breadth and 30 cm in height. The grave pit also had a rectangular shape and measured 1.9m in length, 66 cm in breath and 1.66 m in depth. The body had been placed in a supine position with the left forearm over the chest and the head orientated toward the south. The individual had been wrapped in a blanket and two copper bracelets were found on the left forearm.

Family information: Family indicated that the individual had been a male of 106 years.

Preservation: Condition of the remains was poor. Only fragments of the cranium and long bones were recovered. No scapulae, ribs, vertebrae, hands, or feet were present.

Sex: Sex was not determined from the osteological evidence.

Age: Large patches of dentin had been exposed on all the teeth. From this evidence, it was tentatively suggested that the individual had been over 30 years of age.

Teeth: The lower left second molar had been lost antemortem. The upper right I1, I2, and C, the upper left I1, I2, and C, the lower right I1 and I2, and the lower left I1 were lost postmortem. No carious lesions were observed. The presence or absence of enamel hypoplasia was not scored.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusions: The remains were possibly those of a male who had been over 30 years of age.

113. NANMUL640. DOD: 1954

Burial location/position: Family members identified the grave of NANMUL640 in a ploughed field in the southeastern corner of the Mulenzhe village. Several large stones, which had been packed into an oval shape, marked the location of the grave and measured 3.06 m in length and 1.87 m in width. The grave pit was rectangular in shape and measured 1.8 m in length, 60 cm in breadth and 94 cm in depth. The body had been placed in a supine position with the head orientated towards the north. No grave goods were present.

Family information: Family indicated that the individual had been a female of 84 years.

Preservation: Condition of the remains was poor. Only fragments of the cranium and long bones were recovered. The claviculae, scapulae, ribs, pelvis, vertebrae, hands, and feet were not found.

Sex: Sex was not determined from the osteological evidence.

Age: Small patches of dentin were observed on the molar teeth. From this evidence, it was tentatively suggested that the woman had been over 40 years of age.

Teeth: The lower right first incisor had been lost antemortem. The upper right I1, I2, C and the upper left I1, I2, M2, and M3 were lost postmortem. No carious lesions were observed. The presence or absence of enamel hypoplasia was not recorded.

Stature: Stature was not determined.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a female who had been over 40 years of age.

114. NANBUD649. DOD:1964

Burial location/position: Family members identified the grave of NANBUD649 on the southeastern side of a single room hut in the Budeli village. Four large stones demarcated the grave, which measured 2m in length and 1 m in width. A few potsherds, a plastic cup handle, and a walking stick were found on the surface of the grave. The grave pit was oval in shape and measured 1.63 m in length and 1.8 m in depth. The body had been placed on his right side. A few potsherds were found associated with the remains.

Family information: Family indicated that the individual had been a male of 80 years.

Preservation: Condition of the remains was poor. A complete cranium along with fragments of the pelvis femora, tibiae, and fibulae were recovered. The claviculae, scapulae, humeri, radii, ulnae, ribs, vertebrae, sacrum, hands, and feet were not present.

Sex: A low forehead, and ramal flexure were observed. These features tentatively indicate a male.

Age: The cranial synchondrosis was unfused. None of the teeth had wear and the third molars had not erupted. From this evidence, it was suggested that the individual had been between 18 and 25 years of age.

Dentition: None of the teeth had been lost antemortem. Carious lesions were observed on the upper second molars. All the incisors and lower canines had linear enamel hypoplasias.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 152.1 cm ± 2.371.

Trauma/Pathology: Excluding linear enamel hypoplasia, no trauma or pathology was observed.

Conclusion: The remains were possibly those of a male between 18 and 25 years of age. He had been approximately 153 cm tall. Linear enamel hypoplasias were recorded on the incisors and lower canines.

115. NANMUL668. DOD: 1959

Burial location/position: Family members identified the grave of NANMUL668 in the southeast corner of the new Mulenzhe relocation area. Several stones outlined the grave and measured 2.09 m in length and 1.49 m in breadth. The grave pit was also oval in shape and measured 1.62m in length, 55 cm in breadth and 92 cm in depth. The body had been placed in a supine position with the right forearm on the abdomen and the head orientated towards the north. No grave goods were found.

Family information: Family members indicated that the individual had been a male of 34 years.

Preservation: Condition of the remains was poor. A complete cranium along with fragments of the claviculae, scapulae, humeri, radii, ulnae, ribs, vertebrae, femora, tibiae, fibulae, hands and feet were recovered.

Sex: A low forehead, large mastoid processes, and blunt supraorbital margins were observed. These features indicate a male.

Age: All the cranial sutures were open. Little to no dental wear was observed. From this evidence, it was tentatively suggested that the individual had been between 30 and 50 years of age.

Dentition: The upper right central incisors and the lower incisors had been lost antemortem. The upper right I2, M3, the upper left I1, I2, C, PM2, M1, M2, and M3, the lower left C, PM1, PM2, and M1 were lost postmortem. Carious lesions were noted on the occlusal surfaces of the upper right PM2 and the lower right M3. Due to excessive postmortem tooth loss of the incisors and canines, enamel hypoplasias were not scored.

Stature: Stature was not determined.

Trauma/Pathology: The presence or absence of any trauma or pathology was not assessed due to poor preservation of the remains.

Conclusion: The remains were possibly those of a male between 30 and 50 years of age.

116. NANMAC689. DOD: UNKNOWN

Burial location/position: Family members identified the grave of NANMAC689 inside the Madzivhandila Agricultural College and approximately 700 m northeast of the animal farm unit.

Several loose stones, which had been packed into an oval shape, marked the location of the grave and measured 1.8 m in length and 1.4m in width. The grave pit was oval in shape and measured 1.45 m in length, 67 cm in breadth and 1.34 m in depth. The body had been placed in a flexed position with the head orientated towards the east.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the cranium, claviculae, scapulae, pelvis, vertebrae, and most of the long bones were recovered. No ulnae, sacrum, ribs, hands and feet were found.

Sex: A low forehead, prominent external occipital protuberance, and ramal flexure were observed. The femoral head diameter was wide, 44mm. These features indicate a male.

Age: Dental wear was minimal on all the teeth. Most of the cranial sutures were partially obliterated. No vertebral osteophytes were present. From this evidence, it was estimated that the individual had been between 30 and 50 years of age.

Dentition: The lower right third molar had been lost antemortem. The upper right P2 and lower right M1 were lost postmortem. Carious lesions were recorded on the buccal surfaces of the upper right I1, both upper M3's and the lower left M3, on the distal surface of the upper right P1, and on the occlusal surface of the lower right M2. Pitted and linear enamel hypoplasias were noted on the incisors and canines.

Stature: Stature was not determined due to poor preservation of the remains.

Trauma/Pathology: Excluding enamel hypoplasia, no trauma or pathology were observed.

Conclusion: The remains were possibly those of a male who had been between 30 and 50 years of age. Dental caries were common. Pitted and linear enamel hypoplasias were noted on the incisors and canines.

117. NANMAC704: DOD: 1950

Burial location/position: Family members identified the grave of NANMAC704 inside the Madzivhandila Agricultural College and approximately 500m northeast of the animal farm unit. Several large stones outlined the grave and measured 2.2m in length and 1.4 m in width. The grave pit was oval in shape and measured 1.6 m in length, 50 cm in breadth and 1 m in depth. The orientation of the remains was not described. No grave goods were found.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the cranium, humeri, radii, ulnae, femora, pelvis, tibiae, and fibulae were recovered. The claviclae, scapulae, sacrum, ribs, hands, or feet were not found.

Sex: The sciatic notch was wide, and the long bone shafts were gracile in appearance. These features tentatively indicate a female.

Age: Little to no dental wear was observed on the molars. From this evidence, it was suggested that the individual had been between 20 and 30 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right C and the upper left I1 had been lost postmortem. Two supernumerary premolars were found adjacent to the lower first premolars. No carious lesions were observed. Linear enamel hypoplasias were recorded on the upper incisors and canines.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: Trauma or pathology to the postcranial region was not assessed.

