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A skeletal comparison of the demography and health status of pre- and post-European contact African groups from northern Zimbabwe

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Declaration

I, Elizabeth Johanna (Elaine) Swanepoel, hereby declare
that the work presented in this thesis is based on my original work
(except where acknowledgements indicate otherwise)
and that neither the whole work nor any part of it will be submitted
for another degree to this or any other university.

Signature: EJSwanepoel

Date: 28 February 2015

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ABSTRACT

From the 1650s and corresponding with a trade in African slaves, the livelihood, health and life expectancy of indigenous groups were reported to decline as many Zimbabwean settlements changed their identities due to European influence. In this study, human skeletal remains from three archaeological sites from northern Zimbabwe were investigated to compare the health status of the people that it represents, pre-and post-European contact, to ascertain whether this was indeed the case. The Monk's Kop (A.D. 1270-1285) and Ashford Farms sites (A.D. 1330-1440) date back to a period prior to European contact, whereas the Dambarare site (A.D. 1630-1693) represents a population consisting of both Africans and the Europeans they were in contact with.

This study led to the re-discovery of the Monk's Kop archaeological site and in particular indicated that the remains most probably resemble the high social status members of the society. In the Monk's Kop's skeletal collection (n =43), 14% of individuals presented with signs of skeletal pathology while the corresponding figure was 43% in the Ashford Farms individuals (n=7). The Dambarare sample comprised a total of 40 individuals (both African and European ancestry) of which 43% of the Africans had visible signs of skeletal pathology and included the southernmost case reported for trephination in Africa.

Although the pre-European contact populations of Monk's Kop and Ashford Farms therefore seemed to have suffered less (28% combined average) from pathological conditions in comparison to that of the Dambarare individuals of African ancestry (43%), the difference was not statistically significant. Although most pre- versus post-contact investigations report that the biological and cultural effects on the native population was catastrophic to their health, it seems that the first Europeans (particularly the Portuguese) that came into contact with the previously isolated indigenous northern Zimbabwean population, had a minor effect on the people that they interacted with during the 17th century. The Europeans from Dambarare, in contrast, showed many skeletal signs that reflect a less healthy population which, most probably, was due to both the poor socio-economic conditions in their home country and the impact of a long voyage to Africa. It should be kept in mind that the skeletons may not have represented all of the once living populations.

Keywords: Health Status, Zimbabwe, Palaeopathology, Skeletal remains, Monk's Kop, Dambarare, Ashford Farms, Trephination, Tooth modification

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CHAPTER 1: INTRODUCTION

1.1 Background

Wolf refers to a frequent saying that we all inhabit 'one world' as a shared understanding that is not only true of the present, but also of the past through ecological, demographic, economic and political connections (Wolf, 2010).

During the era of land discoveries via the Atlantic Ocean (A.D. 1450 – 1650), often referred to as the Atlantic Age, Europeans began to have a distinct impact on several continents, such as Africa and Asia, both socially and politically (Gray and Birmingham, 1970; Wallerstein, 1986; Thornton, 1998; Ehret, 2002; Wolf, 2010). From an indigenous point of view, this was an early form of European colonisation (Lightfoot, 1995; Cusick, 1998; Silliman, 2005).

Indigenous populations were drawn into commercial trade which had ramifications far inland and affected people who had never even seen a European trader on the coast (Wolf, 2010). Great Zimbabwe, for example, was chosen as the capital of its era by the native population for the area's temperate climate, varied agricultural potential and a combination of sweetveld and sourveld that was ideal for livestock breeding (Pikirayi, 1997). This magnificent capital was therefore not situated in the gold-producing areas and not connected to a trade route. But as the shift from agricultural activities to gold production occurred due to European trade influence, Great Zimbabwe became unsustainable and was abandoned in the 15 century (Oliver, 2001; Pikirayi, 2001).

The impact of European contact has not been well described in African archaeology. Pikirayi (2009), however, provides a valuable assessment of the effects of European presence in Zimbabwe, specifically African-Portuguese contact. As expected, some societies were not affected by European settlement, while others adjusted and were affected in various ways. After 1650, the slave trade also had an adverse effect on the demographics and productive capabilities of Africa. African settlements often changed their identities on account of the contact with the Portuguese visitors (Pikirayi, 2009). The slave trade, disruption of social structures as well as new diseases that were introduced to the indigenous communities may have had a tremendous effect on the health status of these populations. Domination by the gold trade introduced by the Portuguese into the African settlements challenged the traditional social formation and in essence had an impact on political power. The excessive demands for gold mining was suggested to not only have had+ a negative impact on the environment, but also on the indigenous population as they were forced to mine for gold which undermined the local agricultural subsistence bases (Pikirayi, 2001, 2009). Diseases like small pox, measles and the plague as well as famine resulting from the agricultural collapse that was associated with the abandonment of pending harvests resulted in depopulation. All these factors also meant that there were very little African workers left to mine the gold (Beach, 1980; Mudenge, 1988).

Steyn (2003) investigated similar situations in South Africa related to the effect of European contact. Although it can be speculated that the introduction of modern medicine and ways of living of European settlers should have had a positive effect on indigenous populations, their health status often remained the same for a long time, and even worsened in some instances. Interpersonal violence also became more prominent in some populations as skeletal remains showed an increased incidence of traumic injuries (Steyn, 2003).

In many ways, early African manufacturing prior to European contact could easily have provided for the continent's needs, as semi-manufactured goods such as copper, hide, gold, gum and ivory showed the ability of the Africans to produce many of the goods that were imported to Africa prior to A.D. 1650 (such as iron and cloth). In fact, Europe may have offered nothing to Africa that they did not already produce in the era of the Atlantic trade in the 17th century. It is then ironic to realise that impulsive motivations such as the search for prestige, wealth and fancy of the indigenous population (due to European contact) in many cases had severe repercussions for their ultimate survival (Thornton, 1998).

The impact on the northern Zimbabwean population, specifically regarding their health status transformation, has not been studied and will provide insight into the effect European contact may have had on these societies.

1.2 Purpose of the study

Human remains held in collections in South Africa are well studied and have contributed enormously to our understanding of past civilizations. Not only do these studies have bearing on documenting and elucidating past life ways, population dynamics and demography; aspects of palaeopathology have served to document the pre-historic landscape of disease. In several cases where large collections of human remains were available from specific sites, e.g. Mapungubwe (Steyn, 1994), Venda (L'Abbé, 2005) and Toutswe (Mosothwane, 2004), these studies have also had bearing on the archaeological interpretation of these sites. Various new and improved methods of assessment have been applied and all of these collections have been catalogued. However, hardly any evidence of this nature is available from Zimbabwe. This study therefore aims to provide new evidence on previously unstudied groups that will possibly help to elucidate the history of the area. A proper catalogue of the remains will also have immense value in the management of these remains on all levels. It will provide for a permanent record of the remains held by various collections and will enable scholars, researchers and managers, and most importantly source or descendant communities, to assess and consider collections based on reliable information.

The aim of this study was to establish the biological profile and investigate the health status of the population in the northern region of Zimbabwe as represented by their skeletons. Biological background, such as age at death, sex, ancestry and stature can be estimated through standard morphological and metric procedures (Buikstra and Ubelaker, 1994). The recording of prevalence of pathological lesions and describing traumatic injury within a skeletal population can provide an indication as to occupational activities, general health status, nutritional status and the environment of a specific population (Steinbock, 1976; Schultz, 2001; Ortner, 2003; Roberts and Manchester, 2010). A comparison was therefore drawn between different skeletal collections related to their health status specifically pre-and post-European contact. In addition, this study also presented the first catalogue of these remains and will aim to speculate about the ancestry and dynamics of the societies these skeletal remains represent, which will hopefully be of value to the descendant communities.

Although evidence of European contact has been described in the archaeology of northern Zimbabwe, no clear information regarding the impact European contact had on the health and lifestyle of indigenous groups is available. The following null hypothesis will therefore be tested during this study: The health status of the northern Zimbabwean indigenous population remained unchanged in the post-European contact era, as reflected by their life expectancy and skeletal indicators such as the presence of infectious diseases, bone trauma and other pathological conditions. This hypothesis will be rejected if these indicators of health either did not show any change or improved after European contact.

The health status of a population is often described as either good or poor, dependant on the prevalence of specific and non-specific indicators of health (disease) or lifestyle observed in both the skeleton and the teeth. It has, however, recently been debated that a population should rather be labelled as "diseased" when a statistically significant number of skeletal and dental pathological lesions is observed within its skeletal collection. Conversely, the term "healthy" would infer that the skeletal collection exhibited little or no lesions. The debate will most probably continue for some time as it would have supporters for both arguments, but regardless of the term used, this study will investigate whether the health status of the Africans who lived in northern Zimbabwe showed any difference regarding their health status between the 13th and 17th centuries.

CHAPTER 2: LITERATURE REVIEW

2.1 Zimbabwe and its history

2.1.1 Introduction

The Republic of Zimbabwe, formerly known as Rhodesia, is a non-coastal country situated in southern Africa. This land-locked country is bordered by South Africa (south), Botswana (southwest), Zambia (northwest) and Mozambique (east) and is situated between the Zambezi and Limpopo rivers (Gifford, 2011). Its territory corresponds roughly with the distribution of the Shona people, which currently constitutes the majority of the population. The three official languages include Shona (predominantly - approximately 70% of the population), Ndebele (Sindebele) and English (Murray, 1991).

Zimbabwe comprises of an area of close to 400 000 km^2 which primarily covers a central plateau (extending southwest to northwest) with elevations between 1200 m and 1600 m. The highlands in the east are mountainous with the highest point being Mount Nyangani, but there are minor areas of low veld (20% of country) with elevations of less than 900 m (Gifford, 2011; CIA, 2013).

Even though Zimbabwe has a tropical climate with a rainy season stretching from October till March, this country often experiences periods of drought (Pikirayi, 2001; Gifford, 2011). Agriculture is therefore most intensively practiced in the wet eastern Highlands, whereas the rest of the country is mostly involved in livestock production (Murray, 1991). As is the case in many African countries, the consequences of population growth and poverty include extensive deforestation and poaching of wildlife. Woodland degradation has therefore led to erosion and are significantly reducing the availability of fertile soil, which poses a threat to agricultural activities in Zimbabwe (Chipika and Kowero, 2000). The country has a rich and diversified mineral content, also primarily found in the highland regions.

The history of Zimbabwe is diverse and involved extensive interaction and interference from external influences such as European trade.

2.1.2 History

Geographically, Zambezia is a term used to designate the African region south of the Zambezi River and therefore includes the regions dominated by the drainage thereof. Culturally, however, Zambezia refers to all the political establishments that historically controlled this area (Pikirayi, 2001). The area includes wet highlands and unspoilt savannah grasslands and was originally the home of stone-using foragers who depended significantly on the seasonal movements of game and natural harvests to survive (Pikirayi, 2001). Very little is documented regarding this era, but archaeological evidence suggests that around 150 B.C., herdsmen bringing in cattle and sheep from North Africa appeared in this region and initiated the art of pottery making (Phillipson, 2005).

The Zimbabwe plateau is seen as the most important geographical feature of southern Zambezia. It was the setting of the Zambezian "states" that successfully developed the concept of human society management intertwined with extensive trading and political interactions with populations outside the state (Pikirayi, 2001). The Zambezian states are a complex of states that arose in cultural succession between the 10th and 19th centuries on the Zimbabwe plateau (Pikirayi, 1997). They include well-known and -investigated sites, such as Mapungubwe (A.D. 1040-1290) situated in the Limpopo valley as well as Great Zimbabwe (A.D. 1270-1550) positioned in south-central Zimbabwe. It also includes the state of Mutapa (A.D. 1450-1900) on the northern plateau, the Torwa state (A.D. 1450-1650) and lastly the Changamire-Rozvi state (A.D. 1680-1830), both situated in south-western Zimbabwe (Pikirayi, 1997, 2001). Evidence of the Zambezian states is based on archaeological investigations and European travellers' accounts of the cultures predating the 15th century (Theal, 1898; Pikirayi, 2001). There are no clear archaeological evidence of the motivation for change in authority or landscape from one kingdom to the next (Beach, 1980; Huffman, 2007), but factors such as economic potential, security considerations and environmental suitability were possible stimuli for the transferral of authority from one state to the other (Garlake, 1982; Huffman, 2007). Pikirayi (1997) suggested, on the basis of modern population observation, that the difficulty to sustain a large population without seriously influencing ecological balance might have been the rationale for one state becoming unsustainable and the next viable.

The states, often referred to as kingdoms, were central economic and political leaders that shared numerous cultural traits (Pikirayi, 1997, 2001). Fundamental characteristics of these states included stone-built architecture with settlements situated on hillsides and hilltops rather than valley floors. Cattle breeding and specialisation of domestics crafts, coupled with long-distance trade, were also common traits of all these kingdoms (Garlake, 1973; Pikirayi, 1997; Huffman, 2007). In the past, many of the towns or sites have in the past been attributed to foreign creators such as King Solomon, the Queen of Sheba as well as Arabs, Hebrews, Sumerians, Phoenicians, Egyptians and Indians (Peters, 1900; Bent, 1969). However, the builders are now accepted as having been of African descent specifically related to the current inhabitants of the region (Ki-Zerbo and Niane, 1997; Pikirayi, 2001). Unfortunately few written records exist for the Mapungubwe and Great Zimbabwe states, and if available, it is obviously second-hand knowledge, mostly of Portuguese travellers documented by authors such as João de Barros (Theal, 1898; Pikirayi, 2001).

Mapungubwe state

The Mapungubwe state, originally a farming community, ruled the Shashi-Limpopo valley from A.D. 1040 to 1270 by extending its influence from the southern regions of Zimbabwe into the northern parts of current South Africa (Pikirayi, 2001; Huffman, 2009). The Mapungubwe Hill, which acted as the main centre of authority as well as the living quarters of the elite of the society, is situated approximately 3 km from the confluence of the Shashi and Limpopo rivers (Pikirayi, 1997). The town of Mapungubwe increased their trade up until both economic and political influence was transferred to Great Zimbabwe in the 13th century (Pikirayi, 1997, 2001; Huffman, 2009).

Great Zimbabwe state

The Great Zimbabwe state is documented as being the most influential and largest of the four Zambezian states and is located 27 km SE of Masvingo (Pikirayi, 1997). It is said that Great Zimbabwe was a large town of more than 7.2 km^2 with an estimated population size of between 11 000 and 18 000 people (Pikirayi, 1997). Five occupational periods have been described for the communities of Great Zimbabwe. These include an early farming community, later farming community who participated in long-distance trade of glass beads, emergence of the first stone walls, a peak period of stone wall-building and the fifth and last period where the stone wall architecture declined (Summers, 1971; Pikirayi, 1997). The stone walls of Great Zimbabwe are seen to have been an expression of the prestige and authority of the builders, thus the fifth period of stone wall deterioration could signify the start of the fall of Great Zimbabwe (Pikirayi, 1997). Although Portuguese historians still wrote of an ancient stone-walled city called 'Zimbabwe' that was guarded by a nobleman and accommodated Mwenemutapa's wives (Theal, 1898), luxury item imports from archaeological records dated to only the 15th century and earlier, confirms the loss of Great Zimbabwe as the major Shona capital and the shift of power to the northern plateau of the Mutapa state (Oliver, 2001).

Mutapa state

The Mutapa state is referred to by the indigenous Shona as 'Wene we Mutapa' and by the Portuguese as 'Monomotapa' which means 'Lord of the conquered land'. According to legend, a warrior prince, Nyatsimba Mutota, was sent by his father from Great Zimbabwe to search for salt in the north. Successful in his expedition, he located this commodity in the land of Tavara, situated on the northern edge of the plateau and occupied by elephant hunters of a Shona subdivision. Mutota conquered Tavara and his successor, Matope, kept on extending this new kingdom (Oliver, 2001). In another interpretation, it was said that the last king of Great Zimbabwe became the first king of Mutapa, however archaeological investigations failed to prove that link (Huffman, 2007). Archaeological evidence shows that the Kingdom of Mutapa was built in the Great Zimbabwe tradition, and that this new kingdom developed gradually as the prince slowly searched for independence from Great Zimbabwe (Oliver, 2001). Evidence therefore suggests that the government of Great Zimbabwe continued normally until the Prince's successor established wealth through exploitation of copper and ivory of Chidzurgwe and middle Zambezi. respectively (Beach, 1980).

After establishing open trade routes by conquering the coastal kingdoms of Kiteve and Madanda, the old kingdom of Great Zimbabwe became unsustainable. Although many authors suggested that it was ecological difficulties that resulted in the fall of Great Zimbabwe (Huffman, 1971; Garlake, 1973; Beach, 1980), this great city's prime agricultural basis contradicted this theory through later investigations (Huffman, 2007). By the time that the Portuguese came into contact with Zimbabwe, the Kingdom of Mutapa was well established (Owomoyela, 2002) and already possessed all Shona power (Oliver, 2001). The Kingdom of Mutapa had existed for approximately six generations before contact was established with the Portuguese traders. During this pre-contact period, the state of Mutapa was ruled by a supreme leader who granted rights to land to the chiefs of certain ”tribes”. Each tribe was associated with an ancestor spirit, or *midzimu*, who was further dominated by a *mhondoro* spirit who represented the chief's lineage. The ruler would receive gold, ivory, weapons and livestock in turn for the land rights. These goods were then later traded as commodities at the coast. Although the centralised rule of the Shona collapsed by the middle of the 15th century, the chiefs still played a key role in escalating the Portuguese trade (Beach, 1980).

Changamire-Rozvi state

The development of the Changamire-Rozvi state overlapped with both the declining era of Great Zimbabwe and the domination period of the Mutapa state (Pikirayi, 1997). This state was thus in essence a peer of the Mutapa state and was situated in south-western Zimbabwe in a grassland area in the Guruuswa region. According to Portuguese records, the establishment of the Torwa-Changamire empire was initiated by people originally from the Mutapa state with non-chiefly heredities who felt that they should be included into court discussions. During the 1640's one of the Torwa-Changamire leaders was forced to flee and asked for Portuguese intervention after a power struggle. This resulted in a small Portuguese army being sent to the state that triggered the subsequent destruction of its capital, Khami, during a civil war in the mid-17th century. Hereafter the state centre was moved to Danangombe, but as gold production started declining in the 18th century, this final of the four Zambezian states started losing its influence (Pikirayi, 1997). By 1850 and for the rest of this century, little Shona movement took place, unlike during the previous 1000 years of history. This century initiated the start of influx of the Nguni-speaking Ndebele and Gaza after which the Shona would never rule the northern plateau again (Beach, 1980).

The first European contact with Zimbabwe occurred in the 16th century, and can be described as colonisation if seen from an indigenous view (Lightfoot, 1995; Cusick, 1998; Silliman, 2005). Although Germany, Spain, England, France and Italy took part in trading ventures with Africa, it was Portugal who was the first European country to methodically explore Africa under guidance of Portugal's Prince Henry, also known as the "navigator" (Ki-Zerbo and Niane, 1997). During this era, European expansion to other continents, such as the Americas, also occurred (Wolf, 2010). This had considerable social and political effects on the indigenous populations that the Europeans encountered (Gray and Birmingham, 1970; Kelly, 1997). In the 1880's Cecil Rhodes arrived with the British South Africa company. By 1895 the previously-known Zambezia was now mostly under British control and being called Rhodesia (Parsons, 1994). Although the Shona fought against land intrusion, both the Shona and Ndebele became subjected to British administrations which lead to their displacement. It was only in 1980 that Rhodesia regained independence as the current country of Zimbabwe (CIA, 2013).

2.2 Northern Zimbabwean archaeological sites

2.2.1 Introduction

Pikirayi (1993) demarcates northern Zimbabwe as an extension of the Zimbabwe plateau, which is a highland area over 1000 m above sea level. The northern boundary is marked by the adjacent middle and lowveld areas with the Zambezi River, while the Mazowe-Ruenya and the Manyame-Angwa valleys form natural boundaries at the East and West respectively. The contemporary city of Harare is seen as the southern boundary. Very little has been documented on the history of the northern region of current Zimbabwe prior to the emergence of the Mutapa state in the 15th century, as historians focused on the highland areas, and specifically Mapungubwe and Great Zimbabwe (Oliver, 2001). It is believed that the early farmers of northern Zimbabwe were self-sufficient economically and socio-politically and structured in non-striated village communities for the greater part of the first millennium A.D. (Maggs, 1984; Hall, 1990). Archaeological evidence suggests that these farming communities had no political or social status system, except for possible age or sex ranking (Pwiti, 1996). As cattle herds increased in number (Guta, 1988; Mawoko, 1995), and exotic merchandise were brought inland from the coast, the economic organisation of the early farming communities started redefining their belief system and negotiated new rules of society. It is suggested that the foundation of the shift in ideology was most probably due to the change in attitude related to accumulation of wealth. With the growth of populations and thus changes in demography, the social system which was initially based on equality, began to transform. The development of the four states or chiefdoms was therefore due to changes in complexity, economic practices, ideology and population increase early in the second millennium A.D. This was, according to Pwiti (1996), associated with the Musengezi tradition, which resulted from the growth of the Great Zimbabwe tradition.

Monk's Kop, dated A.D. 1270 - A.D. 1285, falls within the period overlapped by the Mapungubwe and Great Zimbabwe states. Monk's Kop has only been documented by Crawford (1967) and referred to by Fagan (1968) and according to the latter author, Monk's Kop is the earliest dated site to describe mass burials in Zimbabwe (Fagan, 1968).

Portuguese resources suggest that the king of Mutapa controlled over 30 000 km^2, thus the capitals of Mutapa could have housed as much as 5000 people. The northern trade route to the coast was already established prior to the formation of the Mutapa state and was possibly controlled by the Musengezi people prior to the spread of the Zimbabwe culture (Huffman, 1971). This is evidenced by glass beads from early Iron age sites near the Mazoe river such as Surtic Farm and Ingombe Ilede (Garlake, 1982). A number of ruins and trading sites have been found in close proximity of the Mazoe river of which Dambarare, Matafuna, Bocuto, Massapa and Luanze are examples of 16^{th} and 17^{th} century sites, but no archaeological evidence exists of activity on the northern plateau during the Monk's Kop period (Garlake, 1972).

Figure 2.1 indicates the location of Monk's Kop, Dambarare and Ashford Farms. It also shows the areas associated with the four Zimbabwean states of cultural succession as well as prominent Portuguese settlements during the 1600's.

2.2.2 Pre-contact site: Monk's Kop

Monk's Kop is a burial site situated in the "Ancient Park" in the Mtoroshanga district of Zimbabwe next to a larger hill called M'bagazewa (17° 02' 45'' S, 30° 35' 15''

E). On the slopes of the Monk's Kop hill are the remains of a village on a natural terrace. The site was first discovered by Dr A.M. MacGregor who was at the time the Director of the Geological Survey (Crawford, 1967). He immediately recognized the potential of the site on account of the abundant pottery and skeletal remains found in and around a cave. Permission to excavate was obtained from the Historical Monuments Commission and the first excavations took place in 1964. The publications of Crawford's (1967), Mahachi and Pwiti (1991) as well as Mahachi (1986) include mostly archaeological interpretations. Due to this limited documented data, the archaeology of Monk's Kop was re-investigated as part of this study by means of a site visit that included cleaning and remapping thereof . Details of this re-investigation will be presented and discussed in the Results chapters.

The main site of Monk's Kop is situated in a cave under a large granite boulder as can be seen in Figure 2.2 that specifically shows the entrance to the cave during excavations in 1964. There is evidence of rock falls probably due to fires made in the ossuary as part of burial practices and cleansing rituals.

Several rock painting sites are situated around this ossuary. Prior to excavation, the initial cave was approximately 15 meters long and the roof not more than 1 meter high. Situated in a cave at the top of the hill, the site yielded modern-type pottery, organic finds, beads, bangles and skeletal material (Crawford, 1967). The lower layers yielded radiocarbon dates between A.D. 1270 and A.D. 1285. No formal dating was done on the upper layers, but the pottery decorations indicated a later date, according to Crawford (1967). In order to confirm the original published radiocarbon dates, skeletal material were sent for dating as part of the site re-investigation.

Figure 2.3 shows the original site map of specifically the ossuary where the main excavation was done. An abundance of pots and sherds stamp-marked from the Early Iron Age tradition to more elaborate, modern decorations in the upper funerary layer were removed. Organic artefacts including bark cloth and matting shrouds, mostly from Ilala Palm were found, along with a variety of glass, shell and copper beads in the upper and lower funerary layers. Bangles, often associated with the upper and lower limbs of the skeletons, were primarily made of strips of copper and iron; but a few solid copper bangles were also excavated. Skeletal elements included mostly human remains and some animal bones.

The skeletal remains were sent to the University of the Witwatersrand for estimation of sex and age which resulted in approximately 64 adults, 16 juveniles and 5 infants (Crawford, 1967). No detailed skeletal analysis was, however, completed. Upon excavation, the skeletal material were in various states of preservation, mainly due to the effects of a combination of the high acidity of the area's granitic soil and rain water that has gained entry to the ossuary in the past.

The archaeological evidence of Monk's Kop suggests a link to territories in northern Zimbabwe rather than the contemporary culture. It is believed that the Monk's Kop ossuary was used to bury the royal elite, rather than ordinary members of society. This is evident from the burial practices associated with Shona tradition as well as the archaeological finds linked to the Monk's Kop individuals. In the recent past, it was customary for Shona chiefs to be buried together resulting in multiple burials, specifically on high ground (Pwiti, 1996). Successive chiefs and their family members within a society were buried in a cave reserved for only royalty (Mahachi, 1986; Pwiti and Mahachi, 1991). The conus shell discs found in close proximity to the buried individuals of Monk's Kop are also characteristic of chiefly regalia in historic Shona traditions. As part of the Musengezi tradition, Monk's Kop is therefore seen as a burial site suggestive of the chiefdom level of social organisation, which is marked by the utilisation of a cave, situated on a hill-top used for burying the royal with their associated chiefly regalia (Nienaber et al., Submitted; Mahachi, 1986; Pwiti and Mahachi, 1991).

Crawford (1967) describes the contents of the ossuary as a "confused mass" upon excavation which therefore resulted in the remains being commingled in nature. He also suggests that the burial practices utilised during the era that the Monk's Kop ossuary was used, consisted of interring the dead in seated positions. This was evident from the pots found in close vicinity of the buried individuals containing skeletal elements such as hand and foot bones. As the soft tissue of the buried individual disintegrated through to skeletonisation, these skeletal elements which were positioned above the pots, most probably collapsed onto the pots, thereby resulting in the pots containing skeletal material.

Most of the Monk's Kop remains are currently housed at the National Museum of Human Sciences, Harare, Zimbabwe, while four individuals were retained at the Raymond A. Dart collection, University of the Witwatersrand, South Africa.

2.2.3 Pre-contact site: Ashford Farms

Very little has been documented on the archaeology, and excavation of Ashford Farms. The skeletal remains retrieved from this site were done not as part of a planned excavation, but rather through surface collections as they were discovered. No Radiocarbon dates have been previously reported for this site. The location of this site is in close proximity to Monk's Kop and Dambarare (Figure 2.1). As only seven skeletons were reported from the site and the exact locations of the graves were unknown, no attempts were made to visit the site.

2.2.4 Post-contact site: Dambarare

Dambarare was identified in 1923 by Mr H. Light who recognised remnants of a building where he presumably also discovered a human burial. Although material at the site were collected in 1945 by a Mrs E. Goodall and areas identified as gold earthworks in 1961 by Mr D. Abraham (Abraham, 1961), it was only in June, September and October of 1967 when excavations were done by P.S. Garlake on a small area of the church site. A number of burials beneath the floors and alongside the walls of the church building were revealed during the excavation. Trenches of 6 ft. x 6 ft. (1.83 m x 1.83 m) were designated from the centre to the periphery as AA, A, B, C, D, E, F and G, however trenches D and F were not excavated (Garlake, 1969). Garlake excavated this site prior to it being flooded by the construction of a dam associated with the Jumbo mine. According to Garlake, only 2% of the site was excavated prior to the flooding. Today, the only remnants of Dambarare are some of the surrounding earthworks where gold was unearthed during this trading market's existence (Garlake, 1969). Therefore the only documented information of this site is Garlake's paper of 1969, on which most of the Dambarare background information of this literature review is based. The surviving artefacts and human remains are held in the National Museum of Human Sciences in

Harare, Zimbabwe. Currently, the only remnants of Dambarare are indicated as 'Early Portuguese earthworks' in Jumbo mine area.

Dambarare is an example of a settlement site which was significantly influenced by the Portuguese during the 17^{th} century, mainly because of the prospect of gold mining. This large site covered approximately 6 km^2 (Dunbar, 2012) and was situated in the northern region of Zimbabwe, approximately 40 km north of Salisbury (currently known as Harare). At 30°54'15" east and 17°29'00" south, it lies in the Mazoe valley in the vicinity of the Jumbo dam in close proximity to the Mazoe river. Dambarare was situated in the Kingdom of Mutapa which was established in the 14^{th} century approximately 350 km north of Great Zimbabwe (Owomoyela, 2002).

Dambarare is mentioned as one of the three most important "feiras" (trading markets) of the Portuguese in the seventeenth century (Garlake, 1967). It was first mentioned in A.D. 1631 and described by the Portuguese in various archival documents as a noble settlement with many rich inhabitants, where they dug for alluvial gold (Theal, 1898; Abraham, 1962). This "good sized town in the heart of the Mokaranga state", as Manoel Barreto described it in 1667, grew to be one of the principal places where gold was obtained by the Portuguese travellers in the 1600's (Theal, 1898). Dambarare was organized around a church that was served by a Dominican priest (Theal, 1898) with a 'fair' (market). It was associated with surrounding earthworks where gold was unearthed (Abraham, 1962). Gold mining was endangered by conflict from A.D. 1684 onwards with the southern territories, which were outside Portuguese control. In November 1693, this threat became reality when Dambarare was attacked and destroyed by Changamire Dombo who was the first leader of the Rozwi Empire (1660–1866), seen as the recovering Shona people of the Mutapa Kingdom. Dambarare was occasionally visited by traders hereafter, but never regained its original standing (Schebesta, 1966; Garlake, 1969).