Conclusion: The remains were possibly those of a female between 20 and 30 years of age. Linear enamel hypoplasias were recorded on the upper incisors and canines.

118. NANMAC720. DOD: 1940

Burial location/position: Not available.

Family information: Family members indicated that the child had been a male.

Preservation: Condition of the remains was good. Fragments of the cranium along with 18 deciduous teeth, 4 permanent tooth germs, claviculae, scapulae, long bones, vertebrae, pelvis, hands, feet, and epiphyses for the proximal humeri, proximal tibiae, and distal femora were found.

Sex: Sex was not determined from the osteological remains.

Age: A dental eruption chart was used to determine age. All the deciduous teeth had erupted. None of the permanent tooth germs had root development. From this evidence, it was suggested that the individual had been between 3 and 5 years old.

Dentition: None of the teeth had been lost antemortem. The upper right di2 and dm1 were lost postmortem. No carious or enamel hypoplastic lesions were recorded.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male between 3 and 5 years of age.

119. NANBUD723. DOD: 1935

Burial location/position: Family members identified the grave of NANBUD723 on a small rise that overlooked the Budeli village. Several large stones, which had been packed into an oval shape, marked the location of the grave and measured 2.5m in length and 1.9m in width. Twenty diagnostic and 23 non-diagnostic potsherds were found on the surface of the grave. The grave pit was oval in shape and measured 1.6m in length, 1.2m in depth and 60cm in breadth. The body had been placed on the left side in a flexed position with the head orientated towards the north. Fragments of a blanket and several buttons were associated with the remains.

Family information: Family members indicated that the individual had been a female of 75 years.

Preservation: Condition of the remains was poor. Only fragments of the cranium, femora and tibiae were recovered.

Sex: A robust menton and large mastoid processes were observed. The maximum diameter of the femoral head was narrow, approximately 42 mm. These features tentatively suggest a male. **Age:** Dental wear was moderate on the molar teeth. From this evidence, albeit minimal, it was suggested that the person had been over 40 years of age.

Dentition: The lower right M1, M2 and lower left I2 had been antemortem. The upper right I1, C, and M3 and the lower left I1 were lost postmortem. Carious lesions were recorded on the occlusal surfaces of the upper left second molar, the lower second molars and the lower left third molar. Since dental wear was severe on the anterior teeth, enamel hypoplasias were not scored.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusions: The remains were possibly those of a male over 40 years of age.

120. NANMAC724. DOD: 1944

Burial location/position: Not available.

Family information: Not available.

Preservation: Condition of the remains was excellent. Except for the right patella, all the bones were recovered.

Sex: A low forehead, ramal flexure and gonial eversion were observed. Both the sciatic notch and sub-pubic angle were narrow. The femoral head diameter was large, 46 mm. These features indicate a male.

Age: The cranial synchondrosis was fused. Little to no dental wear was observed on the molars. The morphology of the sternal end of the 4th rib was between a phase 2 and 3. Epiphyseal lines were visible on the head of the humerus, head of the femur, bodies of the vertebrae and the superior aspect of the iliac blade. From this evidence, it was estimated that the individual had been between 25 and 30 years.

Dentition: None of the teeth had been lost antemortem or postmortem. Carious lesions were observed on the medial surface of the upper right I1, the distal surface of the upper right P1, the medial surface of the upper left I1, the occlusal surface of the lower right M3, and the occlusal surface of the lower left M2. There were no signs of enamel hypoplasias on the anterior teeth.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 174.4 cm ± 2.371.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a male between 25 and 30 years of age. He had been approximately 175 cm tall.

121. NANMUT764. DOD: UNKNOWN

Burial location/position: Members of the community identified the grave of NANMUT764 on small rise within a thicket of trees and approximately one km upstream of the Levhuvhu River. Several loose stones, which had been packed into a rectangular shape, marked the location of the grave and measured 1.80 m in length and 1.24m in breath. Ten copper bangles and one potsherd were found on top of the grave. The grave pit was elongated in shape and measured 1.42 m in length and 73 cm in breadth. The body had been placed in a flexed position.

Family information: Not available.

Preservation: Condition of the remains was poor. The cranium, claviculae, scapulae, pelvis, sacrum, long bones, hands, and feet were recovered.

Sex: A high forehead, small mastoid processes, and sharp supra-orbital margins were observed. The sciatic notch was wide. These features indicate a female.

Age: The cranial synchondrosis was not fused. The third molars had erupted, but no wear was observed on any of the molar teeth. From this evidence, it was suggested that the person had been 20 and 25 years of age.

Dentition: The upper right I1, the lower left I2, C and M2, and the lower right M2 had been lost antemortem. None of the teeth were lost postmortem. Carious lesions were recorded on the occlusal surfaces of all the upper molars.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 154.3 cm ± 2.789.

Trauma/Pathology: No trauma or pathology was observed.

Conclusions: The remains were possibly those of a female between 20 and 25 years of age. She had been approximately 154cm tall.

122. NANMUL766. DOD: 1945

Burial location/position: Family members identified the grave of NANMUL766 on the southern side of the river and 50 m upstream from the southern footprint of the dam wall. There was no grave dressing. Approximately 68cm beneath the surface, a rectangular shaped grave pit was found and measured 2.04m in length, 71cm in breadth and 1.03m in depth. The body had been placed in a supine position with the right hand on the abdomen. No grave goods were found.

Family information: Family members indicated that the individual had been a male of 50 years.

Preservation: Condition of the remains was good. The cranium, humeri, radii, ulnae, ribs, four thoracic vertebrae, sacrum, pelvis, femora, tibiae, fibulae, hands and feet were recovered.

Sex: A sloping forehead, smallish mastoids and large teeth were observed. The sciatic notch was narrow, and the femoral head diameter was large, 45mm. These features indicate a male.

Age: The cranial synchondrosis was unfused. The third molars had erupted but had no wear.

Epiphyseal lines were visible at the proximal humerus, distal femora and distal tibiae. From these features, it was suggested that the person had been between 18 and 25 years of age.

Dentition: None of the teeth had been lost antemortem. The upper left I1 and I2, and the lower right I1 were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 165.5 cm ± 2.371.

Trauma/Pathology: Small circular lesions were recorded on the cranium, distal epicondyle of the left humerus and the head of the right ulna. No sub-periosteal lesions were observed on the long bones. This is possibly a case of osteomyelitis.

Conclusion: The remains were possibly those of a male between 18 and 25 years of age. He had been approximately 165cm tall. Small circular lesions were observed on the cranium, distal epicondyle of the left humerus and the head of the right ulna and may be associated with osteomyelitis.

123. NANMUL773. DOD: 1925

Burial location/position: Family members identified the grave of NANMUL773 on the eastern side of the Mulenzhe village and approximately 500m south of the road leading to the old Musanda. Large and medium sized stones, which had been packed into a round shape, marked the location of the grave and measured 3.04m in length and 2.13m in width. An iron bed frame, a tire, eight non-diagnostic potsherds, one diagnostic potsherd, three glass fragments, a metal object, a metal rod and one long bolt were found on the surface of the grave. The grave pit was oval in shape and measured 1.36m in length, 73 cm in breadth and 90 cm in depth. The body had been placed on the right side in a flexed position with the head orientated towards the west. No grave goods were found with the remains.

Family information: Family members indicated that the individual had been a female of 70 years.

Preservation: Condition of the remains was poor. Four loose teeth and fragments of the cranium, scapulae, claviculae, ribs, humeri, radii, ulnae, vertebrae, pelvis, femora, tibiae, and fibulae were recovered.

Sex: Sex was determined from the osteological evidence.

Age: Large patches of dentin were exposed on all the teeth. From this evidence, it was tentatively suggested that the individual had been over 30 years of age.

Dentition: Only the upper right first incisor, canine, and first premolar and the lower left second incisor were recovered. All the lower left molars had been lost antemortem. No carious lesions were recorded.

Stature: Stature was not determined due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a female over 30 years of age.

124. NANMUL774. DOD: 1950

Burial location/position: Family members identified the grave of NANMUL774 on the eastern side of the Mulenzhe village and approximately 500m south of the road leading to the old Musanda. Several loose stones, which had been packed into an oval shape, marked the location of the grave and measured 1.8m in length and 1.1m in width. An iron hoe, seven non-diagnostic and six diagnostic potsherds were found on top of the grave. The grave pit was oval in shape and measured 1.47m in length, 67cm in breadth, and 1.03m in depth. The body had been placed on the left side in a flexed position with the head orientated towards the east. No grave goods were found with the remains.

Family information: Family members indicated that the child had been male.

Preservation: Condition of the remains was extremely poor. Only 26 loose teeth (deciduous and permanent dentition) and fragments of the right humerus, left femur and left tibia were recovered.

Sex: Sex was not determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. The permanent incisors had erupted. The permanent first premolars and second molars were partially erupted. From this evidence, it was suggested that the individual had been 8 years ± 24 months.

Dentition: Carious lesions were recorded on the occlusal surfaces on both lower deciduous first molars.

Stature: Stature was not determined.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a male between 6 and 10 years of age. No trauma or pathology was observed.

125. NANMUL775. DOD: 1985

Burial location/position: Family members identified the grave of NANMUL775 approximately 60 m south of the road that leads to the old Musanda of Chief Ramovha. Large rocks, which had been packed into an oval shape, marked the location of the grave and measured 2.34 m in length and 1.28 m in width. One hundred and thirty non-diagnostic potsherds, thirty-four diagnostic potsherds and a divining kit (delosse) were found on the surface of the grave. The divining bones contained six incised rib fragments, one tarsal, a cowrie shell and a small spoon. The grave pit was oval in shape and measured 1.27 m in length, 64 cm in breadth, and 92 cm in depth. The body had been placed on the right side in a flexed position with the orientated towards the west.

Family information: Family members indicated that the individual had been female between 30 and 40 years of age.

Preservation: Condition of the remains was excellent. All the bones were recovered.

Sex: A high forehead, round skull vault and small mastoids were observed. The sciatic notch was wide, and the femoral head diameter was small, 38mm. These features indicate a female.

Age: The sternal rib morphology was a phase 4. Dental attrition was moderate, and no dentin was exposed. Vertebral osteophytes were present on C2 – C4 as well as T9 - T12. From this evidence, it was estimated that the individual had been between 28 -32 years of age.

Dentition: The upper third molars and the lower left first molar had been lost antemortem. None of the teeth were lost postmortem. A carious lesion was recorded on the occlusal surface of the upper left first molar. No enamel hypoplasias were observed.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 153.9 cm ± 2.497.

Trauma/Pathology: Vertebral osteophytes were recorded on C2-C4, T9, T10, L4 and L5 (degree 1).

Conclusion: The remains were of a female between 28 and 32 years of age. She had been approximately 154 cm tall.

126. NANMUL776. DOD: 1985

Burial location/position: Family members identified the grave of NANMUL775 approximately 60 m south of the road that leads to the old Musanda of Chief Ramovha. Large rocks, which had been packed into an oval shape, marked the location of the grave and measured 2.50 m in length and 1.45 m in width. A small glass bottle, 28 non-diagnostic and 23 diagnostic potsherds were found on the surface of the grave. The grave pit was oval in shape and measured 1.3 m in length, 57 cm in breadth and 100 cm in depth. The body had been placed on the right side in a flexed position with the head orientated towards the south. No grave goods were present.

Family information: Family members indicated that the individual had been female between 60 and 70 years of age.

Preservation: Condition of the remains was excellent. All of the bones were recovered, except the ribs.

Sex: A high forehead, round skull vault and absence of ramal flexure were observed in the cranium. The sciatic notch was wide, and the femoral head diameter was small, 38 mm. These features indicate a female.

Age: All the cranial sutures were open. Dental wear was moderate on the molar teeth. From this evidence, it was suggested that the individual had been over 40 years of age.
Teeth: The upper left central incisors had been lost antemortem. Dental caries were recorded on the occlusal surface of the upper right second molar. No enamel hypoplasias were observed.
Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 149.9 cm ± 2.497.
Trauma/Pathology: No trauma or pathology was observed.
Conclusion: The remains were those of a female between 40 and 60 years of age. She had been approximately 150 cm tall. No trauma or pathology was observed.

127. NANMUL789. DOD: UNKNOWN

Burial location/position: Community members identified the grave of NANMUL789 on the western side of the Mulenzhe clinic between the fence and the main road. Several loose stones, which had been packed into an oval shape, marked the location of the grave and measured 2.18m in length and 1.6m in width. Eleven non-diagnostic potsherds were recovered from the surface of the burial. The grave pit was oval in shape and measured 1.85m in length, 60cm in breadth and 83cm in depth. The individual had been placed in a supine position with the right hand on the abdomen and the head orientated towards the north.
Family information: Not available.
Preservation: Condition of the remains was poor. The cranium along with fragments of the claviculae, scapulae, humeri, radii, ulnae, sacrum, pelvis, right femur, tibiae and fibulae were recovered. No ribs, vertebrae, hands or feet were found.
Sex: A low forehead, prominent supra-orbital torus, blunt supra-orbital margins and large mastoids were observed. These features indicate a male.
Age: The cranial synchondrosis was unfused. Little to no dental wear was observed on the molars. From this evidence, it was suggested that the individual had been between 20 and 25 years of age.

Dentition: None of the teeth had been lost antemortem. The upper and lower central incisors were lost postmortem. A carious lesion was recorded on the distal surface of the lower left second premolar.

Stature: The physiological length of tibia was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 166.4 cm ± 2.371.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a male between 20 and 25 years of age. He had been approximately 166 cm tall.

128. NANMUL790. DOD: UNKNOWN

Burial location/position: Community members identified the grave of NANMUL790 on the western side of the Mulenzhe clinic between a fence and the main road. Loose stones, which had been packed into an oval shape, marked the location of the grave and measured 1.7m in length and 92cm in width and 1 m in depth. The body had been placed on the left side in a flexed position.

Family information: Not available.

Preservation: Condition of the remains was good. The mandible, claviculae, humeri, radii, ulnae, vertebrae, sacrum, femora, tibiae and fibulae were intact. The skull vault, facial bones, maxilla, left scapula, ribs and pelvis had extensive postmortem damage.

Sex: A low forehead and prominent browridge was observed. The sciatic notch was narrow and the femoral head diameter was large, 44 mm. These features indicate a male.

Age: Dental wear was moderate on all the teeth. No vertebral osteophytes were observed. The pubic symphyseal morphology was between a phase 5 (Suchey Brooks method)(35-40 years) and a phase 6 (Todds method) (30-35 years). From this evidence, it was suggested that the person had been between 30 and 40 years of age.

Dentition: Six loose teeth were recovered and included the upper right I2, P2, and M3 and the left I2, M1, and M3. The lower right P1, M1, and M2 and the lower left P2, M1 and M3 had been lost antemortem. The right PM2 was lost postmortem. No dental caries was recorded.

Stature: The physiological length of the femur and tibia was used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 168.5 cm ± 2.371.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were those of a male between 30 and 40 years of age. He had been approximately 169 cm tall.

129. NANBUD793. DOD: 1950

Burial location/position: Family members identified the grave of NANBUD793 on the southern side of Tshen and approximately 20 m from the road that leads to the small koppie in the Budeli village. Approximately 10 stones had been scattered on top of the grave. The grave pit was oval in shape and measured 1.63 m in length, 82 cm in width and 85 cm in depth. The body had been placed in a flexed position with the head orientated towards the east. An animal high was found underneath the remains.