This site yielded skeletal remains as well as personal belongings and artefacts. Original reports describe that the skeletal remains of the Portuguese were buried in the church itself, while remains of African women and children as well as one African male were interred outside the church (Garlake, 1969). The African female skeletal remains were associated with copper and bronze bracelets and anklets. One of the African women also wore a girdle of shell and glass beads from which a rosary of small carved ivory beads and a bronze medal was hanging (Garlake, 1969). Figure 2.4 shows a diagrammatic illustration by Garlake of the medallions and metal artefacts associated with some of the burials at Dambarare.

Garlake described four different historical timelines of the site's burials as being 1) interments prior to the erection of the first church, 2) those individuals buried immediately beneath the floors of the first church, 3) burials after the demolition of the first church and lastly 4) those interred during occupation of the second and last church. The burials that were undisturbed contained skeletons lying stretched in full length with their arms folded across the chest or waist, which points towards Christian burial practices (Garlake, 1969). This can be seen in Figure 2.5 which depicts the two burials A3 (old adult male) and A4 (young adult female).

Garlake sent the crania and mandibles to H de Villiers of the University of the Witwatersrand for preliminary analysis. The report which was included in the original publication of Garlake (1969) as an appendix and included basic descriptions of sex and ancestry as well as the position of the individual *in situ*. It also included the stratum the burials were excavated from and associated grave goods. De Villiers reported seven "Caucasoid" males (AA1, AA2, A1, A2, A3, A6 and A7) and two "hybrid" males (AA3 and A5) as the only identifiable individuals from the fifteen burials excavated from inside the church (Garlake, 1969). The rest of the individuals were reported to belong to women and children that were removed from burials outside the church. Only one African male was found, and he was buried well away from the buildings (Garlake, 1969).

2.3 Assessment of health and disease

2.3.1 Introduction

Archaeological site investigations include the analyses of associated skeletons to assess their biological profile and health status in the hope to acquire an indication of the general well-being and adaptation of the specific population that inhabited the immediate and surrounding areas (Steyn, 2003). While biological information, such as age at death, sex, ancestry and stature can be estimated through standard morphological and metric procedures (Buikstra and Ubelaker, 1994), the recording of pathological alterations and traumatic injury can provide evidence on lifestyle, occupational activities, health and nutritional status, environment, climate changes, global exploration and colonisation as well as new technologies and industrialization (Steinbock, 1976; Schultz, 2001; Steckel, 2003; Roberts and Manchester, 2010). Human skeletal remains can be used to elucidate past life ways, population dynamics, demography and disease as can be seen in various studies done in southern Africa (Steyn, 1994; Sealy and Pfeiffer, 2000; Mosothwane, 2004; L'Abbé, 2005; Van der Merwe, 2007)and elsewhere (Møller-Christensen, 1953; Armelagos, 1969; Powell, 1988; Grauer and Roberts, 1996; Kilgore et al., 1997; Clarkson and Crawford, 2001; Jurmain, 2001; Tayles and Buckley, 2004).

Pathology, the study (*logos*) of suffering (*pathos*), is the scientific investigation of disease processes (Roberts and Manchester, 2010). Although ancient pathology was already described in animal remains during the 16th century, it was Sir Marc Armand Ruffer who recognised the wealth of knowledge that could be derived from detailing pathological observations during the examination of excavated mummies (Aufderheide and Rodriguez-Martin, 1998). It was thus only in 1910 that Ruffer added the prefix "palaeo" (*ancient*) to the study of pathology and defined the term as a process where human and animal remains reveal the existence of diseases in ancient times (Roberts and Manchester, 2010; Stevenson, 2011). Angel further extrapolates and defines this field of study as disease in antiquity, in both humans and non-humans, providing insight into the delicate balance between living creatures, disease causing micro-organisms and environmental stresses over the course of history (Angel, 1981).

Palaeopathology is multidisciplinary, deriving its evidence from primary sources (skeletons, mummies and other archaeological remains) as well as more subjective, secondary forms of data such as ancient documents and illustrations (Roberts and Manchester, 2010). The two main goals of palaeopathology are thus to measure and reconstruct health and health differences in ancient populations as well as interpret the differences in terms of environmental and socio-economic factors that may have had an influence on them (Wood et al., 1992). This knowledge gives insight into the general well-being of a group, the evolution of disease as well as the human adaptability to change. The study of diseases in antiquity have also contributed considerably to our understanding of the early detection, history and natural stages of many diseases (Møller-Christensen, 1953; Rogers et al., 1990), also as far as the natural processes of disease is concerned without the intervention of modern medicine, e.g., antibiotics (Ortner, 2003; Roberts and Manchester, 2010).

As most of the material derived from human remains studied by palaeopathologists are skeletonized (Roberts and Manchester, 2010), the knowledge of how disease affects bone, dentine and enamel is essential in understanding the observable abnormalities which will provide evidence of the presence of a disease (Ortner, 2003). Abnormal bone size, shape, density, formation and destruction are variations from normal skeletal anatomy that provide the observer with clues to the possible pathological condition/s that affected an individual (Ortner, 2003). Although abnormal bone formation (initiated by osteoblasts) always provides concrete evidence of an antemortem pathological process, abnormal destruction of bone (initiated by osteoclasts) can manifest as the result of a disease, but can also be the product of peri- and post-mortem changes in the burial context (Ortner, 2003; Roberts and Manchester, 2010). The latter refers to what is known as pseudopathology and can be attributed to either the immediate burial environment (such as soil composition, temperature, water, pH and insect or rodent activity) or difficulties experienced during or after excavation. Pseudopathology often complicate a palaeopathological investigation and its final result (Mann and Murphy, 1990; Ortner, 2003; Van der Merwe, 2007). Although methods such as radiographs, histological and chemical analyses of bone are used to confirm the diagnosis of pathological lesions, visual assessment is often the only method of choice due to time and financial constraints (Ortner, 2003).

In addition to possible misinterpretation or incorrect identification of pathologies, there are various difficulties in the reconstruction of health status from human skeletal material. In a skeletal sample, the prevalence of a pathological condition may not accurately represent the health of the once living population due to condition of the remains, similarities in disease manifestation in bone as well as hidden heterogeneity, or unknown frailty of persons with the group (Wood et al., 1992). Acute pathological conditions may not affect the skeleton, whereas chronic diseases may only affect certain skeletal elements (Ortner, 2003). Since skeletal samples are rarely complete, this could lead to an underestimation of a specific disease/s (Wood et al., 1992; Ortner, 2003; Waldron, 2007). However, an increase in frequency of a specific skeletal lesion can usually be interpreted as an increase in the risk of being affected (Wood et al., 1992; Van der Merwe, 2007). Secondly, infectious diseases present with similar bone lesions, such that bone is deposited, resorbed, or a combination of both. Third, a high prevalence of skeletal lesions associated with infection – while indicating a high pathogen load – may not necessarily imply poor health. Persons without lesions associated with one or more disease may have succumbed to their illnesses earlier than those who chronically lived with the ailment.

Growth, as demonstrated in stature and maturation, can also provide an indication of general health. An interruption in growth can lead to a shortened stature and smaller body size in adulthood. Malnutrition or a decrease in the variety of plant and animal food within a diet can lead to growth retardation, immunodeficiency and infection (Larsen, 2000). Human behaviour and social displacement have also been shown to influence adequate intake of nutrition and in turn has an effect on growth and stature (Cohen, 1989). The assessment of growth in an archaeological setting depends on the preservation of skeletal material as the measurements of the long bone lengths of immature individuals (plotted against the age determined by dental maturation) is compared to reference samples of modern populations (Steyn and Henneberg, 1996). The difference between male and female growth pattern as well as the accuracy of skeletal age estimation also play a major role in estimating growth of a population (Mummert et al., 2011).

Estimating the health and nutritional status of a population is therefore a complicated yet fascinating process of investigation to ascertain how people interacted with their environment and adapted to it over many thousands of years (Roberts and Manchester, 2010). Although there are limits and uncertainties related to interpreting health from archaeological remains, it has provided a vast amount of informative data on pre-history (de Souza et al., 2003) and therefore difficulties experienced to validate these results should not result in invalidating the theory, but rather just be a reminder of the limits and possible errors related to archaeological skeletal remains (Susser, 1977). Palaeopathology, and in particular acquired diseases, (developed during life) include infectious, metabolic or nutritional, neoplastic, joint or degenerative, auto-immune, endocrine and dental diseases. Traumatic lesions, as well as congenital abnormalities (disease present at birth) also potentially affect bone and teeth (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010; İşcan and Steyn, 2013).

Palaeodemographic studies provide estimates of probable sex, age at death and ancestry of the individuals studied in a collection (Larsen, 1999; Jackes, 2000). Although aspects such as life tables derived from the above estimations provide extremely useful information pertaining to the life expectancy, mortality and morbidity of an ancient population (Jackes, 2000), a large sample is required to overcome the difficulties often experienced with archaeological collections as it is normally collected through a complex and selective sampling process and may be seen by many as unrepresentative of the "real" population (Wood et al., 1992; Milner et al., 2000). For this reason, life tables will not be produced from the skeletal collections of this study due to the small sample sizes at the respective sites. The biological profile of these skeletal remains will, however, give an indication as to the life expectancy and general health of the studied populations.

2.3.2 Skeletal signs of pathology

2.3.2.1 Infectious diseases

Infectious diseases are caused by the invasion of living organisms into the human body, such as viruses, bacteria, parasites or fungi (Cohen, 1989; Roberts and Manchester, 2010). Aufderheide and Rodriguez-Martin (1998) refer to the incredible and multiple host adaptations of the malaria parasite as an example of the unique mechanisms that so many human pathogens have evolved to ensure that they can bypass the human biological defences. This complex human-pathogen interaction through time and space has been a significant factor in human evolution by means of natural selection and therefore many times the reason for the rise or fall of civilisations (Steinbock, 1976; Ortner, 2003; Van der Merwe, 2007; Roberts and Manchester, 2010). Epidemics have since historical times resulted in more mortality and morbidity than either famine or war (Roberts and Manchester, 2010).

To pose a real threat to a human population, however, pathogens responsible for infectious diseases must continually complete their life cycles and spread either human-to-human, animal-to-human or soil-to-human (Cohen, 1989). Thus the population size and density as well as human culture and the biological ability to adapt have a significant impact on the presence and virulence of a pathogen (Cohen, 1989; Merbs, 1992). Consequently the spread and maintenance of infectious pathogens is largely dependent on aspects such as the migration of populations due to agricultural development that alters the landscape or trade relations between populations and the transportation associated with it (Cohen, 1989; Roberts and Buikstra, 2003; Tayles and Buckley, 2004). Changes in food-related technology (cooking, toasting, etc.) and food storage (drying, pickling, etc.) may have reduced the chances of disease transmission whereas the domestication of animals increased the risk of encountering pathogens (Cohen, 1989). Severe environmental conditions such as drought as well as stressors as in the case of warfare, have also shown to increase the frequency of infectious diseases (Lambert, 2002; Roberts and Buikstra, 2003).

The biology of infectious pathogens and the human response to these agents has been studied for the past 150 years and is still the core of biomedical research, however many of the mechanisms of how these pathogens cause disease still elude the research community (Ortner, 2003). The general trend, nevertheless, shown specifically by comparing past and present populations, is that the social and economic growth of civilization has increased the infection load, and thus the disadvantage of certain practices has outweighed the benefits of modern living (Cohen, 1989).

Bone presents a unique architecture with a hyper-vascularised environment that provides an ideal setting for growth of organisms (Vigorita, 1999). Although there are a number of chronic infectious diseases, only a limited number can be observed macroscopically on bone (Steinbock, 1976; Tayles and Buckley, 2004). Osteomyelitis is a very common infectious disease in modern society (Vigorita, 1999), but few reports thereof exists in the archaeological record (Ortner, 2003). Tuberculosis, treponemal disease and leprosy are however well described in archaeological skeletal collections (Ortner, 2003; Roberts and Manchester, 2010). Although leprosy is endemic in South Africa, less than 1% of these can be seen on skeletal remains. Leprosy cases in Africa are therefore scarce, and therefore only tuberculosis, treponemal disease and osteomyelitis will be discussed in more detail as they have bearing on African studies.

Tuberculosis

Tuberculosis is a chronic infection of the soft or skeletal tissue caused by the pathogen *Mycobacterium tuberculosis* (Santos and Roberts, 2001, 2006; Ortner, 2003). A primary infection of tuberculosis often goes unnoticed clinically and is thus asymptomatic. The remnants of this first encounter with the pathogen can only be detected radiologically as small amounts of scar tissue in the lungs and the hilar lymph nodes (Aufderheide and Rodriguez-Martin, 1998). These lesions together form the primary complex (Ortner, 2003). In case the primary complex fails to heal or dormant tuberculi bacilli become active again due to the breakdown of such a complex, a secondary infection may become the source of organ tuberculosis (Steinbock, 1976; Ortner, 2003). Prior to antibiotic and chemical therapy, the mortality rate was 35-40% within 5 years with reduced work capacity due to specific joint involvement and arrested ovulation and menstruation due to reproductive organ involvement (Aufderheide and Rodriguez-Martin, 1998).

This condition rarely leaves any visible effects on the skeleton (Halsey et al., 1982). If present, skeletal lesions occur through haematogenous (via blood) distribution (Larsen, 2000; Ortner, 2003), but it is reported that this only takes place in 5-7% of cases which makes it difficult to diagnose tuberculosis in a skeletal collection (Steinbock, 1976; Santos and Roberts, 2001; Ortner, 2003). Vertebral lesions have in the past been the main evidence for diagnoses (Raff et al., 2006) although the meta- and epiphyses of long bones associated with the hip and knee joints also suggest infection (Steinbock, 1976; Ortner, 2003; Santos and Roberts, 2006; Roberts and Manchester, 2010). Holloway et al. (2011) showed that spinal involvement have decreased over time, and thus the other parts of the skeleton, such as the long bones, joints, hands and feet are now more affected if compared with reports of earlier time periods. Recent studies have however shown that rib lesions may be an indication of tuberculosis infection when analysing skeletal collections (Kelley and Micozzi, 1984; Pfeiffer, 1991; Wakely et al., 1991; Lambert, 2002; Raff et al., 2006; Santos and Roberts, 2006), but may be unreliable due to rib lesions being the consequence of many other conditions (Roberts et al., 1994; Mays et al., 2002; Holloway et al., 2011).

Tuberculosis of the spine often leads to kyphosis due to the anterior part of the vertebral body being most affected and is known as Pott's disease (Roberts and Manchester, 2010). Although the morphology of skeletal tuberculosis lesions overlap substantially with that of other diseases such as brucellosis, fungal infections and neoplastic growths (Holloway et al., 2011), some general characteristics include the formation of centrally located sequestrae (dead bone tissue separated from healthy bone) in cancellous bone. This further develops into complete destruction and cavitation of the cancellous bone (Steinbock, 1976; Ortner, 2003; Holloway et al., 2011). Studies have also shown that tuberculosis often commences during childhood and would therefore be seen as lesions in adulthood (Steinbock, 1976), however, recent investigations indicate that the age distribution is changing to more older individuals being infected (Ortner, 2003).

Tuberculosis was a well-established disease in Europe by the Neolithic age and has been documented through various means by many ancient civilisations (Aufderheide and Rodriguez-Martin, 1998). Hippocrates, for example, called it *phthisis* (Hippocrates and Adams, 1985) while it was dubbed the *white plague* during the 17th century tuberculosis epidemic in Europe (Clarkson, 1975; Santos and Roberts, 2006; Roberts and Manchester, 2010). The antiquity of tuberculosis is therefore proved through ancient art, literature and skeletal collections (Aufderheide and Rodriguez-Martin, 1998). Art and literature often reveals the skeletal effect of the ailment by depicting a victim of tuberculosis as having a hunched back (Aufderheide and Rodriguez-Martin, 1998) as this disease often leads to fusion of specifically the thoracic and lumbar vertebrae due to the destruction the anterior regions of the vertebral bodies through the osteolytic lesions (Holloway et al., 2011). Although there is evidence of tuberculosis in European countries through cases dating back as far as 5000 BC (Sager et al., 1972; Formicola et al., 1987; Canci et al., 1996; Roberts and Buikstra, 2003), tuberculosis seemed to have become more common with the commencement of agriculture and domestication of animals such as cattle (Cohen, 1989; Roberts and Manchester, 2010; Nicklisch et al., 2012). Many cases from Asia (Roberts and Buikstra, 2003; Tayles and Buckley, 2004; Suzuki and Inoue, 2007), north Africa (Morse, 1967; Zink et al., 2001, 2003) and the New world (Ortner, 2003; Saez, 2008; Friedrich et al., 2010) also prove the antiquity of this disease.

Very few archaeological cases originating from the southern African region have been documented (Pistorius et al., 1998; Van der Merwe, 2007; Campbell and Ackermann, 2010).

Treponemal disease

Treponematosis is a chronic infection caused by the genus *Treponema* through a microorganism classified as spirochetes that results in tissue damage due to both localised and systemic inflammatory processes (Lafond and Lukehart, 2006; Radolf and Lukehart, 2006). The four types of infection are pinta, yaws, bejel (endemic syphilis) and the controversial venereal syphilis (Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999; Meyer et al., 2002; Roberts and Manchester, 2010). The history and antiquity of the sexually transmitted type, venereal syphilis, underwrites the varied views related to whether the four types are different diseases caused by different species within the genus or whether it is the same species exist (*Treponema pallidum)* which manifests clinically dissimilar (Aufderheide and Rodriguez-Martin, 1998; Meyer et al., 2002; Ortner, 2003; Roberts and Manchester, 2010). Recent genetic studies have shown that they are genetically dissimilar and therefore different species (Centurion-Lara et al., 2006; Gray et al., 2006). The frequency of treponemal disease increased over time as agriculture intensified and populations grew (Hackett, 1967; Smith, 2006; Smith et al., 2011). As treponemal disease increased in frequency in the pre-antibiotic era, the saying "Civilization means syphilization" was a harsh reality for every infected individual of major cities plagued by this disease in the late 19th century (Sehgal et al., 2012). Treponemal disease is not only easily transmitted from adult to adult, but can also cross the placenta from an infected mother to her fetus and is then referred to as congenital syphilis (Steinbock, 1976; Mann and Murphy, 1990; Roberts and Manchester, 2010). It has however been shown that only venereal syphilis regularly cross the placenta and affects the fetus (Ingraham, 1951; Fiumara et al., 1952; Erdal, 2006) whereas bejel and yaws only exhibits this feature in rare cases (Hoeprich, 1994). While the onset of maturity normally designates the onset of venereal syphilis infections, bejel and yaws are characteristically acquired during childhood (Grin, 1956).

The distribution of the four syndromes are linked to specific geographical, climatic and sociocultural landscapes across societies worldwide (Powell, 1988; Antal et al., 2002). *Treponema cerateum* is responsible for *pinta* which is only found in the tropical regions of America. *Yaws* (or Frambesia) affect especially populations within tropical and subtropical regions with poor hygiene levels and is caused by *Treponema pertenue* (Marples and Bacon, 1953; Jelliffe and Stanfield, 1988). In certain ancient societies, yaws infection was seen as an inevitable experience and often people exposed themselves purposefully to the disease in the hope to speed up the process (Lambert, 1941). Endemic (non-venereal) syphilis, also known as *bejel* is caused by the *Treponema pallidum endemicum* species and is limited to rural populations in tropical and subtropical non-humid areas (Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999). *Venereal syphilis*, also referred to as acquired syphilis, is not restricted to any geographical region and manifests mainly in urbanised populations and if caused by a different species, it is believed to be by *Treponema pallidum pallidum* (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010).

A primary, secondary and tertiary stage can be identified in a treponemal disease infection, of which only the tertiary stage results in skeletal lesions. Yaws and bejel produce inflammatory changes within tissues in skin and bone, whereas venereal syphilis affects the arterial and nervous systems in addition to the above inflammatory responses. Although pinta never involves any internal organs or bones, the three other syndromes tend to affect skeletal elements rather than the overlying skin (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010). This could be attributed to the fact that a treponeme prefers the slighter cooler temperature of bone, rather than skin (Ortner, 2003). Due to the nature of this study, only yaws, bejel and venereal syphilis will be discussed further.

Yaws is a chronic and contagious infection during its early stages that causes ulcerative skin changes, but later stages of this infection are non-contagious and can be recurrent and produce a granulomatous (inflammatory growth of newly formed connective tissue) skin lesion. A skeletal lesion is formed a few years later in only 1-5% of untreated cases (Aufderheide and Rodriguez-Martin, 1998). In the last stage of yaws, inflammation of the outer connective tissue layer of bone (periostitis) appears 5-10 years after the early stages, most commonly in the tibia (saber-shin) and often bilaterally (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998; Buckley and Tayles, 2003; Ortner, 2003; Harper et al., 2011). The extensive subperiosteal bone deposition on the anterior border of the tibia is the reason for the abovementioned observation commonly referred to as saber-shin or boomerang leg (pseudo-bowing), which can also in rare cases be seen in the radius and ulna (Hackett, 1936, 1976). Long bones of both limbs including the hands and the feet and although rare, the skull, can also be involved in yaws (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998). Bejel and venereal syphilis follows a similar process as yaws and manifests with similar lesions (Powell and Cook, 2005a), however it forms a rubbery granuloma called a gumma that consists of a necrotic centre surrounded by fibrous capsule, possibly caused by a hyper-allergenic response (Jaffe, 1972; Salazar et al., 2002). Bejel involves mostly the skull especially the nasal area, whereas venereal syphilis affects specifically the parietal and frontal bones commonly referred to as *caries sicca* that forms a grossly thickened appearance due to excessive healing attempts (Csonka, 1953; Hackett, 1976; Steinbock, 1976; Roberts and Manchester, 2010). The last two stages of *caries sicca*, as described by Hackett (1976) are often used as the only definitive identification method of treponemal disease as reported cases of tibial pseudo-bowing have been proven as not related to treponemal disease (Hackett, 1978; Webb, 1995).

The difficulty in the diagnosis of treponematosis in skeletal collections are multifactorial: less than 20% of infected individual present with a skeletal lesion (Aufderheide and Rodriguez-Martin, 1998); overlapping of lesion type, distribution and frequency in bejel, yaws and venereal syphilis (Ortner, 2003); the appearance of the lesion is dependent upon the infected individual's immune system, the duration of the active infection, whether co-infection exists as well as the state of healing (Mays, 1998; Ortner, 2003). The characteristic distribution of bone involvement has previously been argued as being attributed to two mechanisms; the first suggests that the bone lesions are the result of direct extension of the skin lesions, while the second mechanism states that bones closer to the skin are more vulnerable and would therefore show subperiosteal bone growth (Hackett, 1951). A more recent, third proposition argues that the position of the lymph nodes and vessels mirrors the characteristic pattern of treponemal disease on bone (Buckley and Dias, 2002).

Syphilis was first recorded in 1495 as the plague that broke out amongst the Charles VIII army (Quetel, 1990; Crosby, 2003) after which the disease became a common sighting across Europe (Pusey, 1933). Due to this disease emerging shortly after Columbus returned from his exploratory voyages to the New World, a popular medical explanation of the evolutionary history of the disease arose in the 16th century suggesting that the disease originated in the New World (Harper et al., 2011). This theory, known as the "Columbian" hypothesis (Crosby, 1969) has since stimulated vigorous debate in many fields of research (Meyer et al., 2002). Criticism of this hypothesis stimulated another explanation known as the "pre-Columbian" hypothesis (Holcomb, 1934, 1935) which stated that the disease was present in the Old World prior to Columbus. To prove either hypotheses, the description of treponemal reports of skeletal cases have been reviewed (Baker et al., 1988) and reaffirmed (Powell and Cook, 2005b) which resulted in the documentation of numerous cases excavated in the New World as early as 7000 BC (Hutchinson and Richman, 2006) and none in the Old World (Harper et al., 2011). Although a few cases serving as Old World evidence have started to emerge since the above reviews (Brothwell, 2005), it is still required to undergo critical review (Harper et al., 2011). Although a third theory, the "Unitarian" hypothesis (Hudson, 1963, 1965) has been discredited by genetic evidence (Harper et al., 2011), there are still authors who support it (Aristone, 2011).

Although various archaeological cases with suggested treponemal disease manifestations have been reported from Africa, the earliest is that of a *Homo erectus* yaws-infected individual (Rothschild and Rothschild, 1995; Meyer et al., 2002). Evidence of treponemal disease in Sub-Saharan Africa is however limited, with one of the first cases reported in 1995 from Mapungubwe (Steyn and Henneberg, 1995a) which was most probably a case of yaws.

Osteomyelitis

Osteomyelitis is initiated by the invasion of bacteria, but also often viruses, fungi and parasites (Resnick and Niwayama, 1995; Labbé et al., 2010) that infect and inflame bone (osteitis) and bone marrow (myelitis) (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Lazzarini et al., 2004). The majority of infected cases is attributed to the pus-producing bacteria *Staphylococcus aureus* (Aegerter, 1975; Adler, 2000), whereas *Streptococcus* is the second-most frequent infectious agent (Mader and Calhoun, 1989; Ortner, 2003). Infection can spread through various direct or indirect routes to the marrow space, Harversian canals and subperiosteal space. Authors tend to differ regarding what the most common route of the invading pathogen is, as Vigorita (1999) indicates that more than 50% of osteomyelitic cases originate from exogenous factors, whereas Powell (1988) suggests that the hematogenous route is the most common form of the disease. The most common direct route is via traumatic or surgical wounds and is referred to as exogenous or post-traumatic osteomyelitis (Ortner, 2003). Trauma such as open fractures, amputations and prosthetic implants expose bone that can cause full-blown chronic osteomyelitis, but is often only localised (Tsukayama, 1999; Ortner, 2003). Osteomyelitis through open wounds, fractures or due to surgical procedures may occur in any part of the skeleton (Ortner, 2003). A second direct route is that of extension of an infection from adjacent soft tissue infections (Ortner, 2003), but is less common than the above.

The indirect type, hematogenous osteomyelitis, is the result of infection that have spread through blood via a septic focus (Vigorita, 1999; Ortner, 2003). A subperiosteal abscess (cloaca) that raises the adjacent periosteum is formed (Steinbock, 1976; Labbé et al., 2010) as the organism invades the bone through a nutrient foramen (Aufderheide and Rodriguez-Martin, 1998). The infection extends through the medullary cavity and locates itself in the subperiosteal space (Steinbock, 1976; Revell, 1985). The bone starts developing sequestrae (necrotic bone surrounded by living bone) which can separate from the rest of the bone (Aufderheide and Rodriguez-Martin, 1998; Harik and Smeltzer, 2010). A Brodie's abscess can form when the infection is confined to the cancellous bone, thus not spreading to the subperiosteal space. The process is halted due to the individual's immune system destroying the organism and although the pus is now sterile, it has no drainage possibilities. A Brodie's abscess is however only visible radiographically as a small, rounded translucent area (Ortner, 2003).

This disease thus involves progressive bone destruction and formation of sequestrae (Sia and Berbari, 2006) that is followed by a reactive process of bone formation (involucrum) which results in enlarged and deformed bones with irregular surfaces (Aufderheide and Rodriguez-Martin, 1998; Ikpeme et al., 2010; Roberts and Manchester, 2010). Due to the new bone formation, the affected bone can grow in thickness and can be as much as 1 cm longer than the uninfected collateral bone (Swoboda, 1972). In adult osteomyelitis, the knee region as well as the distal tibia and proximal femur are the areas most affected skeletally (Aufderheide and Rodriguez-Martin, 1998; Labbé et al., 2010) while humerus involvement only accounts for 10% of cases (Ortner and Putschar, 1985). In most cases the infection is limited to one bone, however more bones can be compromised (Ortner, 2003). Complications of acute osteomyelitis include the formation of septic arthritis (Steinbock, 1976), epiphyseal slipping of Klose (Piulachs, 1957), bipolar osteomyelitis (Aufderheide and Rodriguez-Martin, 1998), growth disturbances (Piulachs, 1957) and less frequently pathological fractures (Aufderheide and Rodriguez-Martin, 1998). Individuals with an underlying pathophysiology such as sickle-cell disease and peripheral vascular disease are also affected by osteomyelitis (Vigorita, 1999).

Identification of osteomyelitis, as with all diseases, is difficult if the particular lesions are not present in dry skeletal elements. Cloacae, sequestrae and involcra are the best indicators of this disease and should be used to avoid misdiagnosis (Aufderheide and Rodriguez-Martin, 1998). Age and the profile of an individual further determines the site and type of osteomyelitic changes observed in bone (Revell, 1985). Studies have also shown that males have a higher incidence of the disease (Capitanio and Kirkpatrick, 1970), possibly attributed to the greater likelihood of traumatic events experienced in the average male individual (Piulachs, 1957). Preceding antibiotic availability, almost 25% of infected individuals died as the result of osteomyelitis (Vigorita, 1999).

In modern societies, this disease has a world-wide distribution (Aufderheide and Rodriguez-Martin, 1998), and although observed in adults, children aged 3-12 years are most frequently affected (Capitanio and Kirkpatrick, 1970; Jaffe, 1972). It is, however, interesting to note that majority of the archaeological specimens described in literature is associated with adult remains (Birkett, 1983). Although the lesions in adults can be the result of childhood infections (Powell, 1988), it remains unexplained why no children are represented in the archaeological record (Aufderheide and Rodriguez-Martin, 1998). Although the Middle Ages marked the point of increased frequency of osteomyelitic infections due to poorer nutrition and a crowded living environment (Birkett, 1983), the first recorded case dates from as early as the 10th century (Marcsik and Oláh, 1991). Powell (1988) also reports cases with pre-Columbian dates. Cases of osteomyelitis in history through archaeological skeletal material are, however, rare (Ortner, 2003; Lewis, 2007; Santos and Suby, 2012).

2.3.2.2 Metabolic and nutritional disorders

Metabolic diseases often indicate an individual's adaptive reaction to stressors through the abnormalities observed in both skeletal and dental human remains (Roberts and Manchester, 2010). These stressors can involve ingestion of the incorrect amount of a certain food or mineral component (deficiency or excess), a physiological defect associated with nutrient absorption or abnormal hormonal activities (Ortner, 2003; Roberts and Manchester, 2010). Therefore metabolic disorders do not necessarily only encompass poor diet, malnutrition or starvation, but also include anomalies due to shortcomings of human body functioning (Ortner, 2003; Roberts and Manchester, 2010). Vitamin C (Scurvy) and D deficiency (rickets or osteomalacia) as well as an iron deficiency (anaemia) are the most common of the disorders related to a shortage of nutrients or minerals (Stuart-Macadam, 1989a; Ortner et al., 1999), whereas intoxications such as fluorosis, lead-, mercury- and arsenic-poisoning are related to an environmental overdose of certain elements (Aufderheide and Rodriguez-Martin, 1998). These nutritional shortages result in decreased osteoid production and mineralisation with increased bone resorption due to abnormal bone metabolism (Steinbock, 1976), and more than one condition can be present in a single individual due to a possible common cause: malnutrition (Ortner et al., 1999). Identification and recognition of metabolic and nutritional disorders are vital in the understanding of the socio-economic status of past civilisations (Ortner et al., 1999; Brickley and Ives, 2006).