Family information: Family members indicated that the individual had been a male of 38 years.

Preservation: Condition of the remains was extremely poor. Only 14 loose teeth and a right femur were recovered.

Sex: The femoral head diameter was wide, 48 mm. This feature indicates a male.

Age: Dental attrition was moderate and no dentin was exposed on the molars. From this evidence, it was suggested that the person had been between 30 and 50 years of age.

Dentition: The fourteen teeth included the upper right M3, the upper left I2, C, P1, P2, M1, M2 and M3, the lower right M2 and the lower left C, P2, M1, M2, and M3. A carious lesion was recorded on the occlusal surface of the lower left third molar. No enamel hypoplastic lesions were observed.

Stature: Stature was determined due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a male between 30 and 50 years of age.

130. NANMUL808. DOD: UNKNOWN

Burial location/position: The community identified the grave of NANMUL808 approximately 4 m northwest of a small perennial stream and a Bitter false thorn tree in the Mulenzhe village. Six medium sized rocks had been used to mark the location of the grave. The grave pit was oval in shape and measured 95 cm in length, 88cm in breadth and 70 cm in depth. The body had been placed in a flexed position. No grave goods were found.

Family information: Not available.

Preservation: Preservation of the remains was poor. Fragments of the cranium along with 15 deciduous teeth, the right humerus, left scapula, right ulna, six neural arches, seven vertebral bodies, ribs, sacrum, left iliac bone, left pubic bone, right femur, right tibia and fibulae were recovered.

Sex: Sex was not determined from the osteological evidence.

Age: A dental eruption chart was used to estimate age. All of the deciduous teeth had erupted. None of the permanent teeth had erupted. From this evidence, it was suggested that the child had been between 3 and 5 years of age.

Dentition: None of the teeth had been lost antemortem. No carious or enamel hypoplasias were observed.

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 3 to 5 years of age.

131. NANBUD810. DOD: 1951

Burial location/position: Family members identified the grave of NANBUD810 in the eastern corner of the Budeli relocation area. Several large circular stones and sisal plants marked the location of the grave. A shoe, three spoons, a fork, a razor, two hoes, a file, a sickle, an ox head, two knives, a comb, a can, three screw drivers, a small chain, a tin opener, scissors, a 20 mm cartridge shell, a nail, two small bottles, three coins and some wire were found on the surface of the burial. The grave pit was oval in shape and measured 1.2 m in length, 55 cm in breadth and 79 cm in depth. The body had been buried on the left side in a flexed position with the head orientated towards the north. No grave goods were present.

Family information: Family members indicated that the individual had been a male of 80 years.

Preservation: Condition of the remains was poor. Only fragments of the cranium, humeri, radii, ulnae, femora, and tibiae were recovered. The claviclae, scapulae, ribs, vertebrae, pelvis, fibulae, hands or feet were not retrieved.

Sex: Sex was not determined from the osteological evidence.

Age: Dental wear was moderate and no dentin was exposed on any of the teeth. From this evidence, it was suggested that the person had been between 30 and 50 years of age.

Dentition: Only three teeth were recovered and included the upper left C, PM1, and PM2. The lower third molars had been antemortem. The lower right I1, C, P1, P2 and the left I1 and were lost postmortem. No carious or enamel hypoplastic lesions were observed.

Stature: Stature was not estimated due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a male between 30 and 50 years of age.

132. NANMUL863. DOD: 1955

Burial location/position: Family members identified the grave of NANMUL863 on a small hill that overlooked the valley and was northeast of the Mulenzhe clinic. Medium size rocks, which had been packed into the shape of a circle, marked the location of the grave and measured 2.0m in length and 1.8m in breadth. The grave pit was circular in shape and measured 1.21m in length, 71cm in width and 76cm in depth. The burial position was not determined.

Family information: Family members indicated that the individual had been a female of 90 years.

Preservation: Only eight teeth (the upper right I2, P1, P2, and M1, the lower right PM1, M2, and M3, and lower left C) were recovered.

Sex: Sex was not determined from the osteological evidence.

Age: Little to no dental wear was observed on all the teeth. From this evidence, albeit minimal, it was suggested that the individual had been between 20 and 40 years of age.

Dentition: No carious or enamel hypoplastic lesions were observed.

Stature: Stature was not estimated.

Trauma/Pathology: The presence or absence or trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a female between 20 and 40 years of age.

133. NANMUL864. DOD: 1960

Burial location/position: Family members identified the grave of NANMUL864 on a small hill that overlooked the valley and was approximately 10km from the Mulenzhe clinic. Thirty medium sized stones, which had been packed into the shape of a circle, marked the location of the grave and measured 2.1m in length and 1.7m in breadth. Twenty-five broken potsherds were recovered from the surface of the grave. The grave pit was oval in shape and measured 1.4m in length, 55cm in breadth and 1.04m in depth. The body had been placed on the right side in a flex position. No grave goods were found.

Family information: Family members indicated that the individual had been a female between 50 and 60 years.

Preservation: Condition of the remains was good. Fragments of the cranium along with the claviculae, scapulae, humeri, radii, ulnae, sacrum, pelvis, femora, tibiae, fibulae, hands and foot bones were present.

Sex: A high forehead, sharp supra-orbital margin and absence of ramal flexure were observed. Both the sciatic notch and sub-pubic angle were wide and the femoral head diameter was small, 41.5 mm. These features indicate a female.

Age: The pubic symphyseal morphology was a phase 8 or 9 (Todds method; 40-49 years) and phase 5 (Suchey-Brooks method; 50+). From this evidence, it was suggested that the individual had been between 40 and 55 years of age.

Dentition: Most of the teeth had been lost antemortem and included the upper right I1, I2, PM1, M2, and M3, lower right P1, P2, M1, M2 and M3, the lower left I1, and the lower right I1, I2, M1, M2 and M3 had been lost antemortem. No carious lesions were recorded on the remaining teeth.

Stature: The physiological length of the femur and tibia was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 159.1 cm ± 2.497.

Trauma/Pathology: Sub-periosteal lesions were observed on the left fibula.

Conclusion: The remains were possibly those of a female between 40 and 55 years of age. She had been approximately 159 cm tall. Sub-periosteal lesions were observed on the left fibula.

134. NANMUL865. DOD: 1955

Burial location/position: Family members identified the grave of NANMUL864 on a small hill that overlooked the valley and was approximately 10km from the Mulenzhe clinic. Several medium sized rocks, which had been packed into the shape of a circle, marked the location of the grave and measured 1.5m in length and 1.3m in width. A few iron and copper bangles were recovered from the surface of the grave. The grave pit was oval in shape and measured 1.27m in length, 64cm in breadth and 80cm in depth. The body had been placed in a flexed position with the head orientated towards the north. No grave goods were found with the remains.

Family information: Not available.

Preservation: Condition of the remains was poor. Only the cranium, mandible, femora, tibiae, fibulae and foot bones were recovered.

Sex: A high forehead, round skull vault, sharp supra-orbital margins and small mastoids were observed. The femoral head diameter was small, 41mm. These features indicate a female.

Age: All the cranial sutures were open. Dental attrition was moderate and no dentin was exposed on the molar teeth. From this evidence, it was suggested that the person had been between 25 and 35 years of age.

Dentition: None of the teeth had been lost antemortem. The upper right I1 and I2 and the upper left I1 and M3 were lost postmortem. Carious lesions were recorded on the occlusal surface of the upper right third molar and the distal surface of the lower right first molar. No enamel hypoplastic lesions were observed.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 165.3 cm ± 2.497.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a female between 25 and 35 years of age. She had been approximately 161 cm tall.

135. NANMUT878. DOD: 1953

Burial location/position: Family members identified the grave of NANMUT878 approximately 1km upstream of the dam wall and within a thicket of small trees and bushes. Large to medium sized stones had been used to outline the grave. A small glass bottle, 10 diagnostic potsherds and one non-diagnostic potsherd were found on the surface of the burial. The grave pit was oval in shape and measured 1.87m in length, 60 cm in breadth and 95 cm in depth. The body had been placed on the right side in a flexed position with the orientated towards the north.