Vitamin C deficiency

Scurvy is caused by prolonged, inadequate intake of vitamin C (ascorbic acid) that results in defective skin, cartilage and bone production due to this vitamin's integral role in collagen production (Stuart-Macadam, 1989b; Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). Vitamin C is found in marine fish, fresh fruit and uncooked vegetables (Aufderheide and Rodriguez-Martin, 1998). During the Great Famine (1845-1852), Ireland lost more than a million people to famine and scurvy when a plant disease wiped out the potato, the staple food of the poor, which lead to a sudden lack of vitamin C (Geber and Murphy, 2012). As populations moved towards agriculture and started storing and cooking food, the incidence of scurvy increased in the modern world (Ortner, 2003; Roberts and Manchester, 2010). Scurvy was also a major cause of concern to sea captains during the 15th to 18th century, as millions of soldiers and sea travellers died of scurvy during this period (Carpenter, 1986; Whitehead, 1987; Maat, 2004). Due to long sea voyages, vitamin C intake was restricted, but soon ship captains recognised the importance of frequent land-visits to acquire fresh fruit and vegetables (Carre, 1971; Aufderheide and Rodriguez-Martin, 1998; Ortner et al., 1999; Roberts and Manchester, 2010; Mays et al., 2013).

The adult human body can store vitamin C for as long as 5 months, thus the consequences of vitamin C deficiency are only experienced after the depletion of the body's stockpile (Stuart-Macadam, 1989b). A vitamin C-deprived individual shows signs of fatigue, pain, gingivitis, tooth loss, swelling of the lower limbs and profuse sweating (Hodges et al., 1969; Hirschmann and Raugi, 1999). Children, however, show symptoms more rapidly, due to increased growth during childhood (Stuart-Macadam, 1989b). Skeletal manifestations include growth retardation and secondary changes due to traumatic effects on the already-vulnerable bone (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). The age and sex of the individual affected, dictates the expression and location of the observable skeletal manifestations (Geber and Murphy, 2012). In adults, subperiosteal, moderate-sized, haemorrhages are formed due to vascular responses to chronic bleeding and results in porotic and hyperthrophic bone formation as well as periodontal disease (Jaffe, 1972; Ortner et al., 1999; Brickley and Ives, 2010; Van der Merwe et al., 2010b; Geber and Murphy, 2012). Infants, however, often present with larger affected areas, mostly involving the cranium, but lesions are also seen on long bones in close proximity to joints (Aufderheide and Rodriguez-Martin, 1998; Ortner et al., 1999; Geber and Murphy, 2012). A recent study also suggested new bone growth at the foramen rotundum as a diagnostic criterion for identifying scurvy in juveniles (Geber and Murphy, 2012).

Males and taller individuals are often more prone to scorbutic lesions (Geber and Murphy, 2012) that could be attributed to the fact that males tend to require a marginally higher amount of vitamin C due to metabolic and hormonal influences (Basu and Schorah, 1982; Clarkson and Crawford, 2001). Due to scorbutic skeletal traits being non-specific, care should be taken to not misinterpret conditions, especially as anaemia or rickets can show similar lesions. Ortner et al. (1999), however, clearly indicate that anaemia would show marrow hyperplasia, which is not the case in scorbutic lesions.

Although this condition has been well-documented in historical records, it is only after the 1980's that studies have begun to shed more light on the skeletal repercussions of scurvy (Stuart-Macadam, 1989b; Ortner et al., 1999; Brickley and Ives, 2006, 2010; Van der Merwe et al., 2010b; Geber and Murphy, 2012). Reports on adult scurvy in the archaeological record, as is the case with infantile scurvy, have been limited (Aufderheide and Rodriguez-Martin, 1998; Ortner et al., 1999; Brickley and Ives, 2006; Van der Merwe et al., 2010b). A possible reason for the limited reported cases could be that fresh fruit and vegetables were the staple food of many past human populations, thus the lack of vitamin C was improbable (Roberts and Cox, 2000; Roberts and Manchester, 2010). Scorbutic lesions, both adult and infantile, are however still not well understood and have often been misdiagnosed in past populations which might be an alternative reason for the limited archaeological evidence (Ortner et al., 1999; Brickley and Ives, 2006; Geber and Murphy, 2012). In addition, scorbutic lesions only start to develop after the re-introduction of vitamin C to the body, as it is required for osteoid formation (Brickley and Ives, 2010). Therefore, Ortner et al. (1999) comments that scurvy may have not as yet resulted in any skeletal manifestations on an individual at the time of death and thus the skeletal health analysis paradoxical argument is further fuelled (Wood et al., 1992; Goodman, 1993; Waldron, 1994).

European cases of scurvy from archaeological skeletal material date back to 2200 BC (Mays, 2008). Scurvy has been reported from almost all geographical regions for adults (Clarkson and Crawford, 2001; Maat, 2004; Van der Merwe et al., 2010b), juveniles (Ortner et al., 1999, 2001) and infants (Brickley and Ives, 2006; Mays, 2008; Brown and Ortner, 2011).

Vitamin D deficiency

Vitamin D is required to enable the absorption of calcium and phosphorus which in turn mineralise bone during its modelling and remodelling processes, thus functioning as a regulator of mineral-ion homeostasis (Ortner, 2003; St.-Arnaud and Demay, 2003; Roberts and Manchester, 2010). Upon exposure to sunlight (ultraviolet light), Vitamin D is produced in the skin after being metabolized twice to be activated

(St.-Arnaud and Demay, 2003). The lack of vitamin D therefore produces skeletal deformations at sites of endochondrial bone development (Aufderheide and Rodriguez-Martin, 1998). Although vitamin D can be sourced through dietary means (fish oil and animal fat), it can also be produced by the body by a combination of the necessary pre-cursors and adequate sunlight which is unlike Vitamin C which can only be acquired from external sources (Ortner, 2003; Roberts and Manchester, 2010). There are, however, also variants of Vitamin D deficiency disorders which are due to intestinal or renal defects that prevent the absorption of either calcium or phosphorus (Ortner, 2003). Vitamin D deficiency is referred to as rickets in children and results in the bending and deformation of the weight-bearing bones in lower limbs, especially when walking commences (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). The epiphyses of growing long bones also widen and expand due to muscular contraction and unmineralised cartilage in growth plates (Roberts and Manchester, 2010). In adults this metabolic disorder is called osteomalacia and although the mechanism is the same as in rickets, the severity of skeletal involvement is less due to the growth process already being completed in adults (Aufderheide and Rodriguez-Martin, 1998).

Iron deficiency

Anaemia is associated with the reduction of either haemoglobin and/or red blood cell concentration. The most common form of anaemia is caused by a deficiency in iron (Roberts and Manchester, 2010). Red meat, legumes and shellfish contains high quantities of iron which is absorbed easily by the intestines (Roberts and Manchester, 2010). Due to haemoglobin's vital role in oxygen transport, the symptoms of this disorder include fatigue, shortness of breath and palpitations. It is often associated with other form of pathology such as infectious diseases (Stuart-Macadam, 1992). Bone changes occur mostly in childhood, but lesions can be seen in adults. Due to the body's attempt to produce more red blood cells, thinning of the outer table of the skull and thickening of the diploe between the two skull tables are the two main criteria for identification of anaemia. In addition to these lesions that occur mostly in the parietal and occipital bones (porotic hyperostosis), orbital lesions called cribra orbitalia can be observed as a perforated appearance of the roof of the orbital bone (Roberts and Manchester, 2010). It has been proposed that both porotic hyperostosis and cribra orbital can implicate poor sanitation, deficient diets as well as infectious diseases in archaeological populations.

2.3.2.3 Degenerative conditions of the skeleton and joints

With advancing age, long-living organisms, both animals and humans, show gradual deterioration of all major systems within the body. Examples of such degeneration involve both soft tissue, such as cerebral degeneration during memory loss and dementia, as well as the skeleton and associated structures (Roberts and Manchester, 2010). Although soft tissue degeneration can be seen while studying mummified remains, the degeneration of joints and bone are the most common degenerative disease that is identified in archaeological records due to its visibility on dried bone. This is specifically the case in the various manifestations of arthritis where this condition is described as one of the three most common skeletal pathologies identified in archaeological remains (trauma and infectious diseases being the other two) (Ortner, 2003; Roberts and Manchester, 2010).

Degeneration of especially the musculo-skeletal system does not occur only due to ageing, but can also be associated with habitual and occupational activities (Bird, 1990). Wolff's law of transformation, formulated in 1892, states that "bone will adapt to functional pressure or force by increasing or decreasing in its mass to resist stress" (Wolff, 1892). Bone will therefore respond or adapt at a faster rate than the normal growth or ageing process, if an individual should participate in habitual activities, such as specific occupations or activities (Mann and Murphy, 1990; Van der Merwe, 2007). It is therefore crucial to distinguish between age and activity related skeletal changes by first establishing age ranges and thereby avoiding possible misinterpretation (Stirland and Waldron, 1997).

Joint conditions is non-inflammatory, but chronic and pathologically progressive (Aufderheide and Rodriguez-Martin, 1998). As is the case with most pathological conditions identifiable on skeletal specimens, joint condition lesions include two processes; formation and destruction of bone. In an attempt to spread the load and compensate for whatever stress has been created at the affected joint, bony outgrowths are referred to as osteophytes (Roberts and Manchester, 2010). Osteophytes or "lipping" of the bone might be the most evident in a skeletal collection, however further features of joint conditions include loss of cartilage, formation of subchondral cysts (due to synovial fluid infiltration), eburnation (polished appearance of the bone surface as is the case with osteoarthritis) and the development of a fibrotic capsule in the late stages of the disease (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). The destruction of bone due to joint conditions can involve the joint surface, its margins or areas distal to the joint (Roberts and Manchester, 2010).

Although clinically there is a clear distinction and diagnosis of degenerative conditions of the skeleton, arthritis as well as other diseases affecting the joints, lesions on archaeological skeletal populations often involve a combination of conditions and is therefore extremely difficult to confirm with accuracy. Most of these conditions can clinically be diagnosed at an early stage, but lesions on the skeleton only develop much later. This often results in the under-expression of a condition, as is the case in any skeletal palaeopathological study (Ortner, 2003). Cases of osteoarthritis can for example be accompanied by both osteophyte formation (formation of bone) and even Schmorl's nodes (destruction of bone) (Ortner, 2003). Due to the close relationship of the degenerative conditions of the skeleton and joints, the following conditions will be described in this section: Arthritic disease, osteophyte formation, Diffuse idiopathic skeletal hyperostosis (DISH) and Schmorl's nodes.

Arthritic disease

"Arthritis" is a universal term utilised to describe all joint diseases and although there are many forms of this disease, there are only a few that are visible on dried bone (Steinbock, 1976; Ortner, 2003). Possibly the most common type seen in archaeological collections is osteoarthritis (Ortner, 2003; Roberts and Manchester, 2010).

Osteoarthritis includes the breakdown of cartilage which produces a reactive sclerotic bone formation in both subchondral and compact bone (eburnation) and the final formation and growth of new cartilage and bone at the joint margins (osteophytes) due to habitual use of the specific joints (Ortner and Putschar, 1985; Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). However, other individual factors such as genetics, trauma, infection, vascular deficiencies, bone density, metabolism and nutrition also influence osteoarthritis (Larsen, 1999). The hips and knees are impacted due to their weight bearing functionality in the human body, while the shoulder and temporomandibular joints are often affected due to stress related to frequent use (Hodges, 1991; Slaus, 2000). Identification of osteoarthritis in skeletal population studies are characterised by lipping, erosion or eburnation (Ortner, 2003). These characteristics are specific to the joint affected and can be a combination of two or more of these manifestations. A recent study on temporomandibular osteoarthritis showed that eburnation rarely occurs at this joint and that the combination of osteophyte formation and erosion (porosity) should be used for differential diagnosis. (Rando and Waldron, 2012). Osteoarthritis is rarely associated with any inflammation (Ortner, 2003), whereas the types of arthritis described hereafter are linked either with inflammatory or infectious diseases.

Rheumatoid arthritis is chronic, inflammatory disease involving synovial joints and connective tissue that starts with synovitis, which becomes necrotic and eventually produces joint deformities and partial dislocation of the metacarpo-phalangeal joints (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003).

Ankylosing spondylitis results in connective tissue calcification in the spine, sacroiliac and costo-vertebral joints (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). It is a systemic, progressive, inflammatory disease which is rare in puberty and Caucasian males have shown to be more susceptible to the disease (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003).

Non-specific septic arthritis is the result of a pathogen infection of the synovium and its associated structures and is therefore rather classified as an infectious disease (Ortner, 2003). The micro-organism creates an exudate (mass of cells and fluid) at the joint which leads to osteomyelitis and destruction of the joint architecture (Aufderheide and Rodriguez-Martin, 1998).

Psoriatic arthritis is a systemic disease with cutaneous manifestations associated with psoriasis, an autoimmune skin disease (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). The distal interphalangeal joints of the hands and feet are mostly affected and in severe cases complete destruction of the fingers and toes cause "arthritis mutilans" (Aufderheide and Rodriguez-Martin, 1998).

Gouty arthritis is more prevalent in males, have also shown to be a genetic predisposition and is very rare in populations of African ancestry (Ortner, 2003;

Roberts and Manchester, 2010). It is characterised by an increased level of uric acid in the blood that is the consequence of overproduction of uric acid or reduced renal excretion. Sodium crystals are deposited in cartilage, articular connective tissue and bone marrow which stimulates an inflammatory reaction followed by the onset of osteoarthritis (Ortner, 2003; Roberts and Manchester, 2010).

Non-arthritic degenerative diseases also affecting the spine include diffuse idiopathic skeletal hyperostosis (DISH) or Forestier's disease as well as Schmorl's nodes.

Osteophyte formation (Osteophytosis)

Vertebral osteophytosis is related to the degeneration of the intervertebral disc which permits the vertebrae to function in closer approximation than normal (Aufderheide and Rodriguez-Martin, 1998; O'Neill et al., 1999). This is generally an age-related manifestation which results from weight bearing and locomotion which degenerates the spine (Steinbock, 1976; Jurmain and Kilgore, 1995). A study done to ascertain the relationship between anterior vertebral osteophyte lesions and risk factors such as obesity and physical activity found that obesity increased the incidence of osteophytosis and that physical activity in specifically young adult men posed an increased risk (O'Neill et al., 1999). In extreme cases of extensive osteophyte formation, a joint may become fused (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010).

Steinbock's method to score vertebral osteophytes includes the following:

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 ankyloses or bony union between two or more vertebrae

However, actual ankyloses are unlikely to be due to degenerative disease and is more likely to be associated with other conditions such as ankylosing spondylitis (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003).

Diffuse idiopathic skeletal hyperostosis (DISH)

Diffuse idiopathic skeletal hyperostosis (DISH), previously referred to as ankylosing hyperostosis or Forestier's disease has an affinity to produce disproportionate amounts of bone at joint margins due to ligamentous ossification, specifically the anterior longitudinal ligament of the spine (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010). Osteophyte formation, which resembles the flow of candle wax, plays a significant role in the gradual and ultimately complete fusion of the spine (Roberts and Manchester, 2010).

Schmorl's nodes

Schmorl's nodes are resorptive lesions (small circular depressions) on the vertebral body indicating the early stages of degenerative intervertebral disc disease (Mann and Murphy, 1990). These lesions are the result of the nucleus pulposes (centre of an intervertebral disc) expanding and extending into the adjacent vertebral body endplates due to severe and extensive anterior pressure, ultimately creating a small circular depression (Mann and Murphy, 1990; Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). It was first described by Georg Schmorl in 1926 and although the term was at first used to describe the actual herniation of the intervertebral disc (Schmorl and Junghanns, 1959), the term is now used to describe the end-result, i.e. the small circular depression as seen on skeletal material.

The compression of the intervertebral disc has been attributed to various factors which can include trauma (e.g. a fall from a substantial height), manual labour, certain diseases as well as arthritis and scoliosis (Kelley, 1982; O'Neill et al., 1999; Dar et al., 2010). In older individuals, Schmorl's nodes can also develop due to degeneration of the vertebral bodies and loss of resilience of the intervertebral disc that results in disc herniation (Larsen, 1999). The prevalence of Schmorl's nodes in young adults are limited, but if present they are said to be due to activities such as heavy lifting or participation in strenuous physical activities (Mann and Murphy, 1990; Roberts and Manchester, 2010).

The two types of disc degeneration identified includes annulus-driven (radial fissure or disc prolapse) or endplate-driven (end-plate defects and inwards collapse of the annulus). Annulus-driven degeneration conversely affects older individuals, has low heritability and affects the lower lumbar spine. The annulus-driven degeneration generally leads to more severe back pain if compared to the endplate-driven disc deterioration. The endplate driven degeneration often affects younger individuals, has a high heritability and affects mostly the thoracic and upper lumber vertebrae (Adams and Dolan, 2012). Schmorl's nodes are associated the latter and have been shown to be more prevalent in the T7-L1 region (Hilton et al., 1976; Faccia and Williams, 2008; Dar et al., 2010). Dar et al. (2010) speculated that the reasons for the higher incidence of Schmorl's nodes in the thoracic spine, rather than the lumbar region, may be due to the following: 1) A lumbar vertebral body cortex is thicker than that of the thoracic vertebra which provides lumbar vertebrae with more resistance against intervertebral disc herniation (Edwards et al., 2001); 2) Thoracic vertebrae are under torsion stress due to its allowance of rotational movement which has been proved to increase the incidence of Schmorl's nodes (Kapandji, 2008); 3) The larger the cross-sectional area of a vertebral body, the smaller the mechanical stress during axial loading. Lumbar vertebrae are therefore able to resist more stress due to its larger size (Duan et al., 2001).

Archaeological studies have in the past mainly focussed on the identification of Schmorl's and have paid little attention to interpreting the possible consequences on the quality of life (factors such as activity and productivity) of an affected individual. Studies have shown that men are more prone to developing Schmorl's nodes and that centrally located Schmorl's nodes are most often related to back pain. Schmorl's nodes could therefore have had an impact on archaeological populations' activity and productivity levels due to its association with back pain (Faccia and Williams, 2008).

2.3.2.4 Trauma

Any injury or wound to the body comprises trauma (Roberts and Manchester, 2010). Traumatic injuries can be associated with accidents, certain cultural activities and human violence (Aufderheide and Rodriguez-Martin, 1998). The four subcategories of trauma as seen in archaeological skeletal collections were first described by Ortner and Putschar (1981) and are; partial or complete breaks (fractures), abnormal displacement or dislocation of joints, disruption in nerve or blood supply and lastly artificially induced abnormal shape or contour of bone (Ortner and Putschar, 1985;

Ortner, 2003; Roberts and Manchester, 2010). Trauma, and especially fractures, have been one of the most documented pathological conditions in human skeletal studies. This is due to the relative easy identification of trauma on bone owing to the fact that connective tissue has the incredible potential to repair in the event of injury (Steinbock, 1976; Ortner and Putschar, 1985; Roberts and Manchester, 2010).

Traumatic injuries provide an immense amount of information about an ancient population's practices dealing with war and interpersonal violence, how well they knew their terrain or environment as well as the amount of care and compassion they exhibited towards each other. Aspects regarding living conditions such as cultural activities, economy, occupation, dietary status (e.g. how well fractures heal) as well as the availability of medical treatment and the occurrence of complications may be better understood from the analysis of skeletal trauma (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010; Steyn et al., 2010). Trauma can therefore be specific to a certain population and also fluctuates as the biological and social complexity of life changes (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Various studies have been done utilising the identification of trauma to elucidate past populations' living conditions (Brickley, 2006; Torres-Rouff and Costa Junqueira, 2006), workload (Stirland and Waldron, 1997), possible interpersonal violence (Judd, 2004; Torres-Rouff and Costa Junqueira, 2006) as well as their ability of treating traumatic injuries (Grauer and Roberts, 1996). Skeletal trauma associated with violence includes gunshot wounds, fractures, decapitation, strangulation, scalping, crucifixion, mutilation and defleshing (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010). These could either be associated with criminal intent, cultural or ritual practices.

Due to the fact that trauma is painful, can be incapacitating and visually unappealing, people have been searching for methods to treat injuries and thereby either reducing pain or reinstating a normal standards of living (Roberts and Manchester, 2010). Direct archaeological evidence of trauma treatment consists of amputations, splinting and trephination (Grauer and Roberts, 1996; Roberts and Manchester, 2010).

Fractures

A fracture is defined as being a discontinuity or crack in skeletal tissue and is normally caused by external forces that exceed the natural ability of a skeletal structure to resist strain (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). Mechanisms of force include flexion, shearing, compressions, rotation and tension (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). Major causes of fractures include repeated stress and acute injury which involves examples in the modern context such as motor vehicle accidents (Stawicki et al., 2004). An underlying disease can however also cause the weakening of a bone and subsequent fracture (Stawicki et al., 2004; Roberts and Manchester, 2010). Complete fractures can occur with or without displacement of the fragments, while incomplete fractures or cracks do not extend the full length or thickness, therefore no displacement occurs (such as "greenstick" type of fractures in children) (Aufderheide and Rodriguez-Martin, 1998). Fractures can also be open or closed, where closed refers to those fractures with no connection to the outer skin surface. Open fractures are often associated with infection and skeletal evidence of such an infection can be seen as irregular bone surfaces in combination with pitting (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003).

Fractures on dry bone specimens are classified as antemortem, perimortem or post-mortem. Antemortem fractures are clearly distinguishable from peri- and post-mortem fractures by observing evidence of healing. Proper healing of a fracture involves the formation of callus and occurs within days of the injury (Sauer, 1998).

Luxations

Dislocations, also known as luxations, involve a disruption of the normal alignment of two osseous surfaces and can be total or partial (subluxation) (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010; İşcan and Steyn, 2013). The severity of the dislocation is dependent on which joint is involved, as well as the degree and duration of the dislocation (Aufderheide and Rodriguez-Martin, 1998). Dislocations can be classified as congenital or acquired (involving an underlying disease or trauma); the latter often involving the hip and shoulder joints (Roberts and Manchester, 2010). Dislocations are difficult to detect in skeletal specimens, unless the skeleton is discovered with a clear indication of such non-alignment (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). Alternatively, detection will only be possible if the joint had already undergone remodelling (such as the formation of new articular surfaces) to indicate possible dislocation (Ortner, 2003; Roberts and Manchester, 2010).

Amputations

An amputation is the deliberate removal of part of or an entire limb (Roberts and Manchester, 2010). Circumstances under which it has been carried out in historic times include punishment, accidental and war injuries, deliberate surgery (as disease or injury treatment) as well as ritual or cultural practices (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010; Van der Merwe et al., 2010a). The healing process of an amputation can provide insight into the identification of such a procedure. In case of the amputee surviving less than a week, no signs of healing will be observable and after approximately two weeks of vascular erosion, an endosteal callus will be observed. A completely healed amputation is characterised by rounding and smoothing of the stump via elimination of the medullary cavity at the bone end (Aufderheide and Rodriguez-Martin, 1998). Osteophytes and secondary bone atrophy is characteristic of the final physiological adaptation to the procedure (Aufderheide and Rodriguez-Martin, 1998). There is limited evidence of amputations in the archaeological record, due to the low survival frequency of amputees (Roberts and Manchester, 2010). A number of case have been reported from a Kimberley mining population in South Africa (Van der Merwe et al., 2010a).

Trephination

Trephination involves an incision into the scalp followed by the removal of a piece of the skull which would leave a defect in the skull (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010). It was first described in 1867 by Pierre Paul Broca as a prehistoric surgery (Aufderheide and Rodriguez-Martin, 1998; Clower and Finger, 2001). Since then various reports from several geographical roots as well as times in history, have suggested that the procedure was done to create communication between the environment and the cranial cavity, which could be linked to medicinal or magical purposes (Courville, 1967; Margetts, 1967; Majno, 1991; Aufderheide and Rodriguez-Martin, 1998; El Khamlichi, 1998). Various authors have commented on the different types of trephination which can be summarised as follows: 1) Grooving (boring or cutting), where the defect is vertical or steeply bevelled); 2) Scraping where the defect is broad and shallow; 3) Rectangular intersecting incisions where removal of bone took place by means of linear grooves where the defect is rectangular with clear circumcised bone; 4) Drilling, where the defect is circular and connected by means of small holes (Lisowski, 1967; Aufderheide and Rodriguez-Martin, 1998).

The success of the procedure and therefore the survival rate of the patients is highly dependent on the ability to avoid injury of the meninges, brain and blood vessels during the procedure (Aufderheide and Rodriguez-Martin, 1998; El Khamlichi, 1998). Taking this risk into account, it is interesting to note that more than 50% of a sample of the 2000 trephined skulls analysed by Stewart (1958) from various skeletal collections showed long-term survival (Stewart, 1958; Aufderheide and Rodriguez-Martin, 1998).

Although evidence suggests utilisation of this surgery since the Mesolithic, it was more prevalent throughout the Neolithic, but far from a universal practice at any time (Aufderheide and Rodriguez-Martin, 1998). Trephined skulls investigated in the skeletal record is mostly that of adult individuals, but a few skulls of children have also been discovered and described (László, 2014). The highest incidence of trephination comes from Bolivia and Peru, and there is some evidence of the procedure being practiced in Russia, the Canary Islands and North America (Lisowski, 1967; Majno, 1991; Aufderheide and Rodriguez-Martin, 1998). There are few cases of early European examples (Crubézy et al., 2001) and these numbers decline even more after the expansion of Islam and completely disappears from European collections during medieval periods (Aufderheide and Rodriguez-Martin, 1998).

African evidence for this practice comes from Berbers and Kabyles in northern Africa, Kisii from Kenya, Tende from Tanzania, Gouaches in South Morocco (Malbot and Verneau, 1897), the Touareg in Sub-Saharan Africa as well as a few reports from Masai and Egypt (Aufderheide and Rodriguez-Martin, 1998; El Khamlichi, 1998). Evidence of early African neurosurgery, and specifically trephination, is seen on ancient papyrus roles of the pharaonic era in the Nile valley, where it indicated that the pharaoh's skull was trephined just prior to death to enable the soul to reach paradise before the body died (Moodie, 1920; Bailey, 1994). Trephination is suggested to have been the very first neurosurgery performed in Africa (El Khamlichi, 1998). Although there is evidence of African tribe healers performing trephination from the Middle Ages until the middle twentieth century, the technical aspects of trephination was described by Arab physicians, of which Abulkassim Al Zahroaui pioneered a volume devoted to neurosurgery, its pathology, treatment, instruments and techniques (El Khamlichi, 1998). Evidence from North Africa is abundant; however there is very little evidence of trephined skulls in skeletal collections in Sub-Saharan Africa. A possible case of trephination of the "Bushman" race was documented in 1937 where a few skulls showed evidence of skull "mutilation" (Drennan, 1937).

Trephination was said to treat problems with raised intracranial pressure that might have resulted in a variety of symptoms such as headaches, vertigo, coma, or convulsions (Lisowski, 1967). The main motivation for trephination from African evidence seems to have been to treat headaches or wounds after head injuries (El Khamlichi, 1998). It is interesting to note that compared to amputations, there are considerably more cases of trephination recorded in archaeological studies. Taking the surgical risks into account, this is a surprising fact, although the statistics could be clouded by the difficulty associated with the correct identification of an amputation (Roberts and Manchester, 2010).

2.3.2.5 Non-specific indicators of pathology

Non-specific indicators of disease include periostitis, cribra orbitalia, porotic hyperostosis, Harris lines and enamel hypoplasia (the latter being a dental indicator, but to be discussed with skeletal health). Exposure to nutritional deficiencies and environments with a high incidence of viral, bacterial and parasitic infections during childhood contribute to the formation of these non-specific markers of pathology and provide valuable background to the general health of a population (Stuart-Macadam, 1992; Roberts and Manchester, 2010). Lesion development is dependent on the duration, timing and extent of stresses associated with diet, disease, occupation, environment and culture (Wood et al., 1992; Van der Merwe, 2007).

Periostitis

Periostitis are skeletal lesions formed by excessive subperiosteal bone growth (Mann and Murphy, 1990; Ortner, 2003) due to trauma or stresses such as infectious diseases (Mann and Murphy, 1990; Schultz, 2001; Ortner, 2003). Periostitis is recognised by its characteristic woven appearance on dry bone which can later heal and form part of the underlying cortex; resulting in a swollen appearance of the affected area (Larsen, 1999; Ortner, 2003). The seven different morphological variants of periostitis identified is based on the organisation of the layers and their orientation relative to the bone (Resnick and Niwayama, 1995).

Although subperiosteal bone growth is associated with diseases such as treponemal infection and scurvy, non-specific subperiosteal lesions are abundant in the archaeological record (Ortner, 2003) with clear indications of a direct relationship between the incidence of such lesions and stressful living conditions (Larsen, 1999). Causes of periostitis include hypertrophic osteopathy, subperiosteal hematomas, chronic stress injuries, bone cancer, scurvy, leprosy, treponemal disease, tuberculosis and osteomyelitis (Ortner, 2003; Vigorita, 2008).

Cribra orbitalia and porotic hyperostosis

Cribra orbitalia (CO) and porotic hyperostosis (PO) are observed as small porosities and are frequently see in prehistoric juvenile skulls and more so in sub-adults, than adults. The lesions in CO are observed on the superior roof of the orbits whereas PO is visible on the skull vault, also referred to as cribra crania externa (Stuart-Macadam, 1985; Ortner, 2003). This non-specific signs of disease are characterised by the pitting of the orbit (often bilateral) or skull vault (mostly affecting the parietal, occipital and frontal bones) (Stuart-Macadam, 1985; Ortner, 2003). It has been shown that CO only occurs in infants and children older than six months and lesions are most frequently observed in individuals between the ages of six months and six years (Stuart-Macadam, 1985). Steckel et al. (2005) and Stuart-Macadam (1985) described two different scoring systems to record the severity of cribra orbitalia and porotic hyperostosis. The affected bone surface is scored according to the size, formation and distribution of the associated foramina, but also incorporates the relative surface area affected (Stuart-Macadam, 1985; Steckel et al., 2005).

Although it has been shown that both of these non-specific markers are the result of iron-deficiency anaemia which may be caused by either inadequate nutrition or infection (Angel, 1984; Stuart-Macadam, 1989; Ubelaker, 1992; Aufderheide & Rodríguez-Martín, 1998), recent studies also suggest that they may be linked to a population's poor adaptation to the environment (Aufderheide and Rodriguez-Martin, 1998). Causes include megaloblastic anaemia, sinusitis, tooth and oral infection, as well as nasopharyngeal infections (Walker et al., 1991; Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010). Cribra orbitalia can also be the result of a variety of factors such as local periostitis, osteomyelitis as well as secondary effects of diseases such as Vitamin C deficiency, scurvy, haemangioma and osteopenia. Diet has also been suggested to play a role in the presentation of CO, thus an individual's socio-economic status could also possibly influence diet which in turn could be a factor in the formation of this porosity of the orbits (Ortner, 2003; Wapler et al., 2004; Walker et al., 2009; Brickley and Ives, 2010).

Harris lines

Harris lines as well as enamel hypoplasia have been used to indicate periods of arrested growth due to metabolic insults of such magnitude that the body redirects resources to vital areas to ensure survival (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Harris lines are observed as dense, opaque, transverse lines, particularly visible on radiographs (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Reportedly, long bones such as the femur, tibia and radius are most often affected. The cause of the transverse line is a reduced rate of cartilage formation plate however mineralisation continues as normal, which results in the transverse line (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Further studies also proved that the line is in actual fact formed during the period after growth arrest, and thus infers that the presence of Harris lines also provides proof of an individual's ability to recover (Aufderheide and Rodriguez-Martin, 1998). However, recent studies have shown that Harris lines may form as part of normal growth (Alfonso-Durruty, 2011; Papageorgopoulou et al., 2011) and the fact that no x-ray facilities were available, Harris lines will not be discussed further.

2.3.3 Dental signs of pathology

Teeth and the associated orofacial structures are of the utmost importance for a human to survive as vital necessities such as oxygen, water and food, enter through this specialised area (Aufderheide and Rodriguez-Martin, 1998). Due to their robust structure, teeth are often the only body parts that survive the onslaught of deterioration after death and although small in size, they can provide a wealth of information of the individual and the associated environment (Roberts and Manchester, 2010). A person's teeth reflect the composition of the food ingested as the food type denotes the microorganism associated with the food that came into contact with the teeth (Roberts and Manchester, 2010). Diet, oral hygiene, stress, occupation, cultural influences and intercultural differences can be inferred from the analysis of teeth (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010).

Dental and skeletal pathological conditions are often affected by the same disease conditions, however due to the biological differences of teeth and bone, the expressions of the disease condition are dissimilar (Ortner, 2003). Enamel, for example, can be affected during dental crown development due to detrimental circumstances during childhood such as metabolic stress. Pathological changes to enamel, however, are limited to only trauma and destructive bacterial processes (Ortner, 2003). Teeth are vulnerable to disease due to it being affected both physically and chemically and can in turn impact on the surrounding structures such as gingiva (gums) and alveolar bone (Aufderheide and Rodriguez-Martin, 1998).

It is imperative that similar methods are utilised across different studies to enable true comparisons. Assessment of dental disease should therefore include teeth affected as a percentage of teeth available for analysis, individual affected as a percentage of total individuals available for examination and lastly the number of pathological lesions per individual (Roberts and Manchester, 2010).

2.3.3.1 Dental caries

Dental caries (tooth decay) is a disease process characterised by the destruction and demineralisation by organic acids of the organic and inorganic part of a tooth respectively (Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999). Microbial activity (produced by bacterial fermentation of dietary carbohydrates such as food sugars) on the tooth surface initiates progressive destruction of the crown and root of a tooth and is both infectious and transmissible (Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999; Ortner, 2003). Caries are represented by opaque spots or large cavities on the enamel and is the most common dental disease reported in archaeological populations (Larsen, 1999; Roberts and Manchester, 2010). The severity of caries varies from extensive cavitation (resulting in the partial or complete loss of the tooth crowns or roots) to less severe cases where the tooth only exhibits slight enamel opacities (Larsen, 1999).

The epidemiology of dental caries can be subdivided into environmental factors, pathogenic agents, exogenous factors (diet and oral hygiene) and endogenous factors (shape and structure of teeth) (Powell, 1985). Caries is influenced by and subjected to the following modifying factors: 1) exposure of teeth surfaces to the oral environment, 2) presence of indigenous bacterial flora, salivary glycoproteins and inorganic salts and lastly 3) diet. These modifying factors affect the site distribution and rate of development of the carious lesion (Larsen, 1999). Exogenous factors such as food texture and occlusal surface wear have shown to have a positive correlation (Powell, 1985; Meiklejohn et al., 1992), whereas diet has been extensively researched to show that the caries prevalence have increased with the shift of focus to carbohydrates especially as individuals changed to Western dietary patterns (Larsen, 1999). In a study incorporating global samples, it was found that foragers exhibited a low caries prevalence (1.7%), while individuals foraging and supplementing their diet with agricultural products had an increased caries prevalence (4.4%). Pure agriculturalists displayed the highest caries prevalence (8.6%), clearly showing the increases in caries prevalence related to subsistence economy (Turner, 1979). Although it is generally accepted that caries is relatively uncommon in foraging populations, a study of Mesolithic Portugal conversely showed a high caries prevalence which was attributed to the consumption of cariogenic non-agricultural foods such as honey and sticky fruits (e.g. figs). Due to this contrasting evidence, there was also no apparent increase in caries prevalence upon the adoption of agriculture in Portugal (Meiklejohn et al., 1992; Lubell et al., 1994).

The influence that the type of agricultural product consumed (e.g. the use of wheat in the Old World, versus the maize usage in the New World) has on the prevalence of dental caries is still unclear (Larsen, 1999). It has however been suggested that wheat may have been less cariogenic or that the importance of maize in the diet of the new World was of more importance than wheat was for the Old World individuals (Lubell et al., 1994).

It has been shown that females tend to display a higher caries prevalence than males (Hillson, 1979; Formicola et al., 1987; Lukacs, 1989; Morris, 1992; Lukacs and Thompson, 2008). This has been suggested to be linked to the difference in food consumption as many populations are characterised by the males hunting, thereby marked by an increase of meat intake, compared to the females who are often responsible for planting, harvesting and food preparation, which results in a higher percentage of carbohydrate consumption (Larsen, 1999).

The recording of caries includes stating the tooth affected as well as the position and size of the caries, which is further categorised as either no caries, or if applicable reporting of the area of the tooth crown that has been destroyed (< 50%, >50% or entire crown) (Lukacs, 1989; Roberts and Manchester, 2010). Healing of caries is prohibited by the fact that enamel is avascular and therefore continuation of the same environmental condition will lead to complete destruction of the tooth (Aufderheide and Rodriguez-Martin, 1998). Caries of the dental root can also occur when the root is exposed to bacteria by periodontitis (periodontal disease) (Ortner, 2003).

2.3.3.2 Dental abscesses

Dental abscesses can be the result of dental caries, periodontitis or attrition due to the exposure of the pulp cavity to bacteria (Roberts and Manchester, 2010). A dental abscess is initiated by the accumulation of plaque and as the micro-organisms accumulate between the gingiva and teeth, a collection of pus produces enough pressure to form a hole or sinus on the jaw surface to alleviate the pressure (Hillson, 2000; Roberts and Manchester, 2010). The possible underestimation of dental abscesses is underwritten by the fact that archaeological identification can only be done when the hole or sinus is visible on the surface of the jaw, as earlier stages are only detectable via radiographs (Roberts and Manchester, 2010).

2.3.3.3 Dental attrition

Dental attrition or tooth wear is described by Powell (1985) as the natural result of stress placed on teeth during mastication during both digestive and technological activities and is an essential tool in estimating age at death (Cohen, 1989; Larsen, 2000). Abrasion, erosion and attrition are the three regressive changes causing deterioration, the latter specific due to the ageing process (Aufderheide and Rodriguez-Martin, 1998). Attrition is therefore a normal physiological process, while abrasion is due to abnormal mechanical material (e.g. during cultural practices) and erosion the result of a non-bacterial chemical processes such as during environmental pollution (Aufderheide and Rodriguez-Martin, 1998). Dental wear occurs on the biting (occlusal or incisal) and proximal (neighbouring tooth contact) surfaces of a tooth (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Recording methods of attrition to ascertain age have been studied by various authors (Murphy, 1959; Molnar, 1971; Brothwell, 1981; Walker et al., 1991) and is based on pattern and rate of dentine exposure (Mann and Murphy, 1990). While attrition is not classified as a dental disease as such, it predisposes the teeth to other dental pathological conditions such as caries and abscesses (Larsen, 1999; Ortner, 2003). Although physiological attrition is a normal process, ancient populations (hunter-gatherers) have shown to have higher frequencies of destruction than that of modern societies which were mostly agriculturalists (Aufderheide and Rodriguez-Martin, 1998).

2.3.3.4 Calculus

Dental plaque is a substance which accumulates in the mouth as a combination of the causative micro-organisms and the salivary proteins normally present in the oral cavity (Larsen, 1999). Sucrose speeds up the process and when the accumulation becomes mineralised, it is known as calculus. Calculus forms on the teeth in close proximity of the salivary glands and can be classified as being one of two types; Supragingival calculus develops above the gum line, whereas subgingival calculus can be seen below the gums, often on exposed tooth roots and is much harder than supragingival calculus (Roberts and Manchester, 2010). As calculus is a common sighting in the archaeological record, various methods of recording have been developed which includes thickness and extent (Brothwell, 1981; Dobney and

Brothwell, 1988). Gingivitis (inflammation of the soft tissue surrounding the tooth) is often caused by dental plaque and if left untreated develops into periodontitis (Regezi et al., 2000; Ortner, 2003).

2.3.3.5 Periodontitis

Periodontitis, also known as periodontal disease, is a destructive inflammatory process of the alveolar bone that progresses gradually and involves the periodontal ligament, cementum and alveolar bone (Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999). Generalised periodontitis is a horizontal reduction in alveolar bone height and commonly affects all teeth mostly in modern populations, whereas localised periodontitis occurs interdentally resulting in a vertical defect with a high frequency recorded in ancient populations (Aufderheide and Rodriguez-Martin, 1998). Periodontal disease therefore results in resorption of alveolar bone which in turn exposes the tooth root and ultimately leads to tooth loss. Calculus have also shown to initiate periodontal disease as it accumulates around the teeth, forming periodontal pockets (Hillson, 2000). Caution should be taken when identifying periodontitis in skeletal collections as attrition, caries and post-mortem damage is often mistaken for loss of bone around the roots of teeth (Roberts and Manchester, 2010).

2.3.3.6 Antemortem tooth loss

All dental diseases, such as caries, periodontitis and abscesses, can ultimately result in antemortem tooth loss (AMTL). Caries, dental attrition, trauma as well as cultural or ritual practices have also been documented as causes. In the absence of dental treatment, the extraction of a tooth is often the only means of alleviating pain (Turner, 1979; Hillson, 1998, 2000). It is unfortunately difficult to assign a specific cause to an individual's loss of teeth prior to death (Morris, 1998). Due to the fact that tooth extraction are often the result of caries, it can then be suggested that if no other variable influences AMTL, there would be a direct correlation between the frequency of AMTL and dental caries (L'Abbé, 2005). Extraction of teeth due to cultural practices, often involve the anterior, most visible teeth and can be due to gansterism, fashion, accidental damage or peer pressure (L'Abbé, 2005; Friedling and Morris, 2007). Archaeological studies of prehistoric and historic populations often show a high prevalence of AMTL due to poor dental health (Walker, 1978) and include Later Stone

Age sites (Jerardino et al., 1992; Sealy et al., 1992). It has also been suggested that food containing abrasive material can lead to AMTL (Steyn, 1994).

2.3.3.7 Dental modification

Although not classified as a dental disease, modification of teeth is evident in many ancient populations. Dental alteration and mutilation can be the consequence of intentional and unintentional activities which modifies the shape and form of the tooth (Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999). Unintentional mutilation can be due to trauma or activities such as stripping procedures where the anterior teeth are used as a third "hand" (Milner and Larsen, 1991; Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Intentional mutilation or alteration is usually associated with cultural or ritual behaviour of specific populations and can include the alteration of tooth shape, extraction of teeth and inlays of stone or other material, but can also be related to oral surgery (Davies, 1963; Milner and Larsen, 1991; Roberts and Manchester, 2010). Cultural modifications can be testament of a certain time in the individual's life, thus social identity (van Reenen and Briedenhann, 1986) or peer pressure (Friedling and Morris, 2005) or just used for enhancing appearance through decoration (Bachmayer, 1982; Jones, 1992; Roberts and Manchester, 2010). Purposes related to religion (Davies, 1963) and superstition (Halestrap, 1971) have also been reported. It is interesting to note that it is mostly the incisors of either the maxillary or mandibular dental arcade that are involved. This procedure is mostly performed during the onset of puberty, often as part of initiation ceremonies (Briedenhann and Van Reenen, 1985; van Reenen and Briedenhann, 1986).

The intentional mutilation of teeth has been a common practice in Africa and although it differs from area to area and between cultures, it is evidenced by many studies (Halestrap, 1971; Briedenhann and Van Reenen, 1985; van Reenen and Briedenhann, 1986; Jones, 1992; Morris, 1998; Friedling and Morris, 2005). Dental modification was reported in the Mapungubwe/K2 skeletal collection as V-shape filing of the mandibular incisors (Steyn, 1994). A recent study on a Zambian Iron age population showed that 29% of the sampled population had modified maxillary incisors. Incisors were filed or chipped on the mesial portion of the maxillary central incisors which conformed to the inversed V-shape type of modification as described by

Van Reenen (1978)(Gibbon and Grimoud, 2014). There were, however, also cases of V-shape modification where both the mesial and distal surfaces of all four maxillary incisors were made to result in a pointed V-shape (Gould et al., 1984). The study did not report any significant difference in the sample related correlation with sex or age, but most of the samples were that of males (Gibbon and Grimoud, 2014).

Dental mutilation is often traumatic and can lead to infection, inflammation and pulp mortification as was evidenced by the Zambian Iron Age population. There has also been studies which showed the relationship between periapical lesions and dental modification (Reichart et al., 2008) which could be a health risk during the healing stages after trauma (Gibbon and Grimoud, 2014).

2.3.3.8 Enamel hypoplasia

Periods of physiological or metabolic stress being experienced during childhood can interrupt amelogenesis (enamel formation) which causes disruption of the incrementation of the crown matrix (Goodman and Armelagos, 1985). Such interruptions are experienced by the body as a life-threatening situation which results in redirecting resources to vital systems, rather than maintaining processes such as tooth and bone growth (Goodman and Rose, 1991; Aufderheide and Rodriguez-Martin, 1998). Metabolic insults can be because of nutritional deficiency or related to childhood diseases such as measles (Roberts and Manchester, 2010). Enamel hypoplasia is identified as lines, pits or grooves on the enamel surface of incisors and canines, specifically the buccal tooth surfaces in contact with the cheeks. The defect develops during tooth development, but acts as a permanent record of events experienced during growth (Hillson, 2000). It has been shown that enamel hypoplasia is most prevalent in young children between the ages of 2 and 4 years (Goodman et al., 1984).

Thus enamel hypoplasia has been of interest in many research fields as it may infer the exact time of a stressful event by analysing the age at which the enamel hypoplasia formed (assuming that the rate of development was constant), and therefore providing insight into the general health of a population (Goodman and Rose, 1991; Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Several South African sites have reported enamel hypoplastic lesions prevalent in the associated population and include Mapungubwe/K2 (Steyn, 1994), Maroelabult (Steyn et al., 2002) and Venda (L'Abbé, 2005).

2.4 Ancestry

2.4.1 Craniometric investigation

Cranial variation exits amongst modern human populations and has also been used to establish the relationship between past populations and to infer various micro-evolutionary processes such as migrations (Buikstra and Ubelaker, 1994; Stojanowski and Schillaci, 2006; Pietrusewsky, 2008; İşcan and Steyn, 2013). The variation that exists in the skull can be attributed to some extent to both environmental factors, such as annual rainfall, temperature and general climate, and genetic factors (Froment, 1998; Howells, 2004; Harvati and Weaver, 2006). However, genetics contribute the most to the varying characteristics of the human skull, as they are considered as highly heritable traits; on a worldwide scale, phenotypic and genetic distances between human groups are broadly correlated (Relethford, 1994, 2002; Froment, 1998). The flow of genes between populations is influenced by geographical distance, as well as their history, culture, language, economic status and sexual dimorphism (Froment, 1998; Ribot, 2002). Gene flow between populations can take place via three ways and therefore have different implications for cranial variation: 1) Bi-directional gene flow will result in two populations exhibiting relatively similar cranial morphology as is the case in exogamous marriage. Separation into the two distinct, initial populations will therefore be problematic; 2) Uni-directional (or asymmetrical) gene flow dictates that the one population's cranial morphology will remain untouched whereas the other population will become mixed as is the case when marriages only occur from one population into the other; 3) Restricted gene flow occurs when both populations stay untouched, and therefore no genes are shared.

Craniometric assessments are based on the fact that there is a strong relationship between genes and the morphology of the skull (Relethford, 2002). For the African continent, various studies have utilised cranial variables with uni- and multi-variate statistics to investigate similarities and differences between skeletal populations that may have been influenced by gene flow (Rightmire, 1976; Ribot, 2002, 2003; Howells, 2004; L'Abbé, 2005).

In any craniometric study it is beneficial to have extensive knowledge of the history of the population analysed. It is therefore essential to include all possible known factors when attempting a craniometric study as this will dictate the comparative data set which will in turn ensure that the research questions are addressed (Stojanowski and Duncan, 2009). Theories regarding the origin of the Monk's Kop population are based on the pottery and archaeological finds which link this society to that of the Musengezi tradition. Huffman (1978) suggested that the Musengezi pottery was part of the Kutama tradition which were archaeological manifestations of the ancestors of the Shona from northern Zimbabwe who arrived from north of the Limpopo and replaced the previous tradition; all corresponding to possible eastern waves of the migration of Bantu-speaking populations (Huffman, 2007). This initial theory was argued against (Garlake, 1982; Maggs, 1984) on the account of the ceramic links and burial practices and did not explain what happened to the earlier communities. Although Huffman provided a revised suggestion which stated that the Musengezi tradition originated from the Zambezi in the north (Huffman, 1989), it was Garlake (1982) who proposed that this tradition appeared because of cultural change related to economic growth and social re-organisation, rather than the replacement of earlier communities (Garlake, 1982). Garlake also suggested that this transformation involved a change from a matrilineal to a patrilineal society. Interesting to note is that bantu-speaking groups from the west-central migratory wave tended to originally be more matrilineal. Pwiti (1996) based his theory on a change in both demography and ideology in northern Zimbabwe. He proposed that demographically, northern Zimbabwe increased in population size (as can be seen by the increase in number of settlement sites) which necessitated a new form of socio-political organisation. A change in attitude related to the accumulation of wealth (linked to the increased cattle herds and imports of exotic goods from the Indian Ocean) resulted in inequality and therefore a shift in ideology. Pwiti and Garlake therefore both suggested that the Musengezi tradition was not the result of new populations migrating into northern Zimbabwe, but rather the gradual development of the original early farming communities, adding domestic stock to their economy. Manufacturing techniques are suggested to have changed into new technologies, which in combination with the increase in population and change in attitude regarding wealth, resulted in changes in economy and ideology. Pwiti (1996) does, however, mention that this theory should still be proved by "transitional" sites as change always leaves traces, even if it is gradual and not a replacement. Pwiti (1996) also states that the origins of the Musengezi society, and therefore the origins of the Monk's Kop population of this study, are hampered by the limited evidence available. It is also suggested that the people associated with the Musengezi tradition established small chiefdoms throughout northern Zimbabwe which were supported by agricultural production, livestock herding and an element of external trade. It was only with the expansion of the later Great Zimbabwe tradition northwards that the relations of power in northern Zimbabwe changed. It does, however, seem that the Musengezi tradition was not completely replaced and some chiefdoms may have even retained some political autonomy (Pwiti, 1996).

Unfortunately there is no history documented regarding the origins of the Ashford Farms collection, and virtually nothing is known about the archaeology of this site. Radiocarbon dating does however place Ashford Farms in the pre-European contact period (A.D. 1330 – A.D. 1440).

The Dambarare population has been clearly linked to the cultural succession of the four kingdoms or states that arose during the 10^{th} to 19^{th} centuries on the Zimbabwe plateau (Pikirayi, 1997). The Dambarare population was active during the reign of the Mutapa state after the loss of Great Zimbabwe (second kingdom) as the major Shona capital when the power shifted to the northern plateau (Oliver, 2001). The Dambarare African population is therefore suggested to have had ancestral links to the first kingdom (Mapungubwe) which was a group who ruled the Shashi-Limpopo valley from A.D 1040 to A.D. 1270. The Mutapa state existed for at least six generations prior to European contact, which in this case were with the Portuguese. The fourth and final kingdom (Changamire-Rozvi) coincided with, rather than succeeded the Mutapa state and is often seen as a peer of this society situated in the south-western region of Zimbabwe. Portuguese records suggest that the rise of this last kingdom was initiated by people of non-chiefly-heredities who wished to change the socio-political organisation (Pikirayi, 1997).

It is assumed initially that morphological diversity will increase with time as gene flow occurred from East Africa and outside Africa and population history from the Early Iron Age becomes increasingly complex with the arrival of various Bantu-speakers and later southern Europeans. A craniometric study therefore is used as a tool to evaluate phenotypic spatio-temporal variation in a very circumscribed region. This enables the comparison of results obtained from the craniometric data with other sources of known information, such as archaeological and historical evidence to test the hypothesis of increasing population discontinuity (due to non-African admixture) in colonial times. Patterns of variation between males and females can also be compared in order to identify possible indications of asymmetrical gene flow.

2.4.2 Odontometric investigation

Tooth shape and size are influenced by both genetics and the environment, however genetics seems to play the more crucial role in dictating the morphology of the dentition of a specific population (Townsend and Brown, 1978; Dempsey and Townsend, 2001). It has therefore been suggested that tooth size is under control of genetic factors, although environmental factors such as diet may also play a role (Sciulli, 1979; Dempsey and Townsend, 2001). Various investigations have been done to determine similarities and differences between related populations by utilising multivariate statistical analyses of teeth (Steyn, 1994; Mosothwane, 2004; L'Abbé, 2005), however dental attrition and small sample sizes often hinder confirmed interpretations.

Penrose shape distance calculations are uncomplicated due to it utilising the mean and standard deviation values of all data. While the size coefficient calculates the difference in mean values between two samples, the shape coefficient calculates the standard deviations for the same two samples. The size and shape distances are therefore determined by utilising the two coefficients (Penrose, 1954; de Villiers, 1968). The Penrose results indicates the similarity between two populations and the more populations are included in an assessment, the more visible the similarities or dissimilarities.

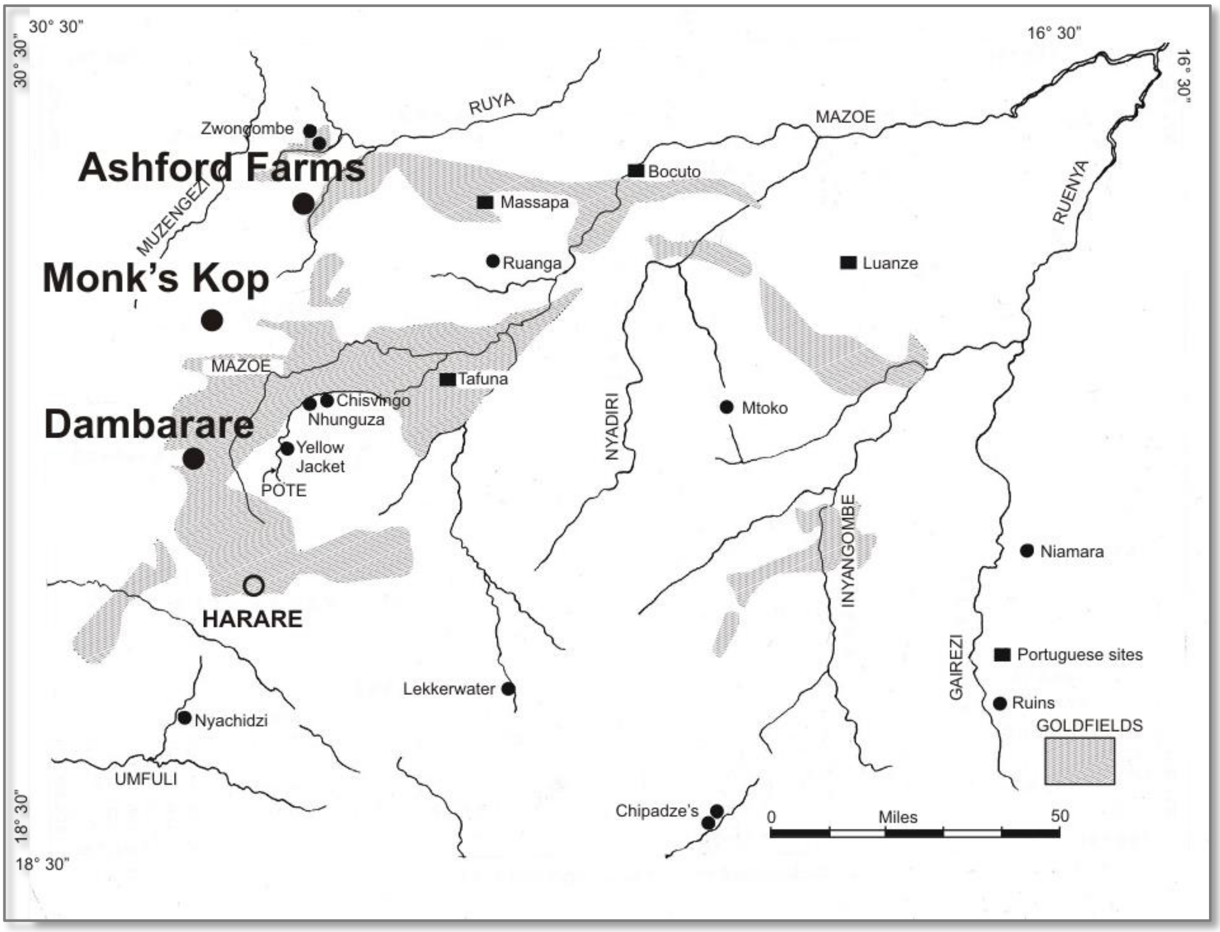


Figure 2.1: Location of Monk's Kop, Dambarare, Ashford Farms and associated sites and settlements.