Family information: Family members indicated that the individual had been a male of 68 years.

Preservation: Condition of the remains was fair. Fragments of the skull, pelvis and several long bone shafts were recovered. The claviclae, scapulae, ulnae, radius, ribs, vertebrae, sacrum, hands or foot bones were not found.

Sex: A sloping forehead, prominent supra-orbital torus and ramal flexure were observed. These features indicate a male.

Age: All the cranial sutures were obliterated. All the teeth had been severely worn. From this evidence, it was suggested that the person had been over 50 years of age.

Teeth: The upper right C, M2, and M3, the upper left I1, M2, and M3, the lower right I1 and P1, and the lower left I1 had been lost antemortem. A carious lesion was recorded on the occlusal surface of the upper left first molar.

Stature: Stature was not estimated due to the poor preservation of the remains.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed due to the poor preservation of the remains.

Conclusion: The remains were possibly those of a male over 50 years of age.

136. NANMUT880. DOD: 1960

Burial location/position: Family members identified the graves of NANMUT880 on a raised area on the western side of the dam wall. Loose stones had been used to mark the location of the grave. The grave pit was rectangular in shape and measured 1.70m in length, 80 cm in breadth and 1m in depth. The body had been placed in a flexed position with the head orientated towards the north. Four non-diagnostic potsherds, eight diagnostic potsherds, a few iron bangles, a single woven copper wire, a bottle top, an iron lamp top, a copper gas burner, and a few small white beads were found with the remains.

Family information: Family members indicated that the individual had been a male of 86 years.

Preservation: Condition of the remains was excellent. All the bones were recovered. The left left clavicle, scapulae, and pelvis had been damaged postmortem.

Sex: A low sloping forehead, slightly prominent browridge, blunt supra-orbital margins, small mastoids, and a distinct external occipital protuberance were observed. The sciatic notch was narrow and the femoral head diameter was large, 43 mm. These features indicate a male.

Age: All the teeth had moderate to severe wear. Vertebral osteophytes were minimal. The auricular surface was within a phase 4 or 5 (35-44 years). From this evidence, it was suggested that the individual had been between 35 and 45 years of age.

Dentition: The upper left second premolar and first molar had been lost antemortem. The upper left M3, lower right I1 and I2 and the lower left dental arcade were lost postmortem. Carious lesions were recorded on the occlusal surfaces of the upper right I2 and the lower right M3. There were no signs of enamel hypoplasias.

Stature: The physiological length of the femur and tibia were used in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 161.8 cm ± 2.371.

Trauma/Pathology: Osteoarthritis was observed on both mandibular fossae and is indicative of temporomandibular joint disease (TMJ). Vertebral osteophytes were found on C3-C5 (degree 1), T7-T12 (degree 1) and L1-L5 (degree 2). Schmorl nodes were recorded on the vertebral body of T11 and T12.

Conclusion: The remains were possibly those of a male between 35 and 45 years of age. He had been approximately 162 cm in tall. Both mandibular fossae exhibited signs of TMJ and mild vertebral osteophytes were recorded on the spinal column.

137. NANBUD887. DOD: 1960

Burial location/position: Family members identified the grave of NANBUD887 approximately 10 m from a bulldozed road in the northwestern corner of the Budeli relocation area. Bulldozers had damaged the surface of the grave. The grave pit measured approximately 1.8 m in length, 40 cm in width and 1.4 m in depth. The body had been placed in a supine position with the head orientated towards the north. A blanket was found in association with the body.

Family information: Not available.

Preservation: Condition of the remains was poor. Fragments of the cranium, scapulae, pelvis, ulnae, radii, femora, tibiae, and fibulae were recovered. The vertebrae, ribs, hand and foot bones were not found.

Sex: The sciatic notch was wide and the femoral head diameter was small (41mm). These features tentatively indicate a female.

Age: All the cranial sutures were open. Minimal to moderate dental wear was observed. From this evidence, it was suggested that the individual had been between 30 and 40 years of age.

Dentition: The lower right M1 and M3 and the lower left M3 had been lost antemortem. The upper left I1 was lost postmortem. None of the teeth had carious lesions. Linear enamel hypoplasias were recorded on the upper and lower canines.

Stature: The physiological length of the femur was used in conjunction with Lundy's stature formulae for female South African Negroids. Estimated stature was 159.8 cm ± 2.789.

Trauma/Pathology: Excluding enamel hypoplasias, no trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 30 and 40 years of age. She had been approximately 160 cm tall. Linear enamel hypoplasias were recorded on the upper and lower canines.

138. NANBUD888. DOD: 1955

Burial location/position: Family members identified the grave of NANBUD888 approximately 50 m from a bulldozed road in the northwestern corner of the Budeli relocation area. Bulldozers had damaged the surface of the grave. Approximately 1.2m below the surface, the remains were found within a grave pit that measured 1.67 m in length and 83 cm in width. The body had been placed in a supine position. Pieces of a blanket, two copper bangles and six non-diagnostic potsherds were found with the remains.

Family information: Family members indicated that the individual had been a male.

Preservation: Condition of the remains was extremely poor. Twenty-three teeth along with fragments of the cranium and long bones were recovered.

Sex: The menton was square in shape. The circumference of the femoral shaft was wide, 29mm. These features tentatively indicate a male.

Age: Dental wear was severe and large patches of dentin were exposed on the molars. From this evidence, it was suggested that the person had been over 50 years of age.

Dentition The lower right incisors and the upper left central incisor had been lost antemortem. The upper left P2 were lost postmortem. Enamel hypoplasis were not scored.

Stature: On account of the poor preservation of the remains, stature was not determined.

Trauma/Pathology: The presence or absence of trauma or pathology was not assessed.

Conclusion: The remains were possibly those of a male over 50 years of age.

139. NANTSHIL925. DOD: 1997

Burial style/position: Not available.

Family information: Family members indicated that the infant had been a female and had died shortly after birth.

Preservation: Condition of the remains was poor. Only fragments the cranium, left scapula, humeri, left radius, left iliac blade, 25 neural arches, 10 vertebral bodies, femora, and tibiae were recovered.

Sex: Sex was not determined from the osteological evidence.

Age: The diaphyseal length of the femur was 52 mm. Using this measurement in conjunction with comparative material from Fazekas and Kosa (1978), it was estimated that the remains were possibly those of a fetus (7 ½ lunar months).

Trauma/Pathology: No trauma or pathology was observed.

Conclusion: The remains were possible those of a male fetus (7 ½ months).

Skeletal material from Mutoti 102 – 124 were analyzed in 1999 and the reports were compiled by Prof. M. Steyn

140. MUT102. DOD: Unknown

Burial location/position: A few scattered rocks, potsherds and a small pot marked the location of the grave. Approximately 60cm beneath the surface, the remains of MUT102 were found. Forty-two non-diagnostic potsherds, one broken pot, four potsherds and a glass bottle were recovered with the remains.

Family information: Not available.

Preservation: Condition of the remains was fair. The skull and mandible were found with slight postmortem damage. All of the long bones were represented but had damage to their proximal and distal ends. No ribs, pelvis, hand or foot bones were present.

Sex: The mastoid processes were small, the supra-orbital ridge sharp and the forehead vertical. The mandible was gracile in appearance and the teeth were small. These features indicate a female individual.

Age: The third molar had erupted, but with little wear present. All cranial sutures were open. These features indicate a young adult individual, probably between 20 and 35 years of age.

Dentition: Five of the incisors had been lost antemortem. Carious lesions were present on four teeth. Enamel hypoplastic lesions on two of the teeth indicate episodes of malnutrition and/or acute illness during early childhood.

Stature: As none of the long bones were complete, no estimation of stature could be made.

Trauma/pathology: No signs of trauma or pathology could be observed.

Conclusion: The remains were of a possible female individual who had been between 20 - 35 years of age. No trauma or pathology was observed.

141. MUT103. DOD: Unknown

Burial location/position: No information was available.

Preservation: Condition of the remains was poor. The skull had extensive postmortem damage but the mandible was nearly complete. Except for the fibulae, all the long bones were present and included the claviculae, humeri, radii, ulnae, femora and tibiae. No ribs, vertebrae, hand or foot bones were recovered.

Family information: Not available.

Sex: The menton was gracile in appearance and the teeth were small. These features tentatively indicate a female.

Age: The third molars had erupted, with small wear facets visible. No other indicators of age were present, and the individual was tentatively diagnosed as 20 - 40 years old.

Dentition: All the teeth were recovered. Four of them were carious.

Stature: Stature was not estimated due to the poor preservation of the remains.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were possibly those of a female between 20 and 40 years of age. No trauma or pathology was observed.

142. MUT104. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was good. The left side of the skull had postmortem damage. All the postcranial bones were present, except for the hand and foot bones.

Sex : A high forehead, small mastoids and sharp supra-orbital margins were observed. Both the sciatic notch and sub-pubic angle were wide. These features tentatively indicate a female.

Age: All teeth, including the third molar, had erupted and were worn. The cranial sutures were mainly open, but some early osteophytes were present on the vertebrae. These features indicate an age of 30 - 50 years.

Dentition All the teeth were present. None had been lost antemortem. No carious lesions or enamel hypoplastic lesions were observed, but calculus deposits were noted.

Stature: Using the length of the femur and tibia with Lundy's stature formula for female South African Negroids, stature was estimated at 155.2 cm ± 2.497.

Trauma/pathology: Vertebral osteophytes were observed on the cervical vertebrae and osteoarthritis was noted on the elbow joint. A healed fracture was present on the right humerus. Spina bifida occulta was present on the lower thoracic vertebrae and the sacrum.

Conclusion: The remains were those of a female 30 and 50 years of age. She had been approximately 155 cm tall. She had a humerus fracture earlier in life, which led to arthritic changes in the right elbow.

143. MUT105. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: The remains were not very well preserved. The skull was fragmentary, but the mandible was complete. All long bones were represented, although none was complete. No vertebrae were found, and only a few ribs, hand and foot bones were present.

Sex: A wide sciatic notch, rounded menton and gracile mandible were indicative of a female individual. However, the mastoids were large and thus a diagnosis of female was tentative.

Age: Although the cranial sutures were mainly open (indicating a younger individual), the teeth were severely worn. No other indicators of age were present. From these features, it was suggested that this individual had been over 30 years of age.

Dentition: Several carious lesions were observed and two dental abscesses were present. Three teeth had been lost antemortem.

Stature: There were no complete long bones present, so an estimate of stature was made using the formulae for fragmentary remains (femur) developed for Black Americans. The stature was calculated to about 150 cm.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were of a possible female individual who was older than 30 years and approximately 150 cm tall. With the exception of advanced dental disease, no other signs of disease or trauma could be observed.

144. MUT106. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was extremely poor. Only fragments of the three long bones and one flat bone were found.

Sex: No estimate could be made due to the poor preservation.

Age: The size of the remains indicated an individual between 0 and 6 months of age.

Teeth: No teeth were found.

Trauma/pathology: No observations could be made, due to the poor preservation.

Conclusion: The remains were of a possible infant between 0 and 6 months of age. No other observations were possible.

145. MUT107. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was poor. The skull was fragmentary but the mandible was complete. All of the long bones were represented but none were complete. Several ribs, vertebrae, hand and foot bones were recovered.

Sex: The skull was gracile and the mastoids were small. The femoral head diameter was 40mm, which falls within the range for females.

Age: The cranial sutures were partially obliterated and osteophytes were present on C2. Dental wear was moderate. These features indicate an individual who had been older than 35 years of age.

Dentition: Several teeth were lost antemortem, and carious lesions were present on three more teeth. A dental abscess was present in the maxilla. Both upper lateral incisors were peg-shaped. Enamel hypoplastic lesions were noted on some of the teeth.

Stature: No observations could be made, due to poor preservation.

Trauma/pathology: An osteophytic growth was noted on C2.

Conclusion: The remains were of a female who had been older than 35 years of age. Dental attrition was moderate. Carious lesions and enamel hypoplastic lesions were present along with arthritic changes on C2.

146. MUT108. DOD: Unknown

Burial location/position: Information is not available.

Family information: Not available.

Preservation: Condition of the remains was poor. The skull was fragmentary and the mandible was incomplete. All the long bones were present but had extensive postmortem damage. No vertebrae or ribs were recovered.

Sex: The mandible was square in shape and gonial eversion was noted. From these features, a tentative diagnosis of male was made.

Age: Dental attrition was severe. All the cranial sutures were partially obliterated. From these characteristics, it was suggested that the individual had been over 30 years of age.

Dentition: All the teeth were present and no dental decay was observed. Some of the teeth had unusual wear patterns with wear facets on the anterior surfaces. This may be due to erosive substances or occupational use of the teeth.

Stature: Stature could not be determined due to poor preservation.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were of a probably male individual who was older than 30 years of age. No signs of disease were observed.

147. MUT109. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was fair. Although the skull was fragmentary, the mandible was intact. All the long bones were represented, but none of them were complete. Fragments of ribs, vertebrae and hand and foot bones were retrieved.

Sex: The mandible was robust in appearance and the menton had a square shape. The mastoids were large and the diameter of the head of the femur was wide, 46mm. These features are indicative of a male individual.

Age: The third molar had erupted, but had little wear. The cranial sutures were open, and no signs of arthritis were present on the bones. From these features, age was estimated to have been between 25 and 45 years of age.

Dentition: Two teeth showed signs of caries - one of them had only the roots remaining in the alveolar bone. One tooth had been lost antemortem. Several teeth had enamel hypoplastic lesions.

Stature: Antemortem stature was calculated by using the formula for incomplete remains, developed for American blacks. For this purpose the femur was used, and a stature estimate of about 177 cm was obtained.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were of a possible male individual who was between 25 and 45 years and approximately 177 cm tall.

148. MUT110. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was excellent. The entire skeleton was present, except for some of the ribs and vertebrae.

Sex: A high forehead and small mastoid processes were observed. The sciatic notch was wide and a distinct preauricular sulcus was present. The femoral head diameter was small, 40mm. From these features, it was suggested that the individual had been male.

Age: The third molar had erupted and were worn. Some of the cranial sutures were completely obliterated, and some early osteophytes were present. These features indicate an age of about 30 - 50 years.

Dentition: A full set of teeth was present, and one carious lesion was observed. Some tartar was present.

Stature: Stature was estimated by using the length of the femur and tibia with Lundy's stature formula for female South African Negroids. Estimated stature was 159cm.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were a possible female individual who had been between 30 – 50 years of age and approximately 159cm tall.

149. MUT111. DOD: Unknown

Burial location/position: Information was not available.

Family information: Not available.

Preservation: Condition of the remains was poor. Only fragments of the skull, a full set of deciduous teeth and four long bones were found.

Sex : Sex could not be determined due to the young age of the individual.

Age: Dental development indicated an age of 18 ± 3 months.

Dentition: A full set of deciduous dentition was present, as well as the tooth germs of several of the permanent teeth.

Trauma/pathology: No signs of trauma or pathology could be observed.

Conclusion: The remains were those of a young child of about 18 months. No other observations could be mad due to the poor preservation and young age.

150. MUT112. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was poor. Only a few cranial fragments, a complete mandible, a right clavicle, ribs and pelvic fragments as well as four long bone shafts were found.

Sex: Sex could not be determined due to the young age of the individual.