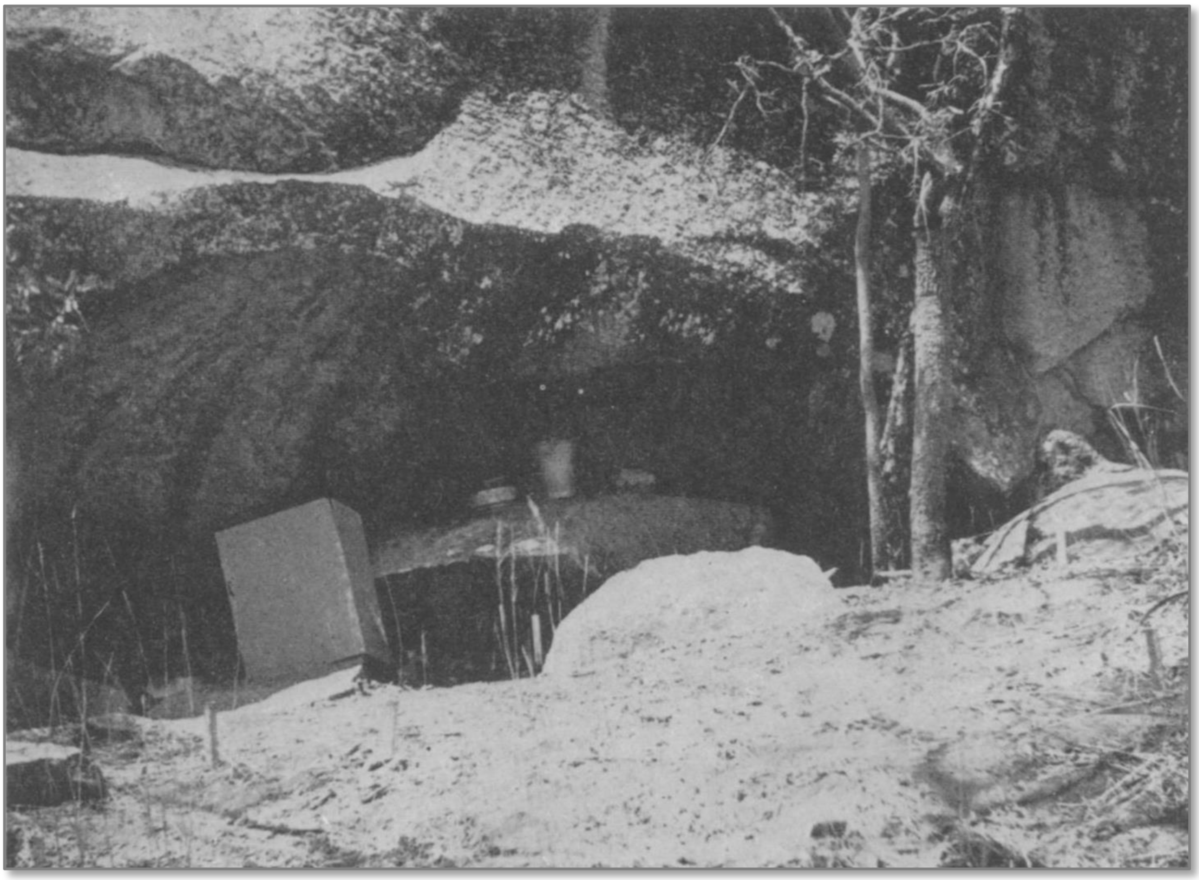


Figure 2.2: Entrance to Monk's Kop during 1964 excavations. (Taken from Crawford, 1967)

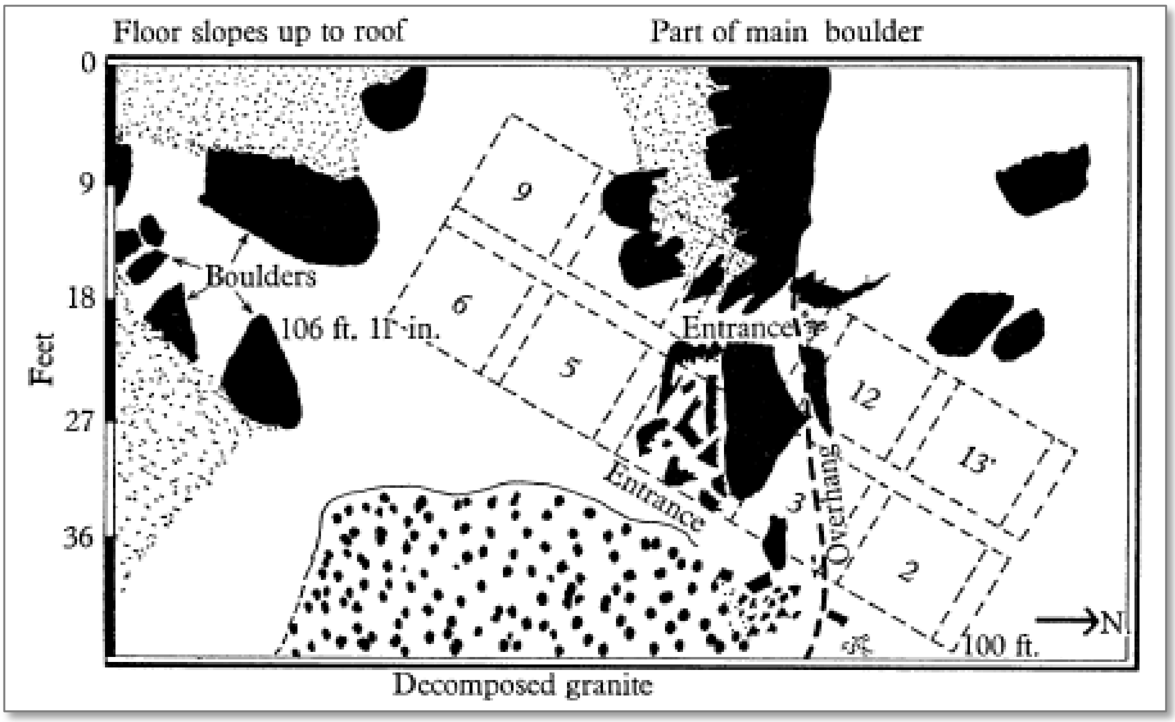
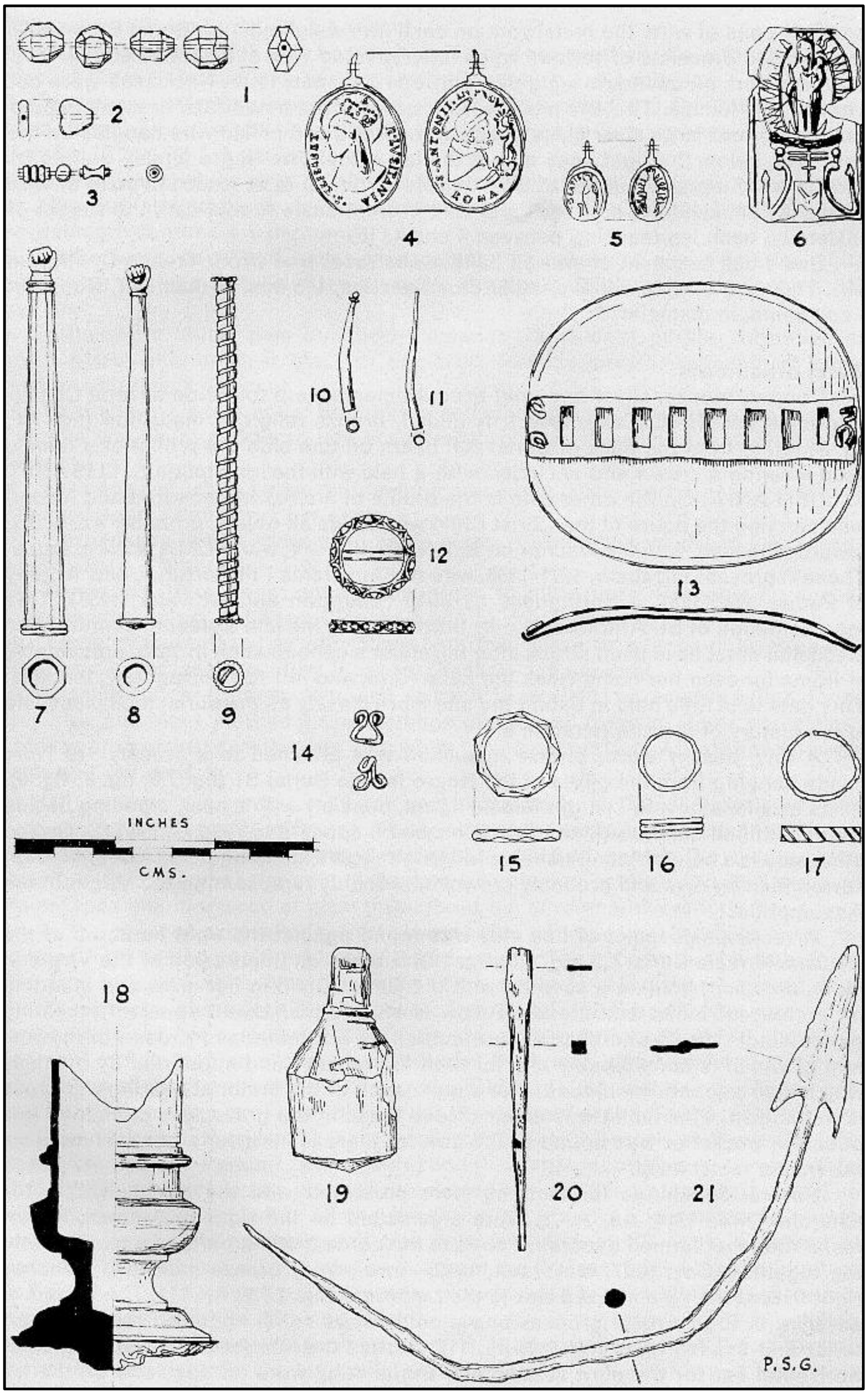


Figure 2.3: Site map of Monk's Kop during 1964 excavations. (Taken from Crawford, 1967)



1-3 = Small finds
4-5 = Medallions
6 = Clay tablet
7-9 = Aiguillettes
10-14 = Fasteners for clothing

15-17 = Rings
18 = Candlestick
19 = Schist cylinder
20 = Iron nail
21 = Iron arrowhead

Figure 2.4: Diagrammatic illustration of the medallions and metal artefacts associated with the Dambarare burials. (Taken from Garlake, 1969)

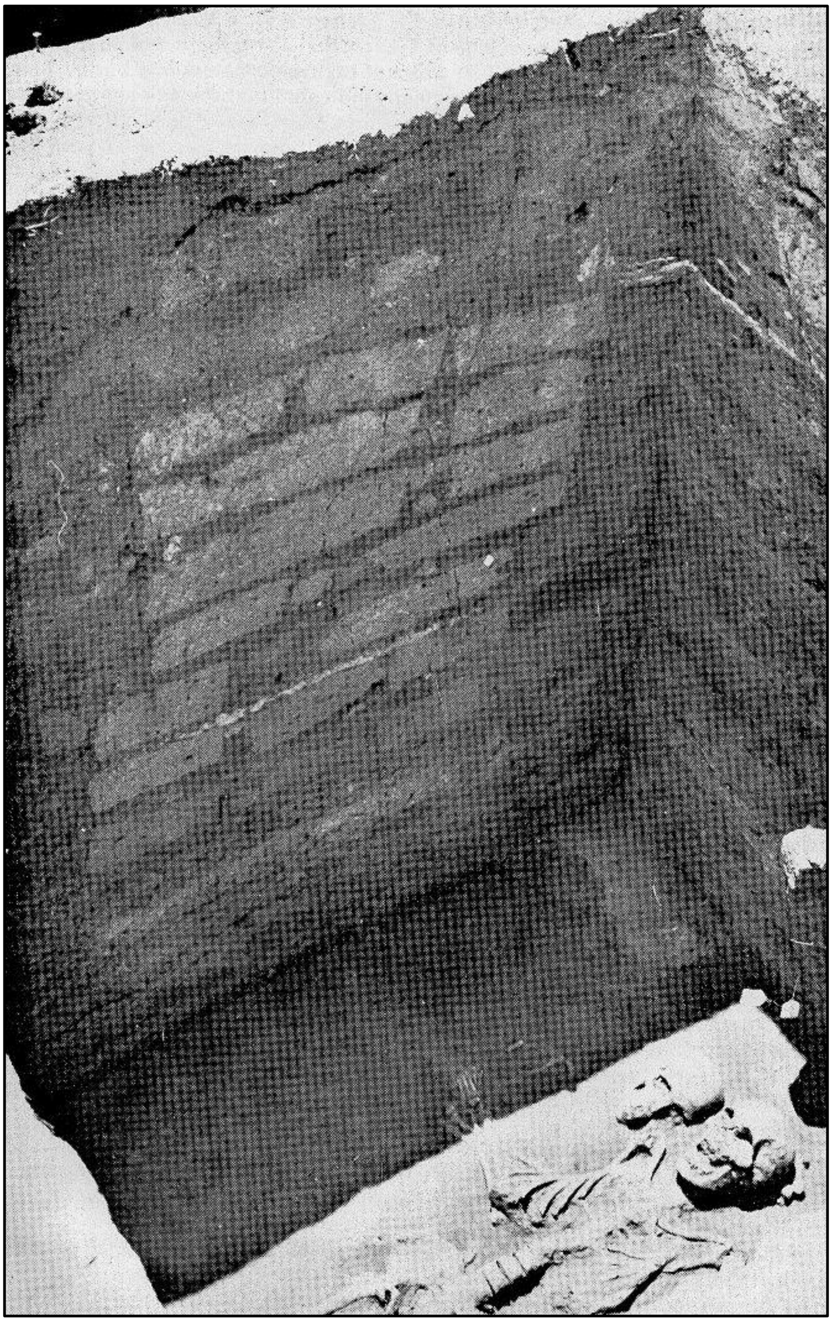


Figure 2.5: Dambarare Burials A3 (adult male) and A4 (adult female) showing Christian-type burial practice. (Taken from Garlake, 1969)

CHAPTER 3: MATERIALS AND METHODS

3.1 Materials

3.1.1 Introduction

The surviving artefacts and human remains investigated in this study are from three northern-Zimbabwean sites and are currently held in the National Museum of Human Sciences in Harare, Zimbabwe as well as the Raymond A. Dart collection, University of the Witwatersrand, South Africa (Dayal et al., 2009). Prior to officially requesting permission to initiate the study, an investigation to ascertain a preliminary minimum number of individuals was undertaken by visiting the National Museum of Human Sciences in Harare. This visit entailed identifying the applicable storage boxes which would contain all excavated material from the three sites housed in the Iron Age lab of the museum and estimating the minimum number of individuals by a quick survey of the contents of the identified boxes. The estimation was mostly based on the identification of skulls.

Permission to analyse the skeletal collections of Monk's Kop, Ashford Farms and Dambarare was obtained from the National Museums and Monuments of Zimbabwe Council through initial discussion with the National Museum of Human Sciences in Harare. This museum houses all human skeletal collections of Zimbabwe. The project was also authorized by the Zimbabwe Research Council in line with the Zimbabwe Research Act of 1986, Section 26A with registration certificate number 01095. The original permission did not include the use of any destructive methods, but as it became imperative as the study progressed to confirm previously published radiocarbon dates of both Monk's Kop and Ashford Farms, further permission was sought. Two separate requests to utilise a small section of the shafts of two humeri from the Monk's Kop and Ashford Farms sites respectively were approved and sent to Beta Analytic Inc. in London for radiocarbon dating.

Upon finalisation of data collection in Zimbabwe, the search for comparative collections for ancestry analysis through craniometric assessment resulted in the discovery of some of the Monk's Kop and Ashford Farms' skeletal material in the Dart

Collection, University of the Witwatersrand, South Africa. Permission was therefore sought to complete a skeletal analysis on al specimens still housed in the Raymond A. Dart collection. Details of these specimens can be seen in Appendix A (Monk's Kop collection) and Appendix B (Ashford Farms collection). The Dart collection's associated skeletal material resulted in the identification of four additional individuals, by means of skull and mandibular specimens not associated with individuals identified in the Zimbabwe collection. One of the additional individuals identified was the Monk's Kop specimen M_450, which will be discussed as one of the significant cases of this study. All other associated skeletal material of the Raymond A. Dart collection were severely fragmented.

The three skeletal collections were analysed as separate entities, but statistical data analysis also compared the results of the pre-contact sites as a combined unit (Monk's Kop and Ashford Farms) with that of the post-contact site, Dambarare. Both Monk's Kop and Ashford Farms yielded data of only African ancestry, however the Dambarare skeletal collection included individuals from both African and European descent. Therefore, assessments and statistical data analysis of the three sites included comparisons of all individuals (both African and European) as well as analyses comparing only individuals of African origin. Comparisons between previously studied skeletal collections and populations, such as Mapungubwe/K2, Toutswe and Venda were also done.

The Monk's Kop and Dambarare sites were actively excavated during the 1960's by two different individuals. The Ashford Farms site was, however, the result of accidental finds by local farmers and took the form of random collections, rather than planned excavations. Due to a variety of factors, the skeletal collections had to initially be re-organised prior to skeletal analysis to ensure that the study included as many as possible of the originally excavated and collected remains and artefacts. Factors which contributed to the decision to re-organise prior to analysis were: 1) Excavation / collection methods of the three sites differed substantially thus skeletal material, as well as associated finds, were assigned accession numbers using diverse methods. To enable clear and comparable analyses, additions to the originally assigned accession numbers were implemented, which will be discussed in detail at the applicable site descriptions hereafter. 2) Storage methods of the collections were dissimilar and skeletal material were often mixed with associated artefacts such as pottery, beads, bangles and cloth. In the cases where skeletal material were already separated from other excavated goods, non-human skeletal material were often stored with human remains. Skeletal remains were also often stored following a pattern of boxing similar bones (example all long bones) in one container, rather than storing elements of the same individual together. Skeletal material were firstly removed from associated artefacts and burial finds. Animal skeletal remains were then separated from human skeletal remains and relabelled accordingly. The cases where similar bones were stored together were reorganised with commencement of skeletal analyses, after which it was repacked with an associated individual in all cases where possible. 3) In many cases skeletal material packaging consisted of the original brown excavation paper bags. Skeletal material were therefore removed, cleaned by use of soft brushes and temporarily repacked in plastic bags to assist with immediate content identification upon commencement of skeletal analysis. 4) Unfortunately some skeletal material were not assigned accession numbers, and although kept in a box labelled as one of the applicable sites, unrelated material, such as skeletal material from other sites, resulted in the non-assigned bones not taken into consideration for this study. The Ashford Farms collection was unfortunately one such case where the post-cranial remains consisted mostly of unmarked long bones stored amongst long bones of non-associated sites, and therefore no post-cranial skeletal material of Ashford Farms could be included in the skeletal analysis of this study.

The reorganisation of the skeletal collection prior to skeletal analysis therefore assisted to ensure accurate data collection. However, although all attempts were made to analyse all applicable skeletal elements of the three applicable sites, excavation and storage methods may have had an influence on the deductions being made in this study. As discussed in the previous chapter, this is however often the case in most skeletal collection investigations, as inevitably the skeletal collection, however complete, well-excavated and correctly-stored, always only represents a fraction of the once-living population.

Commingling is often the result of improper excavation and/or storage methods of skeletal material, as may have been the case in the Monk's Kop collection but also to a lesser extent, the Dambarare collection.

3.1.2 Commingled remains

Commingling is defined as the mixing of body parts or skeletal remains of two or more individuals and can be the result of intentional human action (secondary graves or ossuaries) or natural taphonomic processes (Komar and Buikstra, 2008). Bioturbation (reworking of soils and sediments) is an example of a normal process of progressive loss of soft tissue that results in the settling of skeletal elements in a grave in a disorganised manner (Komar and Buikstra, 2008). Commingling can however also occur after excavation and is often attributed to improper inventory or storage methods. The Monk's Kop site commingled remains, was for example, the result of a combination of purposeful human action (an ossuary) as well as inadequate inventory methods, while Dambarare exhibited commingling due to bioturbation as well as poor storage methods.

The commingled nature of the skeletal remains of the sites investigated was one of the major factors influencing skeletal analysis. In sorting out commingled remains, a basic common-sense approach is needed, such as that described by Byrd & Adams (2014). On a small scale, commingled remains can be separated utilising visual pair-matching, articulation, process of elimination and osteometric comparison (Adams and Byrd, 2006). Aspects such as missing skeletal parts of known individuals, age indicators, preservation and special modifications such as bone discolouration may also assist to pair miscellaneous skeletal elements to known or labelled individual remains (Byrd and Adams, 2003; Adams and Byrd, 2006, 2014). The most common way of estimating the Minimum Number of Individuals (MNI) is by determining the most frequent element represented in the skeletal collection. The Most Likely Number of Individuals (MLNI) provides the maximum likelihood estimate and is based on the Lincoln Index originating from zooarchaeological literature (İşcan and Steyn, 2013; Adams and Byrd, 2014). This method is however dependant on the identification of an element belonging to a specific side.

It does however remain difficult to match bones and a good articulation does not necessarily mean that it is positively matched, although a non-articulation proves non-association (İşcan and Steyn, 2013). Byrd and Adams (2014) therefore provide information on the degree of confidence in a fit between various bones as being low, moderate and high. Elements which result in high degree of confidence includes the cranium and mandible; vertebrae; L5 and sacrum; humerus and ulna; os coxae and sacrum; tibia and talus; ulna and radius; metatarsals; metacarpals, tarsals and metatarsals.

Methods as described above in Adams and Byrd (2006, 2014) and Byrd and Adams (2003) were utilised in this study. In the case of Monk's Kop, the unsuccessfully paired elements were repacked together as per the original accession number and an MNI were calculated. Although Dambarare showed less commingling than Monk's Kop, the unsuccessful pairing of skeletal elements to labelled skeletons, were sorted according to trench number and paired with each other wherever possible. Pairing of skeletal material was however in some instances difficult and in all cases of any uncertainty skeletal elements were not paired rather than possibly pairing incorrect elements. The commingled remains of the Monk's Kop and Dambarare collections were analysed and documented slightly different due to the difference in severity of commingling and the original inventory and excavation method. Details of the exact method used at each assemblage are described below at the respective collection.

3.1.3 Pre-contact skeletal collections

3.1.3.1 Monk's Kop

Monk's Kop was identified by Dr A. M. MacGregor and the excavation of the site was done during 1964 by J. R. Crawford. Skeletal remains included both human and animal elements (Crawford, 1967). Initial investigations of the human skeletal remains done by the University of Witwatersrand, South Africa reported 71 individuals being represented by the skeletal collection. The excavation was done in a grid pattern of 10 ft. (approx. 3 m) which consisted of ten 8 ft. (approx.. 2.4 m) trenches with a 2 ft. (0.6 m) baulk in between. Due to time constraints, only five trenches were excavated.

From Crawford's original packaging methods, it can be deduced that all skeletal material were excavated in groups of elements which were seen as closely related, then placed in a brown paper bag and finally provided an accession number. Accession numbers of skeletal remains ranged from 29 – 487. The same numbering system was incorporated with the beads, cloth and pottery and in limited cases there were still non-skeletal archaeological and cultural material present among the accessioned skeletal remains. Accession numbers were therefore allocated numerically as skeletal material or artefacts were excavated. The collections of skeletal material were, however, not necessarily that of the same individual and often included multiple individuals. The skeletal remains were thus already commingled upon excavation, as Crawford refers to 'skeletons that had disintegrated into a confused scatter pattern' in his report (Crawford, 1967).

The skeletal remains were unpacked, cleaned, photographed and placed in numerical order to attempt to pair remains that were excavated from the same trench. Due to the inventory method at excavation, only some elements could be paired. The most successful element pairing was that of the skull and mandible. Successful paired skull and mandible combinations as well as skulls and mandibles confirmed as not belonging to a single individual were preliminarily identified as an indication of possible minimum number of individuals. All skulls and mandibles were morphologically and osteometrically analysed. Sex and ancestry were identified and age was estimated. Any trauma or pathologies (skeletal or dental) were identified and photographed. Skulls and mandibles were photographed from an anterior, lateral and inferior view, while mandibles were photographed from an anterior and superior view. The inferior view of the skull and superior view of the mandible provided photographic proof of dental patterns and wear.

All other skeletal elements not identified as belonging to a specific individual, were identified to bone and side wherever possible. The skeletal material were in different states of preservation and included complete elements which were well-preserved. The state of preservation was documented for each skeletal element as being one of the following; 75%-100%, 25%-75% or 1%-25% complete. All elements falling within the category of 75%-100% and which could be identified as belonging to a specific side of the body was taken into consideration when calculating the minimum number of individuals as represented by each bone. If the element was incomplete, the specific section/s that the fragment represented was also documented. There were, however, a large number of skeletal elements which were fragmented beyond identification and could not be assigned to either bone or side of body. These elements were documented as fragments. Age estimation in these cases was documented only as adult or sub-adult remains, utilising unfused or partly fused epiphyses as the differentiating factor. In the case of a sub-collection containing both adult and sub-adult elements, the sub-collection was separated accordingly and renamed (e.g. 438a and 438b). All possible measurements were documented and any trauma or pathologies were identified and photographed. The entire sub-collection was then photographed as a unit for record purposes.

All skeletal material were repacked and relabelled according to the original accession number. The skeletal collection of Monk's Kop was relabelled to represent one of the following:

- Accession numbers of the Monk's Kop collection of those who could be confirmed as an individual.
- Accession numbers of the Monk's Kop collection of those who could NOT be confirmed as an individual.

Any sub-collection of bones (whether it was represented by one or more individuals) within an accession number was named according to the following example:

M_319a

If applicable

Monk's Kop
(Added by author)

Sub-collection of bones 319
(Original accession number)

Age-related separation
(Unfused epiphyses)

An accession number could therefore represent a single individual (as shown in the individual skeletal reports in Appendix A) or a sub-collection of elements which could possibly represent more than one individual (as shown in the summary in Appendix A). Individuals and sub-collections were repacked in see-through plastic bags with a label indicating the accession number and a short description of the contents.

The only destructive analysis that was done included the sectioning of a humeral shaft from accession number M_319 which was submitted for radiocarbon dating confirmation via collagen extraction. The sampled bone was sent to Beta Analytic Inc. in London for AMS dating (radiocarbon dating which is done via accelerator mass spectrometry).

3.1.3.2 Ashford Farms

The Ashford Farms site was identified by local farmers and the skeletons came to be housed in the Zimbabwe Museum of Human Sciences by means of collection rather than a planned excavation. Due to this fact, very little is known about the Ashford Farms site. Cranial remains were marked; however postcranial remains within the allocated boxes were unmarked and unfortunately mixed with skeletal remains from other sites. This fact resulted in only the cranial remains which could be directly linked to the site, being analysed. Therefore, no data have been documented for the postcranial remains of Ashford farms. Seven minimum number of individuals were identified by means of cranial remains.

All skeletal remains from Ashford Farms investigated for this study were well-preserved and were either complete or near-complete. The available cranial elements were identified, analysed and photographed. All skeletal material were repacked and relabelled according to the original accession number as per the following example:

A_7

Ashford farm
(Added by author)

Individual 7
(Original accession number)

No radiocarbon dating was previously recorded for this site, thus a 3 cm section of a humeral shaft from accession number AF1F was also sent to Beta Analytic Inc. who completed an AMS dating analysis.

3.1.4 Post-contact skeletal collection

3.1.4.1 Dambarare

The Dambarare site was already identified in 1923 by Mr H. Light and the gold earthworks were described in 1961 by Mr D. Abraham (Abraham, 1961; Garlake, 1969). Excavation, however, was only done in 1967 by P. S. Garlake by designating 6 ft. x 6 ft. (1.83 m x 1.83 m) trenches from the center to the periphery labelled as AA, A, B, C, D, E, F and G. Trenches D and F were, however, not excavated as Garlake reports that only approximately 2% of the area could be excavated at the time after which the site was flooded by the construction of a dam associated with the Jumbo mine (Garlake, 1969). Initial identification yielded 32 individuals accessioned according to trench origin.

Most of the burials were undisturbed upon excavation and could be accessioned as a single individual; however some were unintentionally disturbed by later interments and due to the close proximity of the burials, five individuals were completely commingled (Garlake, 1969). This, as well as subsequent storage methods, resulted in the skeletal remains found commingled. Most of the remains were labelled and packed in plastic bags, which assisted in assigning skeletal elements to individuals, however there were various elements that were not marked. Some of the skeletal remains were thus unassociated and listed as "miscellaneous elements". No destructive analysis was undertaken and all skeletal material were repacked and relabelled according to the original accession number. The skeletal collection of Dambarare was relabelled to represent one of the following:

- An individual within an accession number was named according to the following example:

D_AA4

Dambarare	Trench AA	Individual 4
(Added by author)	(Original trench number)	(Original accession number)

- In cases where skeletal elements could be paired and confirmed as an additional individual, the particular sub-collection of bones were named according to the following example:

D_AAMisc2

Dambarare	Trench AA	Miscellaneous Individual 2
(Added by author)	(Original trench number)	(Added by author)

- In cases where the elements could not be paired or confirmed as an additional individual, the particular sub-collection of bones were retained as originally accessioned and named according to the following example:

D_AAMiscElem6

Dambarare	Trench AA	Miscellaneous Sub-collection 6
(Added by author)	(Original trench number)	(Added by author)

All complete and near-complete skeletal elements were morphologically and osteometrically analysed as per the procedure previously described.

The preservation of all skeletal material of Dambarare was fairly good, but there were some specimens that were embedded in granitic sand. This fact often made skeletal analysis difficult as excessive cleaning would have destroyed the specimen and therefore some observations or measurements could not be done. Cases like these were however minimal and can be seen in Figure 3.1 which illustrates the granitic sand embedded in the skull of one of the Dambarare burials.

3.1.5 Comparative material

3.1.5.1 Introduction

To investigate and interpret health status from a skeletal collection, it is essential to gain additional insight into the once-living population by comparing the remains studied to that of similar groups and populations previously studied. For the purpose of shedding more light on the subsistence economies of the different sites studied, the prevalence of dental caries will be compared to hunter-gatherer populations such as Riet River (Morris, 1992), Kakamas (Morris, 1992) and Oakhurst (Sealy et al., 1992) but also to agricultural societies e.g. Maroelabult (Steyn et al., 2002) and Ingombe llede (Gibbon and Grimoud, 2014)

The populations investigated in this study will also be compared to sites which 1) are in close geographical proximity to northern Zimbabwe and 2) might have had interaction at some time in history with the populations studied. These are Mapungubwe/K2, Venda and Toutswe.

3.1.5.2 Mapungubwe/K2

Mapungubwe and K2 were occupied between A.D. 1000 and A.D. 1300 and is located in the Limpopo province, South Africa, in close proximity of the confluence of the Shashi and Limpopo rivers (Steyn and Henneberg, 1995a; Pikirayi, 2001). This population is an example of an Iron Age society in which both agriculture and livestock breeding played a significant role. Mapungubwe followed the Central Cattle Kraal pattern and is also the first kingdom of the well-known four Zambezian states of succession (Huffman, 1971, 2009). The health and biological background of this Iron Age population was investigated and reconstructed from a total of 96 skeletons from K2 and 12 skeletons from Mapungubwe of which 25 was adults, ten was adolescents and 71 juveniles (Henneberg and Steyn, 1994; Steyn and Henneberg, 1995a, 1997; Steyn, 1997). Although the population was in relative good health, they were not free of disease (Steyn, 1994). Pathological signs of disease included a possible case of treponemal disease, a high caries frequency and non-specific markers of disease such as enamel hypoplasia and Harris lines suggesting possible parasitic diseases due to the high population density and occasional restricted water availability (Henneberg and Steyn, 1994; Steyn, 1994, 1997).

3.1.5.3 Venda

Venda is an example of a modern population situated in the Limpopo province of South Africa who before the 19th century had very little contact with Europeans. During the 20th century the Venda people were, however, introduced to a Western lifestyle through the settlement of missionaries in the region. The Venda population was severely influenced by European contact, both through religion and economy, which resulted in a complete transformation of the Venda community and their traditional ways of life (Stayt, 1931). From the skeletal pathology observed in a total of 157 skeletons (102 adult, 37 juveniles and 14 of unknown age), it was clear that the population endured physical and social hardships. Although it seems that the availability of Western medicine impacted positively on the health of this population, a variety of skeletal pathology was recorded. These included infectious diseases such as leprosy and osteomyelitis, degenerative conditions (osteoarthritis, vertebral osteophytosis and Schmorl's nodes), traumatic injuries (fractures) as well as non-specific indicators of disease such as periostitis(L'Abbé, 2005; L'Abbé and Steyn, 2007).

3.1.5.4 Toutswe

The Toutswe collection comprises of 10 traditional sites situated in east and central Botswana from which a combined total of 84 skeletons (30 adults and 54 juveniles) provided a glimpse of the biological profile and general health of this Iron Age (A.D. 700 – A.D. 1250) population (Mosothwane, 2004; Mosothwane and Steyn, 2009). Results suggest that the population was generally in good health based on the absence of infectious disease and low frequency of stress markers such as cribra orbitalia and porotic hyperostosis (Mosothwane, 2004). There were however cases of spina bifida, degenerative diseases as well as some trauma present in the collection. A possible case of DISH was also noted (Mosothwane, 2004; Mosothwane and Steyn, 2009).

3.2 Methods

3.2.1 Introduction

Standard morphological and osteometric proven methods as published by authors such as Buikstra and Ubelaker (1994), Steinbock (1976), Roberts and Manchester (1995), Webb and Suchey (1985) and Ortner (2003) were used throughout. Descriptions and measurements from both cranial and postcranial skeletal elements (if available) were used to allocate sex, ancestry, estimate sex and identify possible trauma and pathologies.

Due to the nature and location of the skeletal collections, radiographic methods could not be utilised to aid in skeletal analysis.