Age: The mandibular symphysis was fused, and the lower lateral incisors were partially erupted. The lower central incisors had been lost postmortem. From these features, it was suggested that the individual had been between 6 and 9 months old.

Dentition: Several deciduous teeth were present. No carious lesions or enamel hypoplastic lesions were observed.

Trauma/pathology: No signs of trauma or pathology could be found.

Conclusion: The remains were those of a small child of about 6 - 9 months old. No other assessments could be made due to the young age and poor preservation.

151. MUT113. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was excellent. All the bones were recovered and only the left side of the skull had postmortem damage.

Sex: Overall, the skeleton was robust in appearance. The menton was square in shape. The sciatic notch was narrow and the femoral head diameter was large, 48mm. From these features, it was suggested that the individual had been male.

Age: Arthritic changes were noted in several of the joints and the sutures of the skull had advanced closure. From these features, it was suggested that the individual had been older than 40 years of age.

Dentition: Several teeth showed signs of caries, and 11 were lost antemortem. Enamel hypoplastic lesions were observed on some of the teeth.

Stature: Stature was estimated from the length of the femur and tibia in conjunction with Lundy's stature formulae for male South African Negroids. Estimated stature was 164cm.

Trauma/pathology: Osteophytes were observed on several of the vertebrae. Bony outgrowths were noted on the distal ends of the right tibia and fibula.

Conclusion: The remains were of a male individual who had been over 40 years of age and approximately 164cm tall. Pathological changes were observed on the distal tibio-fibular joint.

152. MUT114. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was poor. The skull was fragmentary, and the mandible had been broken into several pieces. All major long bones were represented and some vertebrae, ribs, hand and bones were found.

Sex: The individual was a subadult, and therefore the sex was difficult to establish. What was visible of the pelvis indicated a female individual (wide sciatic notch), but the teeth were relatively large. A tentative diagnosis of a female was made.

Age: The third molars were unerupted, and the epiphyseal lines on the distal fibulae were clearly visible. The head of the femur and the distal tibia were completely fused. These point to an age of about 15 - 17 years.

Dentition: All the teeth were present. One carious lesions and a single enamel hypoplastic lesion were observed.

Stature: As none of the long bones were complete, the formulae for fragmentary bones, developed for American blacks, were used to estimate the stature. With the help of the femur, an antemortem stature of about 154 cm was calculated.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were of a possible female individual who was between 15 and 17 years of age and approximately 154cm tall. No trauma or pathology was observed.

153. MUT115. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was poor. The skull vault was recovered, but the facial bones and mandible had extensive postmortem damage. A complete femur and tibia were recovered, but the rest of the long bones had been damaged. Several pieces of the pelvis, ribs, hand and foot bones were found.

Sex: The mastoids were large. However, the sciatic notch was wide and the femoral head diameter was small, less than 40mm. From these features, it was suggested that the individual had been female.

Age: Dental attrition was severe. The cranial sutures were partially obliterated. From these features, it was suggested that the individual had been between 30 and 50 years of age.

Dentition: Many of the teeth were missing, but as the jaws had not been preserved it could not be established whether this loss happened ante- or postmortem. No caries was found, and tartar was present on several of the teeth.

Stature: Stature was estimated from the length of the femur and tibia with Lundy's stature formula for female South African Negroids. Stature was estimated at 156cm.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were of a possible female individual who had been between 30 - 50 years of age and was about 156 cm tall. No signs of trauma or pathology were observed.

154. MUT116. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was good. The skull vault was intact but the facial bones and mandible had extensive postmortem damage. All the postcranial bones were found.

Sex: A high forehead and small mastoids were observed. The diameter of the head of the femur was small, 40mm. From these features, a tentative diagnosis of female was made.

Age: Dental attrition was severe, and a fair degree of suture closure was present in the skull. From this it was suggested that the individual had been over 45 years of age.

Dentition: One of the teeth showed advanced caries.

Stature: Stature was estimated by using the physiological length of the femur with Lundy's stature formula for female South African Negroids. Stature was estimated at 166cm.

Trauma/pathology: No trauma or pathology was observed.

Conclusion: The remains were of a possible female who had been older than 45 years of age and approximately 45 years of age. No trauma or pathology was observed.

155. MUT117. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was fair. The skull vault was intact but the facial bones had extensive postmortem damage. The mandible was complete. All major long bones were represented but none of them were complete. Some ribs, vertebrae, hand and foot bones as well as fragments of the pelvis were found.

Sex: The menton was narrow in shape but appeared robust. The glabella and mastoids were medium-sized and the head of the femur was small, about 41mm. The sciatic notches were narrow. A tentative diagnosis of female was made.

Age: The cranial sutures were partially obliterated, and early signs of arthritis were seen in the joints. From this, it was suggested that the individual had been older than 40 years of age.

Dentition: A number of teeth were lost antemortem, and one tooth had only the roots remaining. No other signs of caries could be found. Calculus deposits were present on some of the teeth.

Stature: For the purpose of calculating the antemortem stature, the formulae for fragmentary bones (femur), developed for American blacks, were used. The stature was calculated to about 158 cm.

Trauma/pathology: Vertebral osteophytes were observed on the vertebrae.

Conclusion: The remains were of a possible female individual who had been older than 40 years of age and was approximately 158cm tall.

156. MUT118. DOD: Unknown

Burial location/position: No information was available.

Family information: Not available.

Preservation: Condition of the remains was poor. Both the skull and mandible were fragmentary. All the major long bones were represented, and some fragments of hand and foot bones, pelvis, ribs, vertebrae and scapulae were found.

Sex: The menton had a round shape. The sciatic notch was wide. From these features, it was suggested that the individual had been female.

Age: The third molars had erupted, but showed very little wear. All cranial sutures were open.

These features indicate a young adult, probably between 20 and 30 years old.

Dentition: Only one tooth showed signs of caries.

Stature: For the purpose of calculating the antemortem stature, the formulae for fragmentary bones (femur), developed for American blacks, were used. The stature was calculated to about 159 cm.

Trauma/pathology: No signs of trauma or pathology could be observed.

Conclusion: The remains were of a possible female individual who had been between 20 - 30 years of age and had been approximately 159cm tall.

157. MUT119. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was poor, and only segments of three long bones and a temporal bone were recovered.

Sex: Sex was not determined due to the young age and poor preservation.

Age: The degree of development of the tympanic plate indicated an age of about 0 to 6 months.

Dentition: No teeth were present.

Trauma/pathology: The presence or absence of trauma or pathology could not be observed due to the poor preservation of the remains.

Conclusion: The remains were those of a young baby of about 0 to 6 months old. No other observations were possible.

158. MUT120. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was poor and only a few bone fragments and a germ tooth were recovered.

Sex: The sex could not be determined due to the young age and poor preservation.

Age: Based on the degree of dental development, this individual was probably a neonate or very small baby.

Stature: The stature could not be determined due to the young age and poor preservation.

Trauma/pathology: No signs of pathology or trauma could be observed, due to the poor preservation.

Conclusion: The remains were those of a small baby or neonate.

159. MUT121. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: Condition of the remains was poor. Only a few fragments of the skull and half of the mandible was recovered. All the long bones of the upper limb were represented, but none from the lower limbs. Some ribs and vertebrae were present.

Sex: The diameter of the head of the humerus was small, 39mm. This falls within the female range for South African Negroids. A very tentative diagnosis of a female was thus made.

Age: Moderate dental attrition was noted on the third molar, and early osteophytic changes were present on the vertebrae. From this, age was estimated to have been between 30 and 50 years of age.

Dentition: No signs of caries or antemortem losses were evident. Calculus deposits were present.

Stature: Stature was estimated by using the length of the radius in conjunction with Lundy's stature formula for female South African Negroids. Estimated stature was 159cm.

Trauma/pathology: Vertebral osteophytes were observed on the vertebrae. A possible fracture was present on the right clavicle.

Conclusion: The remains were of a possible female individual who had been between 30 and 50 years of age and approximately 159 cm tall.