3.2.2 Age estimation

3.2.2.1 Introduction

Age at death estimation is fundamental in archaeological, palaeoanthropological and forensic investigations (Coqueugniot and Weaver, 2007). The age at death of skeletal remains are estimated utilising methods centred around skeletal growth, development of dentition as well as techniques utilising the deteriorating skeleton as a guide (Komar and Buikstra, 2008; İşcan and Steyn, 2013). Whether the individual under investigation was a child or adult, should therefore first be established prior to proceeding with an exact age estimation (Schmeling et al., 2007). Age estimation methods can therefore be subdivided in those utilised in infants and juveniles (developmental skeletal changes) and those used to estimate adult age ranges (degenerative skeletal changes) (Komar and Buikstra, 2008).

The developing skeletal changes associated with age estimation in sub-adults provide relatively accurate age approximations as it incorporates ossification and fusion events of which the almost exact scheduling has been proven through decades of research (Webb and Suchey, 1985; Becker, 1986; Krogman and İşcan, 1986; Key et al., 1994; Scheuer and Black, 2004; Coqueugniot and Weaver, 2007; Schmeling et al., 2007; Schaefer et al., 2008). Upon adulthood (between 18 and 25 years) growth ceases as the skeleton enters the last phases of maturation (Webb and Suchey, 1985; Byers, 2011). This results in adult age estimations with wider ranges than those of children due to the fact that the estimates are based on the degree of natural degeneration of bone that are not as easily observed and therefore the estimates are often less accurate (Ferembach et al., 1980; Webb and Suchey, 1985; Buikstra and Ubelaker, 1994; Ritz-Timme et al., 2000; İşcan and Steyn, 2013).

Due to the often incomplete nature of skeletal collections, a combination of age estimation techniques provide the best results, although careful judgment should be applied when the different methods produce diverse outcomes (Lovejoy et al., 1985a; Ubelaker, 1987; Ritz-Timme et al., 2000). Most of the age estimation methods currently being used are based upon descriptive phase systems which contain the utilisation of multiple skeletal features that are open to interpretation (Kimmerle et al., 2008). It is also important to note that the quality, quantity and environmental conditions associated with the skeletal remains as well as the cost, time and equipment required play significant roles in deciding what methods would be most appropriate when estimating age at death of a specific collection (Schmeling et al., 2007). Therefore, decisions such as choice of skeletal region, methods to be used, statistical information usage and how to combine all the information retrieved from utilising multiple methods, ultimately influence the final reported age estimate (Garvin and Passalacqua, 2012).

3.2.2.2 Infants and juveniles

The union of ossification centres, long bone length, developmental status of the epiphyses as well as tooth mineralisation, eruption and formation are criteria applied to estimate age at death of children and adolescents (Ubelaker, 1989; Scheuer et al., 2000; Scheuer and Black, 2004; Rösing et al., 2007; Schaefer et al., 2008). Age estimation based on the developing dentition has shown to be most accurate (Ubelaker, 1989; Komar and Buikstra, 2008; AlQahtani et al., 2010), however if dentition is not available, skeletal maturation is the only means of estimating age (Coqueugniot and Weaver, 2007).

Assessment of *tooth eruption and formation*, i.e. the different stages of deciduous and permanent tooth development are the most reliable method of estimating age in sub-adults due to the consistent nature of the sequence and rate of development (Kvaal et al., 1994; Loth and İşcan, 2000a; Scheuer et al., 2000; Schaefer et al., 2008; AlQahtani et al., 2010). Furthermore, tooth formation and eruption are not much influenced by environmental factors as much as skeletal development. Tooth formation takes place via certain stages of mineralisation, starting at the cusp and completing the process at the root. The different tooth types pass through these stages at different times of an individual's dental development timeline, which has been formulated to offer timetables used by anthropologists (Moorrees et al., 1963; Harris and McKee, 1990). Although the study of Schour and Massler (1941) has been used extensively, it consisted of a small sample of diseased, white children (Schour and Massler, 1941) and therefore Ubelaker (1989) and more recently AlQahtani et al. (2010) are most often used by anthropologists. Of the limited number of infants and children analysed in this study, most remains were incomplete and poorly preserved (either crushed or embedded in calcified granite), thus infant age estimations were based on tooth eruption guided by Ubelaker (1989 and Scheuer et al. (2000).

Multiple growth areas in the skeleton, called primary (pre-natal development) and secondary (post-natal development) *ossification centres*, join to ultimately effect bone growth. The development and union of these ossification centres provide a rather good indication of age as the sequence and timing of these events are relatively fixed (Stewart, 1979; Schaefer et al., 2008). The appearance and union of ossification centres was used to approximate juvenile age during this study where applicable by using guidelines described in Krogman and İşcan (1986), Scheuer et al. (2000) and Schaefer et al. (2008).

After the primary and secondary ossification centres have fused, the epiphyses ossify within the joint area at normal cessation of growth and result in the epiphyseal ends uniting with the applicable diaphysis (Scheuer and Black, 2004; Schaefer et al., 2008). Although a faint line that marks the area of fusion can be observed initially, this line disappears by means of normal bone remodelling as part of the ageing process (Byers, 2011). Studies to investigate the approximate timing of *epiphyseal union* lead to sex-specific ranges that is commonly used in both the forensic and anthropological fields (Krogman and İşcan, 1986; Buikstra and Ubelaker, 1994; Loth and İşcan, 2000a; Scheuer et al., 2000; Scheuer and Black, 2004; Schaefer et al., 2008). Although currently the ancestry of the skeletal remains does not feature as a pre-requisite for this age estimation technique, examples of research to further population-specific knowledge of age ranges have been studied, for example in the distal tibia and fibula (Crowder and Austin, 2005) as well as the elbow joint (Sahni et al., 1995). The medial end of the clavicle has been useful due to this bone providing age estimations of sub-adults beyond the fusion of all other skeletal epiphyses, well into the late twenties (Kreitner et al., 1998; Langley-Shirley and Jantz, 2010). The fusion of the anterior aspects of vertebrae S1 and S2 have also shown to be one of the best ways of estimating age related to epiphyseal fusion (Belcastro et al., 2008; Ríos et al., 2008). Recommendations from Schaefer et al. 2008 were used in this study to approximate age from epiphyseal union.

Long bone lengths are often used in the determination of prenatal, natal and early postnatal infants, as foetal size up to birth shows very little variation across different ancestries and sexes, and are therefore fairly accurate (Hoffman, 1979; Stewart, 1979; Loth and İşcan, 2000a; Scheuer et al., 2000). In older children and juveniles, age estimations should ideally incorporate sex differences and population variability to negate possible errors (Ubelaker, 1987), but due to the difficulties associated with sex estimation in infants and juveniles, this is often not possible.

Estimations based on long bone lengths for this study was calculated according to Ubelaker (1987) and Scheuer et al. (2000).

3.2.2.3 Adults

Although the estimation of age at death for children can be done with great accuracy by utilising skeletal and dental development, it is often challenging to establish adult age at death (Ubelaker, 1987; İşcan and Steyn, 2013). It has also been shown that adult age estimations normally result in the overestimation of young adults and the underestimation of older adults (Aykroyd et al., 1999; Boldson et al., 2002; Buckberry and Chamberlain, 2002). Therefore a multiple-method approach is most often used in adult age estimations (Komar and Buikstra, 2008; Byers, 2011), although it is not always clear how they should be combined in a statistically justifiable way (Boldson et al., 2002). Many studies have been done to estimate adult age at death and include the evaluation of cranial suture closure, the sternal ends of ribs, pubic symphysis and auricular surface changes. Osteophytic development and dental changes may also give an indication, and although often the only means of assessment due to incomplete remains, the age estimations done exclusively on these dental changes can at most result in descriptions such as young and older adults (Loth and İşcan, 2000a; Byers, 2011).

The *cranial suture closure* age estimation method is based on the principle that younger individuals exhibit open sutures which then tend to obliterate with age and involves the sutures of the ectocranium (outside of skull), endocranium (inside of skull) and palate (Acsádi and Nemeskéri, 1970; Masset, 1989; Buikstra and Ubelaker, 1994). Already described in the 1920's as a series of papers describing age-related suture changes (Todd and Lyon, 1924, 1925a; b; c), it has been used extensively in age estimations of unknown remains and tested by various authors (Key et al., 1994; Galera et al., 1998). Various subsequent studies utilising suture closure have been done (Masset, 1989; Nawrocki, 1998), but the most used method descriptions include the reinvestigation of Todd and Lyon's cranial suture method (Meindl and Lovejoy, 1985) as well as the description of the complex suture method (Acsádi and Nemeskéri, 1970) as represented in Buikstra and Ubelaker (1994). Galera et al. (1998) reported that endocranial suture closure, according to the methods described by Todd and Lyon

(1924), is valid. The original study of Mann et al. (1991) on a maxillary (palate) suture closure age estimation method was tested by Apostolidou et al. (2011) and also found to be valid (Mann et al., 1991; Apostolidou et al., 2011). Therefore suture closure can still be helpful, although not very accurate. This study utilised mainly the complex suture method described by Acsádi and Nemeskéri (1970).

The utilisation of the *sternal ends of ribs* as it attaches to the sternum via the costal cartilages, is a fairly reliable method that could be added to age estimation analyses (İşcan et al., 1984, 1985). This phase-analysis system is sex-specific and is based on changes detected macroscopically at the costochondral junction, especially observing the formation of the pit, the changes in its walls and the overall density and texture of the rib (İşcan et al., 1984, 1985; Oettlé and Steyn, 2000; Byers, 2011). As age progresses the surface and contour of the bone as well as the rim edge and contour change. Although the age ranges provided by Işcan et al. (1984, 1985) has been criticised due to its limited sample sizes (Klepinger, 2006), it remains a helpful method. The phase-analysis system of Işcan et al. (1984, 1985) was used in this study for individuals of European descent, while Oettlé and Steyn (2000) was utilised for individuals of African descent.

Age estimation techniques by means of the *pubic symphysis* are centered around the symphyseal face of the hip bone (Brooks and Suchey, 1990). Descriptions of the formation of ossific nodules, the ventral and dorsal margins of the symphyseal face, as well as its upper and lower parts are used as a phase-system analysis. Young individuals exhibit a pubic face with ridges and furrows that are transversely organised across the surface. As age sets in, the furrows fill from posteriorly, ultimately resulting in the face being flattened and granular-like and characterised by ossific nodules (Brooks, 1955; Byers, 2011). Originally described by Todd in 1920, the method has been reinvestigated and tested by various investigators and proved to be a reliable and fairly accurate method of age estimation in skeletal remains (Todd, 1920; Brooks, 1955; Meindl et al., 1985; Brooks and Suchey, 1990; Kimmerle et al., 2008). Age estimations utilising the pubic symphysis was invaluable in this study and was based on phase-analysis descriptions of Meindl et al. (1985) and Brooks and Suchey (1990).

The use of the *auricular surface* in age at death estimation of skeletal remains is founded on the changes that occur at the posterior part of the ilium, in particular the texture and apex of the auricular surface as well as the area behind the auricular surface referred to as the retroauricular area. The original publication of Lovejoy and colleagues (Lovejoy et al., 1985b) has been tested and reinvestigated e.g. (Murray and Murray, 1991; Falys et al., 2006) and are said to be accurate regardless of sex (Buckberry and Chamberlain, 2002; Mulhern and Jones, 2005) and ancestry (Osborne et al., 2004; Mulhern and Jones, 2005). With age, the three features that change at the auricular surface itself, are the loss of stria, onset of a granular appearance and an increase of porosity on the auricular surface. Furthermore, the apex changes from a thin to a thickened crescent border and the retroauricular area starts exhibiting osteophytes as it changes from a young smoother looking structure (Lovejoy et al., 1985b).

Age estimations can also be done via analyses of *osteophytic development*, especially utilising the vertebral column. A study on a South African population suggested a method incorporating the anterior, inferior and superior margins of specifically lumbar vertebrae. By means of a scoring system, the gradual formation of osteophytes ranges from awarding a “0” for no indication osteophytes to a score of “4” awarded when osteophyte formation has ultimately resulted in two or more adjacent vertebrae fused (Van der Merwe et al., 2006). Although the osteophytic development value was not calculated in this study, osteophytic development and other degenerative changes were used as additional confirmation of age at death (Buikstra and Ubelaker, 1994; Komar and Buikstra, 2008).

Dental changes associated with ageing include attrition, deposition of secondary dentin, changes in the paradentium, cementum apposition, root transparency and lastly root resorption. One of the first descriptions of the use of dental changes was done in the 1950’s (Gustafson, 1950), but tested and modified by various authors thereafter e.g. (Burns and Maples, 1976; Drusini et al., 1991; Lamendin et al., 1992). Although tooth wear was used as a confirmation of age estimation in this study, the Gustafson method was not utilised. Antemortem tooth loss and dental attrition were taken into account, but was not histologically analysed.

3.2.3 Sex estimation

3.2.3.1 Introduction

The two general characteristics used to attribute sex to skeletal remains are size and architecture; males being generally taller and skeletal elements exhibiting more robust, wider and rugged features. Morphological differences further distinguish the two sexes based on skeletal modifications females require to be able to carry and give birth to children (İşcan and Steyn, 2013). Although it is quite easy to attribute sex to living individuals, sex estimation in skeletal remains is more difficult due to traits related to size and shape forming a continuum and often overlapping (İşcan and Steyn, 2013). Sexual traits currently used have also shown overlap due to facts such as females becoming more robust as age progress (Pfeiffer, 1980; Ruff and Jones, 1981) and certain traits being population specific, especially general robusticity (Rösing et al., 2007; Vance et al., 2011).

Due to the importance of sex estimation in forensic and archaeological context, a plethora of studies have investigated cranial and postcranial skeletal traits to compensate for the often incomplete nature of skeletal remains. Although many studies have been done to broaden the database of skeletal traits which could predict sex , the pelvis and cranium are still the most reliable methods to attribute sex (Loth and İşcan, 2000a; Rösing et al., 2007). Sexually dimorphic skeletal traits of the upper limb bones that have been studied include that of the clavicle (Jit and Singh, 1966; Rogers et al., 2000), scapula (Bainbridge and Tarazaga, 1956; Di Vella et al., 1994), humerus (Rogers, 1999; Steyn and İşcan, 1999; Falys et al., 2005; Vance et al., 2011), radius and ulna (Mall et al., 2001; Barrier and L'Abbé, 2008) as well as the carpals (Sulzmann et al., 2008) and metacarpals (Scheuer and Elkington, 1993; Falsetti, 1995). Lower limb bone studies focussed on femoral skeletal traits (DiBennardo and Taylor, 1979; Steyn and Işcan, 1997; Asala, 2001; Asala et al., 2004; Robinson and Bidmos, 2011), but also include investigations incorporating the tibia (İşcan and Miller-Shaivitz, 1984; Holland, 1991), fibula (Sacragi and Ikeda, 1995) and tarsal bones (Bidmos and Asala, 2004; Gualdi-Russo, 2007). Sexual dimorphic studies of the axial skeleton were already documented in the 1880's and includes that of the sternum (Dwight, 1881) and more recent studies utilising the sternum and sternal ends of ribs (İşcan, 1985; Koçak et al., 2003; Ramadan et al., 2010; Chandrakanth et al., 2012; Changani et al., 2014).

Immature remains have not yet developed the skeletal sex indicators used in adult remains as most sex differences occur after puberty. Therefore the accuracy of assigning sex to remains from juveniles are fairly low (İşcan and Steyn, 2013). Attempts to differentiate between male and female juvenile remains, date back to the late 1800's (Thomson, 1899) . Methods such as tooth sizes (Rösing, 1983) , long bone characteristics (Coussens et al., 2002) cranial (Molleson et al., 1998) and morphological traits (Schutkowski, 1993) still provide uncertain results at best (Walker, 2005; Rösing et al., 2007). Various studies on sex estimation in sub-adults have been done and range from possible methods to estimate sex of fetuses and infants (Reynolds, 1945; Boucher, 1957; Weaver, 1980) to children in the prepubertal period (Reynolds, 1947; Schutkowski, 1993; Vlak et al., 2008). Only a few of the methods described in the studies above attain accuracies of more than 75% which implies that sex estimation in juvenile remains is still problematic (İşcan and Steyn, 2013). Although attempts were made to determine the sex of the immature remains of this study, it should be kept in mind that deductions are circumstantial rather than confirmed.

Despite all the available methods, it remains a complex task to attribute sex to skeletal remains. Sex estimation methods can be grouped based on morphological features or utilising anthropometry (osteometric methods), which has the advantage of being quantifiable (Rösing et al., 2007).

3.2.3.2 Morphological methods

Non-metric methods to establish sex of an individual are based on the visual assessment of size, shape and structure of a skeletal trait and are dependent on both the degree of variation between the two sexes and the experience of the investigator (Meindl et al., 1985; Loth and İşcan, 2000a; Van der Merwe, 2007; Byers, 2011). Various studies have been initiated to standardise visual assessment to ensure repeatability by means of adding figures and "grades" of size and shape e.g. Walker (2008).

The entire *pelvis*, including the sacrum, provides the most significant differentiating features due to its connection to the reproductive role of the female (Phenice, 1969; Bruzek, 2002; Rösing et al., 2007; Byers, 2011). The shape of the pelvic inlet (heart-shaped or circular/elliptical) as well as the shape of parts of the hip bone such as the pubic bone (triangular or rectangular), subpubic angle (V- or U-shaped) and obturator foramen (ovoid or triangular) were assessed in this study. The general pelvic size differences that included aspects such as the complete pelvis (robust or gracile), the greater sciatic notch (small and deep or large and wide) and the iliac tuberosity (large or small) were also assessed. Further general descriptions comprised of the presence or absence of a preauricular sulcus as well as the direction of the acetabulum (directed laterally or antero-laterally). The Phenice method is one of the most used methods of sex estimation, specifically utilising the ventral arc, subpubic concavity and the medial aspect of the ishio-pubic ramus (Phenice, 1969; Klales et al., 2012). Although separate of the hip bone, the sacrum completes the pelvis and its shape (narrower or broader), size (longer or shorter) and whether it is curved or not was also used as an indicator to assess sex in this study.

All the above differentiating sexual traits of the pelvis were guided by Phenice (1969), Krogman and İşcan (1986), Loth and İşcan (2000) and İşcan and Steyn (2013). The shape of the pubic bone and the greater sciatic notch were especially useful in difficult cases as it has been proved that it provides one of the most dependable sexually dimorphic skeletal traits (Patriquin et al., 2003).

Morphological differences of the *skull and mandible* were also assessed according to descriptions of Krogman and İşcan (1986), Loth and İşcan (2000), Walker (2008), Buikstra and Ubelaker (1994) and İşcan and Steyn (2013). It included the size and shape of parts of the skull and mandible as well as the presence or absence of certain structures. Larger size is usually an indication of a male and included the assessment of the overall size of the skull, supraorbital torus, mastoid processes, occipital condyles, teeth as well as the frontal and parietal eminences. Shape differences included the supraorbital margins (rounded or sharp), orbits (rectangular or rounded), forehead (sloped or vertical), palate (U- or parabola shaped) and chin (square or rounded). A smooth skull and absence of muscle lines on the occipital area indicated a female individual. Walker (2008) tested the accuracy of sex estimations based on visual assessments of the mental eminence, orbital margin, glabellar area, nuchal area, and mastoid process and found an 88% accuracy rate. Known age at death and ancestry also did not influence the estimation of sex significantly during his investigation (Walker, 2008).

The *distal humerus* was also used as confirmation in difficult cases and specifically utilised methods described by Rogers (1999) and tested by Vance et al. (2011) which includes the trochlear extension (in or out of symmetry with the capitulum), olecranon fossa shape (triangular or oval) as well as the angle of the medial epicondyle (parallel or projected upwards from the rest of the distal extremity). The accuracy of this methods was, however, low.

3.2.3.3 Osteometric methods

Sexual dimorphism is less visible on long bones, and therefore a metric analysis is especially crucial if the pelvis and/or cranium are not available or incomplete. Osteometric methods for sex estimation are based on the fact that males tend to be taller and more robust than females (İşcan and Steyn, 2013). The use of metric parameters are usually easy to assess and interpret, but do have overlaps between sexes (DiBennardo and Taylor, 1979; Steyn and İşcan, 1998, 1999; Asala, 2001). It is, however, important to note that sex estimation by means of anthropometry can also population specific (Loth and İşcan, 2000b; Komar and Buikstra, 2008), however metric methods can be a reliable tool for sex estimation across all populations when developed correctly (Spradley et al., 2008; Steyn and Patriquin, 2009).

The earlier studies on sex estimation utilising metric methods often focussed on pelvic indices (İşcan and Steyn, 2013) and included measurements utilising the pelvic brim (Turner, 1886) as well as determining the metric relationship between the pubis and ischium (Washburn, 1948). Later studies started using discriminant function analysis; the first such study incorporated traditional ischial and pubic length indices, but combined it with an additional four measurements of the greater sciatic notch and acetabular region (Howells, 1965). Since the introduction of the various founding metric sex estimation studies, many population specific studies followed, with many such studies originating from the South African context e.g. Steyn and İşcan (1998), Asala (2001), Patriquin et al. (2003) and Bidsmos and Asala (2004).

Population specific data on a Portuguese collection was developed utilising odontometric indices and concluded that the canine index showed the greatest sex discriminant characteristics, however the incisor index showed no significant difference between the two sexes (Pereira et al., 2010). This method does however require both right and left dental arcades to ensure accuracy, and due to the high level of ante- and post-mortem tooth loss observed in this study, this method was not attempted on the Dambarare skeletal collection. A recent study also utilised a Portuguese population to ascertain stature and sex from measurements of the 1st and 2nd metatarsal bones (Rodríguez et al., 2014). Due to the recent nature of this publication, this method could not be used on the Dambarare collection.

Metric analysis for this study was mainly done using Patriquin et al. (2003), Loth and İşcan (2000 b) and Steyn and İşcan (1998).

3.2.4 Ancestry

Ancestry can be defined as the evolutionary or genetic line of descent of any animal or plant (Stevenson, 2011). Similar to sex, ancestry can be assessed by means of morphological or osteometric methods. The utilisation of both methods of investigation as a multi-disciplinary approach often results in a more reliable outcome (İşcan and Steyn, 2013). Once again, morphological methods is subjective by nature, but remains the main method of assigning ancestry and consists of visual identifications of primarily the cranial skeleton (Krogman and İşcan, 1986; Gill and Rhine, 1990). Initial reports of the Dambarare collection indicated the presence of individuals from both European and African descent.

Morphological differences of the *skull and mandible* were assessed according to descriptions of Krogman and İşcan (1986), İşcan and Steyn (1999) as well as İşcan et al. (2000) and included differences of parts of the skull and mandible as well as the presence or absence of certain structures. Skull length, breadth and height as well as its general appearance is characteristic to the three major ancestry types and has been tested for accuracy in many studies and were demonstrated to not be reliable (Hefner, 2009; L'Abbé et al., 2011). The facial breadth, height and profile as well as the orbital and nasal openings were also evaluated as part of the ancestry estimation. The lower nasal margin and nasal profile are also strong indicators of ancestry.

Comparable to sex estimation, *postcranial* skeletal traits are better assessed through metric parameters. Postcranial studies have however been proved to be less reliable than morphological investigations (İşcan et al., 2000; Byers), but studies utilising the femur (Stewart, 1962), humerus , radius and tibia showed to be valuable when cranial remains are not available (İşcan et al., 2000). Ancestry assessment of this study was aided by metric analyses using data from Patriquin et al. (2003), Loth and İşcan (2000 b) and İşcan and Steyn (1999).

3.2.4.1 Craniometric assessment

The aim of this part of the study was to explore in a diachronic manner the morphological variation of both pre- and post-European contact groups from the northern region of Zimbabwe. Population relationships and movement around A.D. 1300 – A.D. 1600 in this region was investigated by assessing firstly whether the three populations studied were related to each other (i.e. whether there was any population continuity) and secondly whether the pre-contact sites (Monk's Kop and Ashford Farms) were related to each other. The craniometric study therefore tested the hypothesis of increasing morphological diversity through time. Craniometric assessments were done for males and females separately to provide detailed insight into the relationship of the Monk's Kop, Ashford Farms and Dambarare (African and European) populations. The craniometric analysis also included comparable populations Table 3.1. The Venda collection was excluded from the male analysis due to the small sample size.

The statistical analyses included eight (GOL, XCB, BBH, BNL, BPL, NLB, OBH, NPH) variables (metric traits) which were used to maximise the sample. Cranial and mandibular metric variables were used in the craniometric analysis and are listed and described in Tables 3.2 - 3.3 respectively. These measurements are comparable to those of Howells (1973), Morris (1992) and Ribot (2002). The variable codes were adopted from Ribot (2002).

Stem-and-leaf displays and tables for testing skewness were used to check the normality of the sample (Zar, 1984). Due to the small number of archaeological specimens available in comparison to the larger comparative groups, a Factor analysis (Principal Components Analysis or PCA) was performed (Pietrusewsky, 2010) on

Statistical Package for the Social Sciences (SPSS 17.0 and SYSTAT 10.0). The regression factor scores were analysed through a test of equality of means (one-way analysis of variance) by comparing between and within group variation to assist with exploring the degree of differentiation of the large comparative samples. Scatterplots of the regression factor scores for two factors were drawn with ellipses of confidence (p = 0.95) for each relatively large comparative sample which assisted to visualize the distribution of the sample in a multivariate space. Regression factor scores were also used to compute proximity matrices of squared Euclidean distances in order to evaluate the closeness of the archaeological specimens from Zimbabwe (and South Africa and Botswana) to the comparative group means.

3.2.4.2 Odontometric assessment

The odontometric assessment of this study used measurement techniques described by Brothwell (1963) and Kieser (1990) and individual measurement were taken to the nearest 0.01 mm. Two dental measurements taken were taken of all permanent teeth and included mesiodistal and buccolingual crown dimensions utilising a digital calliper. The mesiodistal (MD) measurement is the maximum distance between the mesial and distal contact points or areas whereas the buccolingual (BL) measurement is the maximum distance between the labial and lingual surfaces. The MD and BL measurements are at right angles to each other (Kieser, 1990). An intra- and inter-reliability test was done on the Monk's Kop skeletal collection to ascertain the repeatability of the dental measurements taken during this study.

The condition of the teeth investigated (dental attrition, caries, calculus, fractures and restorations) as well as the equipment utilised (type of calliper) can be the cause of error during measurement of teeth (Kieser, 1990). Teeth were therefore identified as "not scorable" if a tooth's shape and size was influenced by dental attrition as both the MD and BL distances shortens due to interproximal and occlusal attrition respectively. Teeth exhibiting dental caries, fractures, calculus or any modifications were also not measured. The same digital calliper was used in all measurement taken.

The teeth of both the left and right dental arcade of adult remains were measured and the means and standard deviations were calculated in Microsoft Excel.

Penrose coefficient equations determine size and shape coefficients and was calculated in Microsoft Excel as indicated below.

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

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

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

Where:
d = difference between standardised means
m = total number of teeth measurements within the comparison

Only the posterior teeth measurements i.e. the first premolar (P1), the second premolar (P2), the first molar (M1), the second molar (M2) and the third molar (M3) were used a Penrose analysis coefficient equations due to the variability in shape and size of the anterior teeth and the fact that single rooted teeth are often lost antemortem.

Due to the high number of individuals for whom the sex was indeterminable, the data for males and females were pooled. The calculations were categorised according to applicable ancestry, which in this case was either individuals from European or African descent. Monk's Kop and Ashford Farms were therefore compared to other applicable African populations; Mapungubwe (Steyn, 1994), K2 (Steyn, 1994), Venda (L'Abbé, 2005), Toutswe (Mosothwane, 2004) and a modern South African "Black" population (Jacobson, 1982). Dambarare's collection was subdivided into the individuals from African and European ancestry. The African population of Dambarare was compared to that of Monk's Kop, Ashford Farms and the comparative African populations, whereas the Portuguese population was compared to a modern population of "White" South Africans (Kieser, 1990) as comparative Portuguese data were not available at the time of the study.

3.2.5 Stature estimation and osteometry

The use of a full skeleton, described by Fully (1956) estimates height from the summed heights and lengths of body segments that make up stature and incorporates a correction factor for soft tissue (Fully, 1956; Raxter et al., 2006). This technique is rarely used in bioarchaeological studies due to its prerequisite; a complete skeleton. Thus this method, referred to as the Fully's method, was not used in this study. Subsequent research showed that living height could be deducted or calculated from individual bones of the skeleton (İşcan and Steyn, 2013).

Total Skeletal Height of individuals of African descent was estimated using the regression equations of Lundy and Feldesman (1987), as this was deemed to be the most appropriate, available formulae. These were then used to estimate living height with the help of the Raxter et al (2006) soft tissue correction factors, but no correction was made for age as many of the skeletons were too incomplete to arrive at a close age estimate (Lundy and Feldesman, 1987). Stature of Europeans was estimated according to equations for modern Portuguese populations (De Mendonça, 2000). In the case of unknown sex, the femur: stature ratio (Feldesman and Fountain, 1996) was used when present; if not present, no attempts were made to estimate stature in these cases. Stature estimations of immature individuals were not attempted in this study due to it being less reliable.

Standard cranial and post-cranial measurements, as outlined by Buikstra & Ubelaker (1994) were collected and recorded by utilizing standard metric equipment such as measuring tapes, callipers and osteometric boards. As was the case for the crania, random samples of skeletal elements were measured three times by the investigator and once by an experienced anthropologist, thereby testing the inter- and intra-observer reliability.

3.2.6 Palaeopathological assessment

Standard palaeopathological literature and illustrations recorded in, for example, Steinbock (1976), Roberts and Manchester (1995), Aufderheide & Rodriquez-Martin (1998) and Ortner (2003) were used to assess skeletal lesions or macroscopic indications of pathological bone alterations. It was not possible to obtain X-rays from any of the remains, as no X-ray facilities were available. No destructive analyses were performed. Therefore diagnosis of specific and non-specific pathological conditions or a traumatic event was based on the type and distribution of the skeletal alteration.

The frequency of a disease or traumatic event was calculated as the incidence of skeletal lesions in relation to the number of individuals in the population. Dependent on the pathological condition, certain skeletal elements were also taken into consideration e.g. the incidence of Schmorl's nodes were calculated in relation to the individuals investigated where vertebrae were available for assessment. Chi-squared tests were performed to establish significant differences between the presence of a specific pathological condition or traumatic event of the Monk's Kop, Ashford Farms and Dambarare collections. Incidences between males and females were also assessed with a Chi-squared test where appropriate.

The Monk's Kop-Ashford Farms combination and Dambarare collection combination as well as the male-female frequencies were compared to the applicable pathological condition in the populations of Mapungubwe, Toutswe and Venda and also tested for significant differences by means of Chi-squared tests.

3.2.7 Dental Health

3.2.7.1 Dental caries

All teeth were examined and visually assessed for carious activity and abscesses.

Dental caries was only scored when dental enamel or tooth root destruction was evident, as per the guidance of Roberts and Manchester (1995). This is due to the fact that normal post-burial processes are often mistaken for carious activity as the early stages of caries is characterised by similar discolourations on teeth. Confirmation of these early stages can only be done through microscopic investigation (Hillson, 1998), but the location of the caries (maxilla or mandible), the specific tooth affected (incisor, canine, premolar or molar), the specific area on the tooth (mesial, distal, buccal, lingual, occlusal or tooth root) as well as the approximate size of crown destruction (small pit, < 50%, >50% or entire crown) (Lukacs, 1989) were recorded. Calculations for four frequencies were done guided by Lukacs (1989), L'Abbe (2005) and Van der Merwe (2007).

The first calculation, individual caries frequency, provides a general overview of the incidence of caries in a population, thus establishes the frequency of individuals within the population studied with dental caries.

Individual caries frequency =

$$\frac{\text{Total number of individuals affected with caries}}{\text{Total number of individuals in the sample}} \times 100$$

The caries intensity calculation describes the relationship between the number of carious teeth and all the teeth in the sample, irrespective of tooth type, whereas the caries intensity per tooth calculation indicates what type of tooth was involved:

Caries intensity (tooth count) =

$$\frac{\text{Total number of teeth affected with caries}}{\text{Total number of teeth in the sample}} \times 100$$

Caries intensity per tooth =

$$\frac{\text{Total number of tooth type (X) affected with caries}}{\text{Total number of tooth type (X) in the sample}} \times 100$$

The last calculation gives an indication of average number of teeth per individual (mouth) that were affected by caries.

Carious teeth per mouth =

$$\frac{\text{Total number of teeth affected with caries}}{\text{Total number of individuals in the sample}} \times 100$$

Due to the fact that carious lesions often directly result in antemortem tooth loss if left untreated, archaeological samples often underestimate dental caries. For this reason, a calculation incorporating a correction factor was done to estimate the number of teeth lost due to carious lesions guided by Lukacs (1995). Dental pulp exposure, as well as dental caries and dental attrition are the main causes for antemortem tooth loss (AMTL), therefore the information required to "correct" dental caries intensity include the number of teeth lost antemortem, the number of carious teeth with and without pulp exposure due to either dental caries or dental attrition (Lukacs, 1995). The above variables are combined in calculations guided by Lukacs (1995) and Van der Merwe (2007), as follows:

Caries correction factor =

$$\frac{\text{Total number of teeth with pulp exposure due to dental caries}}{\text{Total number of teeth with pulp exposure}} \times 100$$

Estimated number of teeth lost due to caries =

Total number of teeth lost due to caries × Caries correction factor

Estimated number of teeth with caries =

Estimated number of teeth lost due to caries × Number of carious teeth observed

Total number of teeth =

Number of teeth observed **+** Number of teeth lost antemortem

Corrected caries rate =

$$\frac{\text{Total estimated number of teeth with caries}}{\text{Total number of original teeth}} \times 100$$

Statistical analysis of dental caries included establishing whether significant differences existed between the pre- and post-contact period, males and females, different types of teeth, observed caries intensity and estimated caries intensity by means of Chi-squared tests. Only permanent dentition was taken into consideration in this study, thus only teeth of adult individuals from Monk's Kop, Ashford Farms and Dambarare collections were used in statistical analyses and compared to that of the Mapungubwe/K2, Toutswe and Venda populations.

3.2.7.2 Abscesses

Dental abscesses (DA) were scored only if a rounded, smooth-edged pit (fistula) was observed at the apex of the tooth. The fistula could be situated on either the lingual or buccal aspect of the tooth but should have been evident macroscopically (Lukacs, 1989; Hillson, 1998). Dental abscesses are also often underestimated in archaeological populations as the fistula only develops during the late stages of abscess formation (Hillson, 1998).

The percentage of individuals who exhibited DA was calculated as an individual frequency as follows:

Individual DA frequency =

$$\frac{\text{Total number of individuals affected with abscesses}}{\text{Total number of individuals in the sample}} \times 100$$

Chi-squared tests were done to establish significant differences, if any, in individuals affected by abscesses between the pre- and post-contact period, males and females as well as the comparative populations of Mapungubwe/K2, Toutswe and Venda.

3.2.7.3 Antemortem tooth loss

Antemortem tooth loss (AMTL) is characterised by alveolar bone resorption, filling of an alveolar socket, wear facets on the remaining adjacent teeth and gradual movement of the posterior teeth towards the middle-front section of the jaw (mesial drift) (Turner, 1979; Lukacs, 1989). As was the case with dental caries and abscesses, AMTL may also be underestimated as tooth loss just prior to death will not show any signs of alveolar resorption as yet and will be recorded as post-mortem loss (Turner, 1979). Frequencies described by Lukacs (1989), Steyn (1994) and L'Abbe (2005) were utilised in this study.

Individual AMTL frequency provides a general overview of the incidence of AMTL in a population, thus what frequency of individuals within the population studied, exhibited AMTL, and whether one or multiple teeth were involved:

Individual AMTL frequency =

$$\frac{\text{Total number of individuals affected with AMTL}}{\text{Total number of individuals in the sample}} \times 100$$

The ATML intensity calculation describes the correlation between the number of teeth lost antemortem and all the teeth in the sample, irrespective of tooth type, whereas the ATML intensity per tooth calculation indicates what type of tooth was involved:

AMTL intensity (tooth count) =

$$\frac{\text{Total number of teeth lost antemortem}}{\text{Total number of teeth in the sample}} \times 100$$

AMTL intensity per tooth =

$$\frac{\text{Total number of tooth type (X) lost antemortem}}{\text{Total number of tooth type (X) in the sample}} \times 100$$

The last calculation gives an indication of average amount of teeth per individual (mouth) that were affected by the loss of teeth antemortem.

AMTL per mouth =

$$\frac{\text{Total number of teeth lost antemortem}}{\text{Total number of individuals in the sample}} \times 100$$

Data analysis of AMTL included establishing whether significant differences existed between the pre- and post-contact period, males and females, different types of teeth and AMTL intensity by means of Chi-squared tests. Relevant data from the pre-and post-contact period were also compared to that of the Mapungubwe/K2, Toutswe and Venda populations.

3.2.7.4 Alveolar resorption

Alveolar resorption is triggered by gingivitis or periodontal disease and is difficult to distinguish from normal atrophy associated with increasing age. Direct comparison with other studies is also challenging due to the varying standards used by different investigators (Lukacs, 1989). Alveolar resorption in this study was classified according to the grading system suggested by Lucaks (1989). Alveolar resorption was therefore recorded in this study as being one of the following:

0 = Absent
1 = Slight (>50% of root exposed)
2 = Moderate (<50% of root exposed)
3 = Severe (Evulsion of the tooth, but alveolus still discernible)
4 = Complete (Evulsion of tooth, alveolus completely obliterated)

Statistical analysis of alveolar resorption included only comparisons by means of Chi-squared tests between the pre- and post-contact period and males and females of individuals investigated in this study due to the varying standards used by different investigators.

3.2.7.5 Dental wear and tooth modifications

Dental wear can be scored by means of various methods. This study only documented degree of wear by utilising descriptions based on the Molnar system as described below. Dental wear was indicated on a scale from unworn, to minimal, moderate, extensive and severe.

All teeth, permanent and deciduous, were screened for any type of intentional alterations or tooth modifications. These could include any type of alteration such as chipping, filing or complete removal of teeth. The individual as well as the type of modification was documented and photographed.

3.2.7.6 Enamel hypoplasia

Although not strictly a dental pathology, but rather a sign of a more generalised indication of health and nutrition, the methods used to score enamel hypoplasia (EH) is described here under dental observations, but will be taken into account in the final assessment of skeletal health. Enamel hypoplasia was scored on all teeth if it was macroscopically visible. In uncertain cases, enamel hypoplasia was confirmed when resistance was encountered as a sliding calliper was scraped along the enamel surface. Each measurement was taken from the midpoint of the labial/buccal cemento-enamel junction to the most occlusal point of the hypoplastic lesion. Measurement were done with the same sharp-point digital calliper and logged to the nearest 0.1 mm. Only enamel hypoplastic lesions that demonstrated a deficiency in enamel thickness and which breadth was noticeable without magnification were recorded (Goodman and Rose, 1991). Separate measurements were recorded to indicate multiple lines. All teeth (anterior and posterior) were screened for possible lesions, even though enamel hypoplasia almost never occurs on posterior teeth.

Calculations to illustrate the incidence of enamel hypoplasia were done according to Lukacs (1989) and L'Abbe (2005).

Individual EH frequency provides a general overview of the incidence of EH in a population. It therefore reflects the percentage of individuals within the population studied who exhibited EH, whether one or multiple teeth were involved:

Individual EH frequency =

$$\frac{\text{Total number of individuals affected with EH}}{\text{Total number of individuals in the sample}} \text{ X } 100$$

The EH intensity calculation describes the correlation between the number of EH and all the teeth in the sample, irrespective of tooth type.

EH intensity (tooth count) =

$$\frac{\text{Total number of teeth affected with EH}}{\text{Total number of teeth in the sample}} \text{ X } 100$$

Chi-squared tests were done to establish whether significant differences existed between individuals of different sex and contact periods and how the sites studies compared with similar populations such as Mapungubwe/K2, Venda and Toutswe.

Table 3.1: Collections compared within craniometric investigation.

Collection	Code	Source and Context	Period	*n*	Accession numbers of samples
Monk's Kop	N/A	Zimbabwe (Crawford, 1967)	13th -15th Century	12 ♂=5 ♀=7	♂= 200, 293, 297, 473, 430a ♀= 199, 286, 291, 292, 295, 296, 416
Ashford Farms	N/A	Zimbabwe (No contextual data)	14th - 15th Century	5 ♂=2 ♀=3	♂=2, 4 ♀= 1, 3, 7
Dambarare	N/A	Zimbabwe (Garlake, 1969)	17th Century	8 ♂=5 ♀=3	♂= A2, A5, AA2, AA3, C6 ♀= B1, B3, B4
Mapungubwe	N/A	South Africa (Steyn, 1994)	11th -14th Century	5 ♂=1 ♀=4	♂= A1714 ♀= A1730, A1722, A1715, A1701
Toutswe	N/A	Botswana (Mosothwane, 2004)	8th -13th Century	4 ♂=3 ♀=1	♂= 5(1), 16, 3 ♀= 25
Venda	VEN	South Africa (L'Abbé, 2005)	20th Century	30 ♂=13 ♀=17	Refer to reference
Basuku Central Bantu-speakers	BAS	Democratic Republic of Congo (Ribot, 2003, 2004)	19th - 20th Century	84 ♂=34 ♀=50	Refer to reference
Bahutu East Bantu-speakers	BAH	Rwanda (Ribot, 2003, 2004)	19th - 20th Century	62 ♂=26 ♀= 36	Refer to reference
Sakalave and various other ethnic groups	MADA	Madagascar Deswarte (pers.comm.)	19th - 20th Century	96 ♂=58 ♀= 38	Refer to reference
Zalavár	EUR	Hungary (Howells, 2004)	9th - 11th Century	96 ♂=53 ♀=43	Refer to reference

Table 3.2: Descriptive statistics and cranial metric variables utilised in the craniometric assessment.

Skeletal Collection		**Monk's Kop**						**Ashford Farms**						**Dambarare (African)**						**Dambarare (European)**					
Sex		Male (n=15)			Female (n=16)			Male (n=2)			Female (n=3)			Male (n=2)			Female (n=4)			Male (n=12)			Female (n=2)		
Cranial measurements	Abbr.	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Maximum cranial length	GOL	6	182.0	6.1	9	178.4	5.3	2	185.0	2.8	3	178.3	3.5	1	184.0	-	2	175.3	5.3	9	183.8	6.2	1	181.0	-
Maximum cranial breadth	XCB	6	129.3	5.7	9	114.9	38	2	132.3	6.0	3	129.0	8.9	1	126.0	-	2	129.8	5.3	7	134.4	6.9	1	130.5	-
Bizygomatic breadth	ZYB	3	132.3	5.5	5	121.7	7	2	136.5	6.4	3	126.5	9.3	-	-	-	1	122.5	-	7	123.6	6.6	-	-	-
Basion-Bregma height	BBH	6	132.3	6.7	6	126.3	4.7	2	135.5	4.9	3	129.7	5.1	-	-	-	1	125.5	-	9	135.1	4.4	1	127.0	-
Cranial base length	BNL	6	101.1	4.7	7	99.36	5.2	2	105.5	7.8	3	98.3	6.5	-	-	-	1	101.0	-	10	103.3	6.0	1	92.0	-
Basion-Prosthion length	BPL	3	100.9	1.0	5	99.88	7.3	2	102.7	6.1	3	93.6	4.4	-	-	-	3	83.0	27.0	7	97.7	5.4	1	88.0	-
Minimum frontal breadth	WFB	6	96.4	3.8	9	95.51	2.4	2	91.6	4.2	3	90.3	1.6	2	92.0	4.2	2	90.8	0.8	11	97.3	4.8	1	94.6	-
Maximum alveolar breadth	MAB	4	62.8	1.1	7	61.91	3.5	1	59.0	-	1	61.9	-	2	63.6	0.8	2	58.1	4.5	8	62.8	4.2	1	60.9	-
Maximum alveolar length	-	3	52.4	1.0	6	53.27	3.8	-	-	-	-	-	-	-	-	-	1	55.2	-	6	54.9	2.1	1	51.2	-
Upper facial height	NPH	4	61.8	2.9	6	60.85	2.7	2	67.2	0.4	2	29.9	42.3	1	67.1	-	3	63.1	0.7	7	69.7	6.1	1	65.1	-
Total facial height	-	2	106.4	4.6	3	107.3	4.3	2	114.5	4.0	2	107.1	2.7	-	-	-	1	105.3	-	7	115.3	9.8	1	110.8	-
Nasal height	NLH	5	44.6	2.7	7	43.79	1.2	2	47.5	1.6	3	44.7	3.3	1	48.1	-	4	45.5	1.0	10	52.4	2.8	1	47.2	-
Nasal breadth	NLB	6	26.2	1.6	7	26.14	1.7	2	27.1	1.1	3	25.0	1.9	1	27.1	-	4	26.4	3.6	11	24.9	1.9	1	27.9	-
Orbital breadth	OBB	6	40.3	1.9	7	38.45	2.2	2	38.5	1.9	3	38.4	1.2	1	32.3	-	3	38.3	1.2	8	41.3	3.2	1	39.6	-
Orbital height	OBH	6	33.2	1.8	7	32.59	1.4	2	35.3	2.2	3	33.7	1.5	1	31.6	-	3	32.2	0.6	8	33.5	2.4	1	37.5	-
Bi-orbital breadth	EKB	5	97.3	2.5	7	94.91	4.2	2	94.3	3.0	3	91.6	0.8	1	91.7	-	3	93.7	5.1	8	97.4	5.0	1	93.2	-
Inter-orbital breadth	DKB	6	24.9	3.2	7	24.81	2	2	23.5	2.0	3	22.9	3.2	-	-	-	2	23.9	3.0	8	25.9	2.8	1	20.7	-
Total sagittal arch	-	5	364.8	8.4	8	344.3	37	2	366.5	10.6	3	354.7	2.3	-	-	-	1	344.0	-	5	371.8	23.4	1	370.0	-
Nasion-Bregma arch	FAR	6	129.2	4.8	9	124.1	7.1	2	121.0	7.1	3	120.3	4.5	2	135.0	4.2	3	122.0	6.9	11	128.0	7.2	1	128.0	-
Bregma-Lambda arch	PAR	6	125.8	5.0	9	119.9	8.1	2	130.5	10.6	3	126.0	8.5	1	119.0	-	3	117.7	8.3	10	127.3	9.3	1	120.0	-
Lambda-Opisthion arch	OAR	5	110.6	7.0	9	114.3	4.6	2	116.0	7.1	3	110.3	6.8	-	-	-	1	113.0	-	6	114.8	9.0	1	123.0	-
Nasion-Bregma chord	FRC	6	111.4	2.8	9	108.5	4.4	2	106.9	6.6	3	104.3	1.7	2	116.9	1.3	3	106.8	4.4	11	111.6	5.7	1	106.8	-
Bregma-Lambda chord	PAC	6	113.3	4.2	9	107.6	7.2	2	112.8	7.3	3	112.9	5.6	1	107.9	-	3	106.4	7.5	10	113.6	7.4	1	108.7	-
Lambda-Opisthion chord	OCC	5	92.8	5.1	9	97.87	7	2	97.2	2.8	3	92.1	5.2	-	-	-	1	94.9	-	6	95.2	6.1	1	93.6	-
Cranial Circumference	-	6	501.3	7.1	8	494.2	13	2	500.0	2.8	3	483.0	7.2	1	505.0	-	2	267.5	-	6	521.2	12.8	1	507.0	-
Foramen magnum length	FOL	4	35.0	3.1	7	33.6	2.2	2	37.6	5.9	3	37.4	2.8	-	-	-	2	22.5	14.8	5	37.0	1.6	1	36.5	-
Foramen magnum breadth	FOB	5	30.5	3.3	8	27.3	3.5	2	32.7	1.2	3	30.2	1.5	-	-	-	1	25.9	-	7	33.1	8.7	1	25.8	-
Mastoid length	-	5	27.3	7.3	8	22.78	2.7	2	25.5	3.8	3	20.7	5.4	-	-	-	2	23.9	0.7	8	28.9	4.8	1	26.8	-

Table 3.3: Descriptive statistics and mandibular metric variables utilised in the craniometric assessment.

Skeletal Collection		**Monk's Kop**						**Ashford Farms**						**Dambarare (African)**						**Dambarare (European)**					
Sex		Male (n=15)			Female (n=16)			Male (n=2)			Female (n=3)			Male (n=2)			Female (n=4)			Male (n=12)			Female (n=2)		
Mandibular measurements	Abbr.	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	STD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Symphyseal height	-	9	31.4	4.5	10	32.69	3.2	1	34.6	-	3	31.3	4.0	1	38.3	-	4	31.0	2.4	8	32.4	3.4	2	29.3	4.0
Body height	-	12	29.7	2.8	10	33.91	17	2	33.8	0.4	3	28.7	4.4	1	34.0	-	4	30.1	2.1	8	31.1	2.8	2	29.1	1.6
Body thickness	-	12	12.0	1.1	11	13.94	5.3	2	13.4	0.9	3	12.5	1.0	1	13.2	-	4	12.5	0.8	8	13.0	1.7	2	11.8	0.8
Bi-gonial diameter	-	6	86.0	5.8	5	84.64	7.3	2	86.6	14.7	2	94.7	6.4	1	89.7	-	3	87.0	6.0	7	88.2	4.8	1	94.6	-
Bi-condylar breadth	-	6	108.7	3.9	3	107.1	3.6	2	108.1	9.6	1	110.7	-	1	104.4	-	3	107.1	6.2	7	111.6	3.9	1	114.7	-
Minimum ramus breadth	-	9	34.3	2.0	10	34.11	2.3	2	38.3	2.3	3	36.3	3.9	1	31.5	-	4	33.7	4.7	12	32.3	2.3	1	30.8	-
Maximum length mandible	-	6	99.7	3.3	3	104.3	2.5	2	105.8	1.1	1	106.0	-	1	105.0	-	3	96.3	3.3	8	104.4	3.7	1	102.0	-

n = Number of teeth investigated per tooth type
SD = Standard deviation

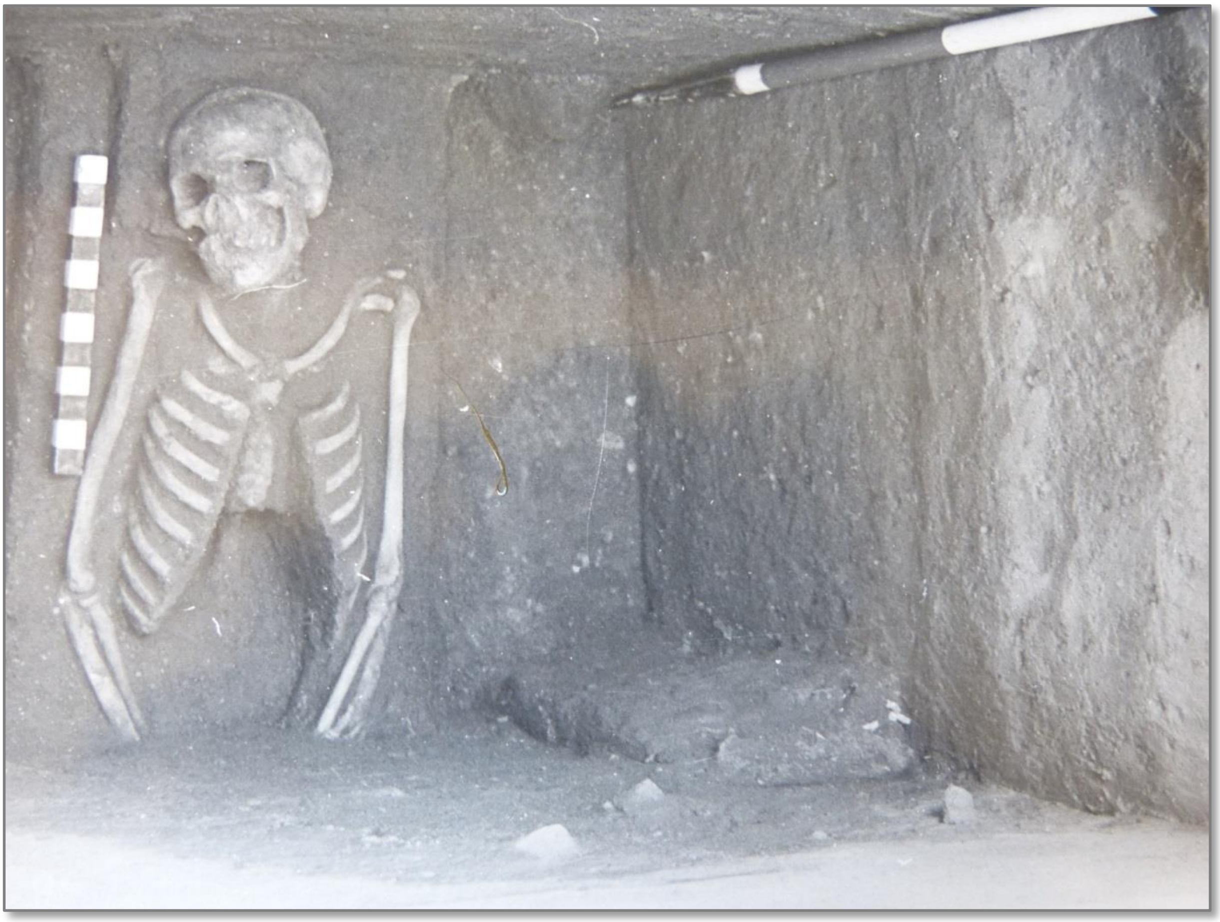


Figure 3.1: Dambarare burial showing granitic sand embedded between skeletal elements. (Taken from Garlake, 1969)

CHAPTER 4: BIOLOGICAL BACKGROUND

4.1 Introduction

The human skeletal remains from three archaeological sites from the northern Zimbabwean region were investigated to ascertain a biological profile, ancestral relationships and assess the health status of the people that it represents. The Monk's Kop and Ashford Farms sites date back to a period prior to European contact, whereas the Dambarare site represents a population consisting of both Africans and the Europeans they were in contact with. Although the results of Monk's Kop and Ashford Farms will be discussed separately, a combined total will be provided for these sites representing the pre-contact group to enable comparison with the post-European contact site, Dambarare.

The three sites resulted in the analysis of a combined total of 90 individuals. It is important to note that this total is the result of a calculated minimum number of individuals due to the commingled nature of many of the remains. It is therefore most likely an underestimation as is the unfortunate reality of most commingled collections (Ubelaker, 2002; Byrd and Adams, 2003). For maximum accuracy and consistency, the minimum number of individuals will therefore be used throughout the chapters to follow.

Reports of all human skeletal remains that could be identified as belonging to a specific individual can be found in Appendices A to C. Descriptions include age, sex, ancestry, stature, pathology, preservation, storage location and burial information and diagrammatic / photographic illustrations of the burial goods wherever applicable and possible. It also includes a photograph of all specimens related to the individual or subcollection as well as an anterior view if the skull and/or mandible as applicable. Appendix D provides a summary of the commingled remains that could not be allocated to a specific individual. These remains are tabled and briefly described according to their original accession numbers as requested by the National Museum of Human Sciences (Harare, Zimbabwe). All skeletal material currently stored at the National Museum of Human Sciences were sorted, analysed and repacked.

4.1.1 Sorting of commingled remains

The skeletal remains of Monk's Kop, and to some extent the Dambarare collection, were commingled in nature due to burial practice, excavation and possibly curation methods. Upon excavation, a group of bony elements were allocated an accession number. These groups of bones often included more than one individual but could unfortunately in most cases not be paired or allocated as belonging to a single individual using accepted methods such as preservation status, articulating surface properties, size and sex.

All bony elements were documented, categorised and counted according to four criteria; age category at death, representation, % preservation and side (wherever applicable). Firstly, wherever possible, it was established whether the bony element belonged to that of an adult or sub-adult. Epiphyseal fusion (closed, partially closed or open) was the main method in establishing this age category at death. Representation of the bony element confirmed whether it was complete and if not the case, what section of the bony element was represented in the skeletal collection. Preservation status was also documented and was indicated as being one of three possibilities; 1%-25%, 25%-75% or 75%-100% complete. All other elements were also categorised according to adult and sub-adult origin. The minimum numbers of individuals per age category (adult or sub-adult) were then calculated for every bony element according to the total elements observed within the category 75%-100%. These minimum numbers of individuals per bony element can be seen in Tables 4.1 - 4.12.

As skull and mandible articulation yields the highest accuracy in individual identification, all skull and mandibles were identified and paired wherever possible. The skeletal remains yielded 18 adult and three sub-adult skulls (n=21) from Monk's Kop as can be seen in Table 4.1 The 32 mandibles represented 28 adult and four sub-adult mandibles (Table 4.2) of which ten pairs could be identified as belonging to single individuals by means of positive articulation. Thus of a total of 53 (21 + 32) possible individuals, ten skulls and mandibles were positively paired which resulted in 43 (53 – 10) minimum number of individuals being identified utilising the skulls and mandibles. The bone which was mostly represented outside the skull and mandible combinations was the clavicle at a minimum number of 28 individuals (23 adults and 5 sub-adults) as can be seen in Table 4.8. It is interesting to note that the bones least represented were a combination of Ribs 11 and 12 (Table 4.6), but also the femur (Table 4.7).

All adult and sub-adult complete and fragmented vertebrae were identified as belonging to one of the following categories: C1, C2 C3-C7, T1-T12 and lastly L1-L5. These categories were based on the ability to clearly allocate a specific specimen as belonging to that specific vertebra or section of vertebrae. The MNI was therefore calculated for every vertebrae category, of which the region C3-C7 was most represented (Table 4.3). The ribs of this collection were also analysed in a similar manner with categories as follows: Rib 1, Rib 2, Ribs 3-10 and Ribs 11 and 12. Rib 1 was most represented with a MNI of 15 (Table 4.6).

The sacrum (Table 4.4), sternum (Table 4.5), all upper and lower limb long bones (Table 4.7), as well as their pectoral (Table 4.9) and pelvic girdle (Table 4.9) connections were analysed according to part of bone present and all elements consisting of 75% or more of its original structure were allocated as complete. The highest number of such complete elements (whether it was left, right or of unknown side), was therefore indicated as being the MNI for that specific bone. As can be seen in Table 4.12, the carpals, tarsals, metacarpals and metatarsals were counted if the bone consisted of more than 75% or more of its original structure and divided by the total number of the specific bone present in the body. The phalanges of both hands and feet were pooled where after the same process was followed to indicate MNI.

4.1.2 Pre-contact skeletal collection: Monk's Kop

A total of 71 skeletons were reported to have been excavated by J.R. Crawford in 1964. Skeletal material were then briefly sent to the University of Witwatersrand for a preliminary analysis that consisted of age and sex estimations utilising only cranial remains (Crawford, 1967). Although reports indicated that all human skeletal material were returned to the then Queen Victoria Museum in Zimbabwe, two skulls (M_285 and M_450) as well as fragmentary miscellaneous cranial and postcranial elements were subsequently discovered in the Raymond A. Dart Collection, University of the Witwatersrand, South Africa. The Monk's Kop remains are therefore currently stored at the now National Museum of Human Sciences, in Harare (Zimbabwe) as well as in the

Dart collection, University of the Witwatersrand (South Africa). Details of storage location are provided in the individual skeletal reports in Appendix A.

All available human skeletal material of the current Monk's Kop collection were used for this study and resulted in a minimum number of 43 individuals (MNI) being analysed (Appendix A). This total number of individuals was established using the number of near-complete mandibles and skulls in the collection after pairing. The difference between the previously reported number of individuals excavated (Crawford, 1967) and the MNI for this study can possibly be explained by one or a combination of the following factors: a) Monk's Kop skeletal remains were disinterred from an ossuary-type burial. Many of the individuals were buried in a seated position which resulted in skeletal elements commingling upon skeletonisation. The commingled nature of this collection upon excavation made it extremely difficult to assign skeletal elements to a specific individual. Therefore skeletal remains were not excavated as individuals, but rather as groups of bones within a specific excavated area. b) Skeletal remains were not provided an accession number that linked it to a specific individual. Consequently, post-excavation curation and storage methods could have resulted in skeletal elements being separated. There were often cases where similar bones were placed together, e.g. all humeri, which possibly resulted in its separation from the associated individual. Despite various attempts to pair or re-pair skeletal elements (using methods such as size, articulating properties and preservation status), many of the skeletal elements could not be confirmed as belonging to a specific individual.