160. MUT123. DOD: Unknown

Burial location/position: No information is available.

Family information: Not available.

Preservation: A full set of deciduous teeth, parts of the right humerus, both femora, one clavicle, one ilium and some bone fragments were recovered.

Sex: Sex could not be determined due to the young age of the individual.

Age: Based on the degree of dental development, this individual was about 9 ± 3 months old.

Dentition: No signs of pathology were observed.

Trauma/pathology: No signs of pathology or trauma were observed.

Conclusion: The remains were those of a small child of about 9 ± 3 months old.

161. MUT124. DOD: Unknown

Burial location/position: Information is not available.

Family information: Not available.

Preservation: Condition of the remains was poor. Some cranial fragments and half a mandible were recovered. All the major long bones with the exception of the fibulae were represented along with several hand and foot bones.

Sex: The head of the femur was wide, 45mm. From this feature, it was tentatively suggested that the individual had been male.

Age: The mandible was nearly edentulous, with atrophy. Three teeth with advanced wear were present. The age was estimated as older than 35 years.

Stature: Stature could not be determined due to the poor preservation of the remains.

Teeth: Most of the teeth were lost antemortem, and the mandible was atrophied.

Trauma/pathology: No signs of pathology or trauma were observed.

Conclusion: The remains were of a male individual who had been older than 35 years of age. No trauma or pathology was observed.

Appendix B. Descriptive statistics of the cranial measurements for males and females

	Males (n = 45)			Females (n = 51)		
	n	Mean	sd*	n	Mean	sd*
Cranium						
Max length	24	183.9	6.54	26	180.1	7.20
Max breadth	23	123.0	5.33	25	125.2	5.72
Bizygomatic breadth	6	123.8	5.71	7	122.5	5.77
Basion-bregma	21	135.1	7.46	21	130.1	6.03
Cranial base length	21	103.6	6.43	20	99.4	5.61
Basion-prosthion length	20	102.9	5.69	18	100.2	5.78
Max alveolar breadth	19	63.8	3.29	19	59.6	4.25
Max alveolar length	22	54.0	13.15	21	53.8	14.23
Biauricular breadth	19	117.5	5.07	21	112.2	5.40
Upper facial height	23	64.6	7.53	24	65.0	4.48
Min frontal breadth	20	96.9	5.31	22	95.8	3.59
Upper facial breadth	16	105.8	4.10	18	102.2	4.76
Nasal height	24	49.6	3.23	24	47.5	4.93
Nasal breadth	24	28.2	1.47	25	27.2	3.40
Orbital breadth	23	42.4	3.50	22	41.7	3.82
Orbital height	23	36.1	3.05	22	35.4	2.06
Biorbital breadth	16	100.0	4.12	15	95.7	3.79
Interorbital breadth	24	25.6	3.02	22	25.3	2.77
Frontal chord	21	112.3	5.39	25	111.0	6.13
Parietal chord	21	118.5	8.35	24	114.6	6.66
Occipital chord	20	71.5	9.66	19	71.1	14.28
Foramen magnum length	20	37.3	2.20	19	37.4	3.01
Foramen magnum breadth	18	29.3	3.34	19	29.1	2.39
Mastoid length	23	27.9	5.80	26	26.0	4.17
Chin height	32	32.0	3.60	33	32.0	4.59
Body height @ mental foramen	37	30.5	3.10	39	29.1	3.88
Body thickness @ mental foramen	38	12.4	1.66	39	12.4	4.32
Bigonial diameter	20	94.3	7.86	20	88.7	3.93
Bicondylar breadth	11	117.1	10.09	14	112.0	5.71
Min ramus breadth	34	36.0	2.72	33	33.2	3.19
Max ramus breadth	25	44.6	3.17	25	41.3	5.19
Max ramus height	22	60.1	7.99	20	54.6	10.74
Mandibular length	24	88.0	10.55	25	78.4	7.42
Mandibular angle	14	118.8	5.65	16	126.5	6.84

* standard deviation
max = maximum
min = minimum
sag = sagittal
vert = vertical
ap = anterior - posterior
dm = diameter

Appendix C. Descriptive statistics of the postcranial measurements for males and females

	Males (n = 45)			Females (n = 51)		
Postcranial	n	Mean	sd*	n	Mean	sd*
Clavicle, max length	12	146.6	10.73	13	135.3	10.84
Clavicle, sag dia @ midshaft	25	12.7	1.08	19	10.2	1.58
Clavicle, vert dia @ midshaft	25	11.5	2.06	19	9.8	1.80
Scapula, height	6	149.3	14.31	7	134.9	8.67
Scapula, breadth	6	103.7	7.12	10	97.0	4.45
Humerus, max length	16	327.4	17.22	15	299.9	17.72
Humerus, epicondylar breadth	20	57.3	5.92	20	53.1	4.80
Humerus, max head dm	16	42.6	3.33	18	36.8	2.09
Humerus, max dm @ midshaft	36	22.2	1.50	40	20.6	2.36
Humerus, min dm @ midshaft	13	18.3	2.11	21	15.4	1.66
Radius, max length	15	259.7	12.42	15	236.9	13.79
Radius, sag dm @ midshaft	28	12.7	1.68	29	10.9	0.80
Radius, transverse dm @ midshaft	29	14.8	1.49	28	13.8	2.02
Ulna, max length	11	276.2	11.83	14	239.5	66.18
Ulna, dorso-volar diameter	30	14.7	1.86	28	13.3	1.95
Ulna, transverse diameter	30	15.3	1.42	27	13.3	2.05
Ulna, physiological length	11	252.9	11.51	13	216.5	59.45
Ulna, min circumference	14	6.3	9.13	16	8.5	10.85
Sacrum, number of segments	5	4.6	0.55	7	4.4	0.53
Sacrum, anterior height	5	112.4	15.18	6	108.0	13.16
Sacrum, anterior surface breadth	6	97.8	23.86	12	104.7	6.22
Max breadth of S1	12	48.1	5.37	11	44.1	7.45
Pelvis height	5	204.6	16.98	7	186.4	13.53
Iliac breadth	4	134.4	4.39	6	140.7	9.37
Pubis length	3	81.0	16.09	8	70.8	8.07
Ischium length	7	88.0	9.04	12	83.6	10.43
Femur, max length	19	465.0	25.16	27	433.2	19.55
Femur, bicondylar length	22	462.2	27.95	26	430.4	22.56
Femur, epicondylar breadth	18	70.8	9.86	26	66.4	5.34
Femur, max diameter head	29	44.7	4.39	33	39.6	2.64
Femur, ap subtrochantric dm	43	25.4	2.38	46	23.5	2.48
Femur, transverse subtrochantric dm	43	31.2	2.59	46	28.2	2.39
Femur, ap midshaft diameter	41	29.1	2.91	48	26.1	2.81
Femur, transverse midshaft diameter	41	26.4	3.66	48	25.1	1.72
Femur, circumference @ midshaft	37	13.2	17.79	46	27.2	32.43
Tibia, condylar-malleolar length	15	398.2	22.38	26	368.3	16.50
Tibia, proximal epiphyseal breadth	17	69.7	5.90	25	62.8	4.65
Tibia, max distal epiphyseal breadth	18	42.4	7.73	26	40.0	3.53
Tibia, transverse @ nutrient foramen	14	24.7	2.14	21	22.4	3.41
Tibia, ap @ nutrient foramen	38	34.9	2.76	44	30.6	3.42
Tibia, physiological length	18	386.4	21.26	27	345.0	54.81
Fibula, max length	5	372.0	13.04	18	336.3	67.54
Fibula, min length	6	12.3	1.75	5	10.2	1.10
Fibula, max diameter of midshaft	25	15.1	1.35	25	13.1	2.19
Calcaneus, maximum length	20	76.8	4.93	21	71.5	3.94
Calcaneus, middle breadth	22	38.5	2.68	25	36.3	3.22