The Monk's Kop remains were associated with adornments such as beads, bangles and pottery. Figure 4.1 illustrates such an example depicting a set of copper bangles associated with the right upper limb of M_430b, a sub-adult of unknown sex. Both the ulna and radius had a complete epiphyseal union of the proximal extremities, however the distal epiphyses of both forearm bones were still in the process of fusion, thereby suggesting a possible age of 15 to 20 years of age at death (Schaefer et al., 2008). As can be seen, the copper bangles are still partially embedded in granitic sand.

This project included a re-investigation of the Monk's Kop site by means of a survey and documentation project, done in collaboration with archaeologists, which resulted in the re-identification of the site (Figure 4.2) as well as a full site map (Figure

4.3) which included the related surrounding area in order to establish contextual information for the skeletal collection. Figure 4.4 illustrates the proposed excavation site as completed by Crawford in 1967. The site yielded evidence that indicates involvement of Stone Age, Iron Age as well as recent modern cultural landscapes. Numerous rock art sites were also observed along the slopes and summits of the granite dome hills surrounding Monk's Kop (Nienaber et al., Submitted). Although the Monk's Kop ossuary was previously identified as belonging to the typical Musengezi tradition (Crawford, 1967), the utilisation of the landscape and relationship between the ossuary and surrounding are still to be confirmed.

Radiocarbon dating was done by Gulbenkian Radiocarbon Dating Laboratory (Salisbury) as part of Crawford's investigation and was reported as A.D. I285 ± 95 and A.D. 1270 ± 95 from samples S.R. 101 and S.R. 100 respectively. The samples consisted of carbonised wood and bone from the lower funerary layers from Trench 5, layer 4. Crawford however stated that it is probable that the date of the upper interment layer is later due the pottery of the upper layer being more elaborate than the lower.

Another sample was analysed as part of this study to confirm the previously reported dates. The sample consisted of a 40 mm section of the shaft of a right humerus of M_319 which was sectioned by a technician of the Zimbabwe Museum of Human Sciences under supervision of the author and the presiding archaeologist, Mr G. Bvocho. The analysis reported dates as RCYBP (radiocarbon years before present, where "present" was A.D. 1950). The modern reference standard was 95% of the 14C activity as published by the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). The measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard. The conventional radiocarbon age was reported as 630 ± 30 B.P. and represents the measured Radiocarbon age corrected for isotopic fractionation calculated using 13C. This date however is not calendar calibrated and therefore a Calendar calibrated age was calculated as part of the analysis. Results of the 2 Sigma calibrated date of 95% probability was Cal A.D. 1 to 140 (Cal B.P. 660 to 550). There were three points of intercept of the radiocarbon age and the calibration curve; Cal A.D. 1300 (Cal B.P. 640), Cal A.D. 1360 (Cal B.P. 590) and Cal A.D. 1380 (Cal B.P. 570). The 1 Sigma calibrated results (68% probability) was reported as Cal A.D. 1290 to 1320 (Cal B.P. 660 to 630) and Cal A.D. 1350 to 1390 (Cal B.P. 60 to 560).

This date broadly corresponds (although slightly later) with the previously reported date of Crawford's investigation and therefore Monk's Kop is clearly a sample of a pre-European contact population.

4.1.3 Pre-contact skeletal collection: Ashford Farms

Very little has been documented on the archaeology and excavation of Ashford Farms. No information on the graves or skeletons were available. As explained before, a total number of 7 individuals were analysed which comprised of only cranial elements (Appendix B). Postcranial elements were available, but were incorrectly labelled or not labelled at all. These postcranial remains were also boxed with what seemed to be remains from another site and difficulties such as three left ulnae accessioned as belonging to the same individual resulted in no postcranial remains for Ashford Farms being included in this study.

A sample was C-14 dated as part of this study to ascertain approximate dates for this site. The sample consisted of a 30 mm section of the shaft of a right humerus of an individual originally marked as AF1F which was also sectioned on the premises of the Zimbabwe Museum of Human Sciences under the supervision of both the author and the main archaeologist. This was the only long bone sample that was confirmed as belonging to the Ashford site collection. The analysis was done utilising the same procedure as described in the Monk's Kop section. The conventional radiocarbon age was reported as 520 ± 30 B.P. The Calendar calibrated age conversion resulted in Cal A.D. 1330 to 1340 (Cal B.P. 620 to 610) and Cal A.D. 1400 to 1440 (Cal B.P. 550 to 510) respectively (2 Sigma calibrated date of 95% probability). The point of intercept of the radiocarbon age with the calibration curve was Cal A.D. 1420 (Cal B.P. 530). The 1 Sigma calibrated result which is a 68% probability resulted in Cal A.D. 1410 to 1430 (Cal B.P. 540 to 520).

Ashford Farms, although dated to slightly later than Monk's Kop, therefore also clearly fall with the pre-European contact period.

4.1.4 Post-contact skeletal collection: Dambarare

The archaeological background to Dambarare was discussed in the literature review and due to the fact that the original site was most probably flooded by the Jumbo dam, no additional archaeological investigations were attempted.

A total of 29 skeletons were reportedly excavated in 1967 by P.S. Garlake and also sent to the University of Witwatersrand, South Africa for a preliminary sex and age estimation analysis (Garlake, 1969). The report on the remains, done by de Villiers is attached as an appendix to the Garlake article (Garlake, 1969).

All the skeletal material of Dambarare are currently stored at the National Museum of Human Sciences in Harare, Zimbabwe, and analysis revealed a total of 40 individuals. The difference in number of reported skeletons (Garlake, 1969) and this investigation can be attributed to one or a combination of the following aspects: a) The method of accessioning excavated material upon excavation b) Post-excavation curation and storage methods that could have resulted in skeletal elements being separated or combined. c) The fact that there were 12 single or sets of femora which could not be paired with any of the documented individuals as they were not accessioned as belonging to a specific individual. Although attempts were made to pair these femora with already identified individuals lacking femora, none of these femora could be paired successfully. Therefore these femora were only paired with each other and will be referred to in this study as additional miscellaneous individuals (e.g. D_AAMisc1).

The excavation of the Dambarare graves was less complicated than that of Monk's Kop due to the Christian-type of burial practice observable at this site. Although a few of the interments overlapped, individual skeletal elements were in most cases clearly accessioned and labelled. Unfortunately only a fraction of this site was excavated, with the rest of the site being submerged in later years during the building of the Jumbo dam.

4.2 Biological profile

The biological profile for the purposes of this study will include basic information regarding the sex, age, ancestry and stature at time of death for the three respective sites (where applicable). Due to the small sample sizes of the three respective sites, no life tables (formal palaeodemographic analysis) have been reconstructed.

4.2.1 Sex, age and ancestry

4.2.1.1 Monk's Kop

The Monk's Kop skeletal analysis resulted in the identification of a minimum number of 43 individuals of African ancestry representing both sexes as well adult and sub-adult individuals (Table 4.13 - 4.14). These individuals comprised of 20 (46.5%) females, 17 (39.5%) males and 6 (14%) individuals of indeterminate sex (which included sub-adults). Due to the early confirmed date, all skeletal remains were allocated as being from African ancestry.

Due to poor preservation, only 19 of these individuals could be placed into a specific age range. Sub-adults under the age of 15 years only constituted two individuals; one in the 0-4 years and the other in the 10-14 years category. An additional sub-adult of possibly an age less than 15 years was also identified, resulting in a 7% representation of individuals in the age category sub-adults. Three individuals could be placed in the 20-34 age range and together with the eight additional individuals in the non-specific age range, a total of 11 (25.6%) individuals were categorised as young adults (Table 4.14). In the category of middle-aged adults, seven individuals could be placed in the specific age category of 35-45 years of age, whereas an additional eight individuals could only be identified as belonging to the middle-aged age range. The number of individuals identified as belonging to the middle-aged adult category then resulted in a total of 15 (34.9%) individuals. The specific age range of 46 and above as well as the old adult category is represented by a total of 14 (32.6%) individuals.

4.2.1.2 Ashford Farms

The Ashford Farms population is represented by three (42.9%) females, two males (28.6%) and two individuals (28.6%) of indeterminate sex. All individuals could be placed in the specific age categories as indicated in Table 4.14. Both adults and sub-adults were represented. The three sub-adult individuals were placed in the in the 5-9 years category (2), and the 15-19 years category (1). The adults were represented in the 35-45 years category (28.6%) and the 46 and above age category (28.6%).

4.2.1.3 Dambarare

Skeletal analysis indicated the presence of at least 40 individuals of different sex, age at death and ancestry for the Dambarare collection. All results in this chapter are subdivided to accommodate the respective ancestries, as this would provide more accurate interpretations and possibility of clear comparisons, however a total for this collection is provided in all cases. Analysis of the remains regarding ancestry and sex compared well with the original report of H de Villiers (only cranial elements analysed), but did differ in a few cases. Many of the differences could possibly be due to poor labelling and storage upon and after excavation, but also a clearer understanding of ancestral difference which may not have been so well-described when the remains were analysed by de Villiers. Table 4.15 provides a summary of the Dambarare individuals as described by De Villiers and this study as a comparison. The following individuals varied in either sex or ancestry from the original report - Individual D_AA3 was indicated in De Villiers's report as a "hybrid", whereas the current study proposes European descent; D_AA4 was reported as an undetermined sex whereas the current study reports it as being male. Individual A4 was listed as undetermined sex and ancestry in the original report. In the current investigation it is suggested that this individual is a female of European descent based on female mandibular traits, sharp supra-orbital margins, absent brow ridge, vertical forehead slope, distal humerus traits (Rogers, 1999; Falys et al., 2005; Vance et al., 2011) and humerus head measurements (Steyn and İşcan, 1999). In the De Villiers report (Garlake, 1969), individual D_A5 was described as a "hybrid" whereas the craniometrics measurements as wells as the orthognathic facial profile and narrow nasal opening observed in the current study suggest that this individual may be of European descent. Individual D_B2 was listed in the original report as a 'hybrid', whereas the current report suggests African descent; Individual D_C7 was indicated in the original report as being European, whereas the current study suggests an individual from African descent. It was also established that the postcranial elements of individuals D_B3 and D_B4 were switched shortly after excavation.

There were some individuals mentioned in the original report which were not labelled as such in the current collection. These were AA5, AA6 and AA7, which were mentioned in the De Villiers report as individuals for which the skulls were not recovered and AA8's skeletal remains were not recovered at all. Although no skeletal remains in the current investigation were labelled as being any of the above-mentioned individuals, there were 12 miscellaneous individuals identified from trench AA, which might have included the individuals originally identified as AA5, AA6 and AA7. Therefore, skeletal elements of the 12 non-labelled miscellaneous individuals could have included individuals AA5, AA6 and AA7 postcranial remains that De Villiers reported on. Individuals A8, A9, AW1 and AW2 were also not labelled as such in the skeletal remains investigated and could also have been included in the miscellaneous remains in the current report.

Table 4.13 provides a summary of the sex and ancestry of all individuals. Of the 40 individuals, only 24 (60%) could be identified as belonging to a specific sex due to incompleteness and young age of individuals. The European grouping was represented by 13 males and one female. In contrast, the African grouping which consisted of seven individuals was represented by more females (5) than males (2). Of the 19 individuals that could not be allocated to either ancestry groupings, one female and two males were identified while the rest were of unknown sex. The combined skeletal sample, however, comprise of mainly male specimens (16 of the 24 with known sex). This is due to the Europeans, presumably mostly missionaries, being almost exclusively comprised of males.

Table 4.14 provides an indication of the number of individuals in each age group, utilising age groupings as suggested by Falys and Lewis (2011), for the European, African and unknown ancestry groupings respectively. Of the 40 individuals, only 27 individuals' age at death could be approximated. The rest were all represented by single long bones only, which all had completely obliterated epiphyses, indicating that they were adults and were therefore grouped as being adults. The Europeans were mostly represented by adults, whereas the African and unknown ancestry groupings had the highest number of individuals in the 15 to 19 years group. Two children of approximately 1-2 years were also identified, but could not be allocated to either sex or ancestry groupings.

4.2.2 Stature

Antemortem stature could unfortunately only be estimated for the Dambarare population. The excavation methods, poor preservation and subsequent curation of the skeletal collection resulted in the Monk's Kop collection being commingled with no lower limb bones well enough preserved to estimate antemortem stature. The Ashford Farms collection is unfortunately only represented by cranial elements and therefore antemortem stature could also not be estimated for this population.

The antemortem stature estimations of the Dambarare individuals can be seen in Table 4.16. Male individuals of European ancestry showed a mean stature of 164.88 cm, with a minimum of 157.83 cm and maximum of 171.01 cm (SD = 4.14 cm). The one European female was estimated to have been 154.52 cm tall antemortem. Unfortunately the poor preservation of the male individuals of African descent of the Dambarare collection meant that no estimation could be calculated for this population. The African females of the Dambarare population had a mean stature of 152.99 cm, with a minimum of 146.5 cm and a maximum of 165.43 cm (SD = 10.78 cm).

The African grouping showed correlation with the "medium" stature range of Tobias (1972) which both the South African and Rhodesian (Zimbabwean) samples are grouped under. Individuals B2 and B4 however were substantially shorter than the medium range. Individual B2's case could be explained by the fact that both individuals were indicated as females and therefore could correlate with the 5-7% reported dimorphism in Tobias's report (Tobias, 1972). Individual B2 also have an age of death under 20 years of age.

4.3 Ancestry

The estimation of ancestry of individuals of all three sites were investigated by means of both morphological and osteometric methods. In addition, craniometric and odontometric comparisons were done which displays population relationships and movements thereby shedding more light on the ancestry of identified individuals.

4.3.1 Craniometric analysis

The factor loadings for the male analysis after Varimax rotation for the craniometric analyses resulted in factor 1 (height/length of the vault) and factor 2 (facial projection and nasal breadth) showing the greatest variation in males (Table 4.17). The females exhibited the same tendencies; however they also showed a high factor loading for maximum cranial breadth. The tests of equality of means on the regression factor scores (between the large comparative groups) were always significant at $p < 0.001$ for both the male and female analyses (Table 4.18). The F-values were highest for the variables related to length and breadth of the vault as well as facial projection and breadth of nose. The post hoc multiple comparison tests showed that the male and female comparative groups were always significantly different. When the sample size was less than 15, it was not considered.

The scatterplots of the regression factor scores for two factors can be graphically seen in Figure 4.5, showing the position of the archaeological specimens within the comparative variation. At first sight male variation seems higher, as the specimens under focus are distributed more widely than females which will be confirmed by the proximity matrices.

The squared Euclidean distances (Table 4.19) showed that:

1) The Monk's Kop males are more closely associated with the East Bantu-speaking group (Bahutu) and Madagascans. Although the latter is a mixture of various groups, this does reflect gene flow from East Africa, and therefore affinities with the archaeological specimens from Zimbabwe;

2) The Monk's Kop females are more diverse, and showed similarities with East and Central Bantu-speaking Africans. Some of the individuals were also close to the Madagascans, but in general it also indicated gene flow from East Africa;

3) Dambarare males showed a clear mix of affinities, and although there was evidence of gene flow from East Africa, most individuals were related to groups outside Africa (thus most probably the Portuguese individuals);

4) The two female Dambarare individuals however were identified as being the most closely related to Bahutu. Therefore it can be suggested that the Dambarare females were from local ancestry, while the men were descendants from outside Africa;

5) Both the males and females of Ashford Farms resulted in a diverse association and therefore did not result in any clear relation to any of the comparable collections;

6) The Mapungubwe/K2 population were more closely related to Central Bantu-speaking Africans;

7) The Toutswe population showed a mixed association with both Central and East Bantu-speaking groups.

All results tend to support an increasing morphological diversity through time as proposed initially. East African groups tend to be more variable in comparison to others in sub-Saharan Africa as the gene flow from the Indian Ocean had a big influence on the history of these populations. Therefore they are more difficult to interpret. The male variation was also higher than the variation in the females. This can however be due to various factors such as gene flow from outside Africa (the Portuguese from Dambarare), and enhanced by patrilocality (as male groups move less, they will on a longer term become more different from each other). The posterior probabilities showed that individuals from the three sites studied were very similar to various southern Africans. It was however clear that some individuals from Dambarare were of European descent. These results therefore support the previously published archaeological data (such as grave location, grave goods and burial customs) as well as the craniometric data indicating the presence of not only Africans.

It is important to note that due to poor preservation, only a small sample of variables were analysed. Each of the comparative populations was not entirely appropriate for the craniometric analysis here, because of lack of data specific to the context analysed. Therefore caution should be taken when making deductions from both analyses of male and female individuals.

4.3.2 Odontometric analysis

In this study, the mesiodistal (MD) and buccolingual (BL) diameters of all permanent teeth were recorded. Inter- and intra-repeatability were tested on five individuals of the Monk's Kop collection which proved that all measurements were reliable. Descriptive statistics of the mandibular and maxillary premolars and molars are shown in Table 4.19 - 4.20 for all three collections studied. Due to the small sample sizes and large number of teeth of unknown sex, males and females were pooled in all analyses.

A significant tooth size difference was observed in the mesiodistal diameter of the maxillary M3 between the three investigated populations. Monk's Kop showed a much smaller diameter at a mean of 8.74 mm, Dambarare at an average mean of 9.64 mm, whereas Ashford Farms showed a considerably larger mesiodistal diameter of M3 at 10.61 mm. The small sample size may however have influenced the results.

Penrose shape distances were calculated using Mapungubwe, K2, Toutswe, Venda, as well as South African white and black modern population as comparative data. Mapungubwe, K2, Toutswe and the Venda collections originated in close proximity of the studied sites. Mapungubwe is also the first Zambezian state of succession of which Dambarare and Monk's Kop could be linked to. Due to the close proximity of South Africa to these northern Zimbabwean sites and the possible link with migrating populations from Zimbabwe to South Africa, white and black South African populations were also utilised. These statistics can be seen in Table 4.21 (Maxilla) and Table 4.22 for the maxilla and mandible respectively.

For the maxilla, Monk's Kop showed the closest association with the Venda and Mapungubwe/K2 populations at 0.087 and 0.088 respectively. The mandibular dimensions however differed completely as it was closest aligned with Toutswe at 0.051 and the black modern South African population at 0.060, but also close to the K2/Mapungubwe populations.

The maxillary dimensions of the Ashford Farms collection were surprisingly associated with the populations of European descent (Dambarare and the white modern South African grouping). The Penrose shape distance is however in both these cases still very high, thus although it is the closest associated with these populations, it is a very slight association. The Ashford Farms mandibular dimensions were similar to that of Venda (0.181) and Toutswe (0.231). The Ashford Farms site therefore shows very little correlation with any of the comparative or studies collections which may be due to the limited sample size available from the Ashford Farms population.

The individuals of European descent in the Dambarare collection showed similar maxillary dimensions when compared with the Ashford Farms and the Venda populations. The association is however only slight as the shape distances are 0.304 and 0.337. The mandibular dimensions of this population is closest associated with the Dambarare population of African origin (0.187) and the black modern South African population (0.253).

The Dambarare African individuals displayed maxillary dimensions with a close association to K2 at 0.255 and Venda at 0.312, but it was closest to the Monk's Kop collection with 0.178. The mandibular dimensions is however associated to that the Dambarare population of European descent (0.187) and that of Toutswe (0.254).

The Monk's Kop and Dambarare collections are therefore associated mostly with the Mapungubwe/K2 populations as well as Venda, whereas the Ashford farms shows very little association with any of the populations.

Table 4.1: Number of adult and sub-adult skulls with % preservation represented in the Monk's Kop commingled remains collection.

Side	Preservation	Adult: Skull	Sub-adult: Skull
MIDLINE*	75% - 100% preserved	18	3
	25% - 75% preserved	0	0
	1%-25% preserved	206	15
	Total elements	223	18
	MNI (Adult vs. sub-adult)	18	3
	MNI (Total for skull)#	**21**	

* Due to the difficulty assessing side of small skull fragments (e.g. left or right parietal fragment), only a combined representation of all skull elements regarding preservation status in the sample is provided, thus no side indicated.
# Sum of maximum adult and maximum sub-adult MNI for specific bone
[dashed box] = Maximum MNI possible for specific bone based on this total

Table 4.2: Number of adult and sub-adult mandibles indicating side and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult: Mandible	Sub-adult: Mandible
LEFT	Section	Ramus	13	4
		Condylar process	1	0
		Coronoid process	5	1
	Complete*		17	1
		Total elements	36	6
RIGHT	Section	Ramus	13	5
		Condylar process	1	2
		Coronoid process	5	0
	Complete*		16	1
		Total elements	35	6
MID-LINE	Section	Body	35	5
		Total elements	35	5
		75% - 100% preserved	28	4
		25% - 75% preserved	0	0
		1%-25% preserved	1	0
		MNI (Adult vs. sub-adult)	28	4
		MNI (Total for mandible)#	**32**	

* Elements were indicated as complete if the specimen consisted of a non-fractured unit of a ramus, condylar and coronoid process
# Sum of maximum adult and maximum sub-adult MNI for specific bone
[dashed box] = Maximum MNI possible for specific bone based on this total

Table 4.3: Number of adult and sub-adult vertebrae indicating sections and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description	Adult C1	Adult C2	Adult C3 – C7	Adult T1 – T12	Adult L1 – L5	Sub-adult C1	Sub-adult C2	Sub-adult C3 – C7	Sub-adult T1 – T12	Sub-adult L1 – L5
MIDLINE	Section: Body	0	0	18	13	17	0	0	2	14	9
	Section: Neural arch	0	0	21	0	0	0	0	0	3	4
	Complete	12	10	77	122	51	1	0	0	12	5
	Total elements	12	10	116	135	68	1	0	2	29	18
	75% - 100% preserved	$\boxed{12}$	$\boxed{10}$	82	127	65	$\boxed{1}$	$\boxed{0}$	2	24	12
	25% - 75% preserved	1	1	12	56	15	0	0	0	5	2
	1%-25% preserved	0	2	6	6	3	0	0	0	0	0
	MNI (Adult vs. sub-adult)	12	10	16[1]	11[2]	13[3]	1	0	1[1]	2[2]	2[3]

	C1	C2	C3 – C7	T1 – T12	L1 – L5
MNI (Total for respective vertebrae)#	**13**	**10**	**17**	**13**	**15**

Sum of maximum adult and maximum sub-adult MNI for specific bone

$\boxed{}$ = Maximum MNI possible for specific bone based on this total

1 = $\frac{\text{Combined number of near-complete (75\%-100\%) elements}}{\text{5 (Maximum number of C3-C7 present in an individual)}}$

2 = $\frac{\text{Combined number of near-complete (75\%-100\%) elements}}{\text{12 (Maximum number of T1-T12 present in an individual)}}$

3 = $\frac{\text{Combined number of near-complete (75\%-100\%) elements}}{\text{5 (Maximum number of L1-L5 present in an individual)}}$

Table 4.4: Number of adult and sub-adult sacra indicating sections and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult	Sub-adult
			Sacrum	Sacrum
MIDLINE	Section	S1	4	0
		S2	4	0
		S3	3	0
		S4	2	0
		S5	0	0
		Coccyx	0	0
	Complete		6	1
	TOTAL elements		19	1
		75% - 100%	7	1
		25% - 75%	3	0
		1%-25%	0	0
	MNI (Adult vs. sub-adult)		7	1
	MNI (Total for sacrum)#		**8**	

\# Sum of maximum adult and maximum sub-adult MNI for specific bone
[dashed box] = Maximum MNI possible for specific bone based on this total

Table 4.5: Number of adult and sub-adult sternums indicating sections and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult	Sub-adult
			Sternum	Sternum
MIDLINE	Section	Manubrium	6	3
		Body of sternum	7	2
		Xiphoid process	1	0
	Complete		5	2
	Total elements		19	7
		75% - 100% preserved	13	3
		25% - 75% preserved	3	2
		1%-25% preserved	0	0
		MNI (Adult vs. sub-adult)	13	3
		MNI (Total for sternum)#	**16**	

\# Sum of maximum adult and maximum sub-adult MNI for specific bone
[dashed box] = Maximum MNI possible for specific bone based on this total

Table 4.6: Number of adult and sub-adult <u>ribs</u> indicating sections, side and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult Rib 1	Adult Rib 2	Adult Ribs 3-10	Adult Ribs 11-12	Sub-adult Rib 1	Sub-adult Rib 2	Sub-adult Ribs 3-10	Sub-adult Ribs 11-12
LEFT	Section	Sternal end	0	0	-	-		0	-	-
		Shaft	0	2	-	-	0	0	-	-
		Vertebral end	1	1	-	-	0	0	-	-
	Complete		11	4	-	-	3	1	-	-
	TOTAL elements		12	7			3	1		
	75% - 100% preserved		11	6	-	-	3	1	-	-
	25% - 75% preserved		1	0	-	-	0	0	-	-
	1%-25% preserved		0	0	-	-	0	0	-	-
RIGHT	Section	Sternal end	0	0	-	-	0	0	-	-
		Shaft	3	0	-	-	0	0	-	-
		Vertebral end	0	0	-	-	0	0	-	-
	Complete		9	4	-	-	5	1	-	-
	TOTAL elements		12	4			5	1		
	75% - 100% preserved		11	4	-	-	4	1	-	-
	25% - 75% preserved		1	0	-	-	0	0	-	-
	1%-25% preserved		0	0	-	-	0	0	-	-
UNKNOWN	Section	Sternal end	0	0	0	0	0	0	0	0
		Shaft	0	0	11	2	0	0	11	0
		Vertebral end	0	0	32	3	0	0	11	0
	Complete		0	0	155	15	0	0	25	2
	TOTAL elements		0	0	198	20	0	0	47	2
	75% - 100% preserved		0	0	164	17	0	0	36	2
	25% - 75% preserved		0	0	12	1	0	0	0	0
	1%-25% preserved		0	0	14	0	0	0	0	0
	MNI (Adult vs. sub-adult)		11	6	10[1]	4[2]	4	1	2[1]	1[2]

	Rib 1	Rib 2	Ribs 3-10	Ribs 11-12
MNI (Total for respective ribs)#	**15**	**7**	**12**	**5**

Sum of maximum adult and maximum sub-adult MNI for specific bone
= Maximum MNI possible for specific bone based on this total

1 = <u>Combined number of near-complete (75%-100%) elements</u>
16 (Maximum number of Ribs 3-10 present in an individual)

2 = <u>Combined number of near-complete (75%-100%) elements</u>
4 (Maximum number of Ribs 11-12 present in an individual)

Table 4.7: Number of adult and sub-adult humeri, radii, ulnae, femora, tibiae and fibulae indicating side, section and % preservation represented in the Monk's Kop commingled remains collection.

Side		Description	Adult						Sub-adult					
			Humerus	Radius	Ulna	Femur	Tibia	Fibula	Humerus	Radius	Ulna	Femur	Tibia	Fibula
LEFT	Section	Proximal extremity	2	5	5	1	1	3	1	0	1	1	0	0
		Shaft: Complete 3/3	5	7	4	3	3	2	1	1	0	2	0	0
		Shaft: Proximal 1/3	0	1	2	0	1	1	0	0	1	1	0	0
		Shaft: Middle 1/3	1	1	2	0	1	1	0	0	1	0	0	0
		Shaft: Distal 1/3	1	0	0	0	0	2	1	0	0	0	0	0
		Distal extremity	1	1	2	0	2	6	1	0	0	2	0	1
	Complete		2	3	3	0	1	2	2	0	0	1	0	0
		TOTAL elements	12	18	18	4	9	17	6	1	3	7	0	1
		75% - 100% preserved	6	9	6	2	2	3	3	1	1	3	0	0
		25% - 75% preserved	3	3	4	1	3	5	1	0	0	1	0	0
		1%-25% preserved	0	0	2	0	2	1	1	0	0	2	0	1
RIGHT	Section	Proximal extremity	1	1	7	2	0	0	0	0	1	1	0	0
		Shaft: Complete 3/3	1	4	5	2	9	2	2	2	1	1	0	0
		Shaft: Proximal 1/3	0	0	5	0	0	0	0	0	0	1	0	0
		Shaft: Middle 1/3	0	1	1	1	0	0	0	0	0	0	0	0
		Shaft: Distal 1/3	0	0	0	0	0	0	0	0	0	0	0	0
		Distal extremity	0	1	0	0	5	6	0	1	0	2	0	0
	Complete		4	3	3	0	1	3	1	0	0	1	0	0
		TOTAL elements	6	10	21	5	15	11	3	3	2	6	0	0
		75% - 100% preserved	5	7	9	2	9	5	3	2	1	2	0	0
		25% - 75% preserved	0	1	3	1	1	0	0	0	0	1	0	0
		1%-25% preserved	1	0	2	1	1	4	0	0	0	1	0	0
UNKNOWN	Section	Proximal extremity	1	4	0	3	2	0	0	0	0	2	0	0
		Shaft: Complete 3/3	0	1	2	2	7	10	1	1	1	1	0	0
		Shaft: Proximal 1/3	0	2	0	0	0	1	0	0	0	0	0	0
		Shaft: Middle 1/3	1	5	4	3	1	8	0	0	0	1	0	0
		Shaft: Distal 1/3	1	1	0	0	0	0	0	0	0	0	0	0
		Distal extremity	0	0	1	2	1	0	0	0	0	0	2	0
	Complete		0	0	0	0	0	0	0	0	0	0	0	0
		TOTAL elements	3	13	7	10	11	19	1	1	1	4	2	0
		75% - 100% preserved	0	1	3	0	3	5	0	1	1	0	0	0
		25% - 75% preserved	2	6	2	3	3	13	1	0	0	2	0	0
		1%-25% preserved	1	4	2	5	2	0	0	0	0	2	2	0
		MNI (Adult vs. sub-adult)	6	9	9	2	9	5	3	2	1	3	1*	1

	Humerus	Radius	Ulna	Femur	Tibia	Fibula
MNI (Total for respective long bones)#	**9**	**11**	**10**	**5**	**10**	**6**

*Although 2 distal extremities recorded, the side was unknown, thus maximum 1 MNI
Sum of maximum adult and maximum sub-adult MNI for specific bone
= Maximum MNI possible for specific bone based on this total

Table 4.8: Number of adult and sub-adult clavicles indicating side, section and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult: Clavicle	Sub-adult: Clavicle
LEFT	Section	Medial extremity	4	1
		Shaft: Complete 3/3	8	2
		Shaft: Medial 1/3	1	1
		Shaft: Middle 1/3	1	0
		Shaft: Lateral 1/3	1	0
		Lateral extremity	4	0
	Complete		14	3
		TOTAL elements	33	7
		75% - 100% preserved	19	5
		25% - 75% preserved	5	1
		1%-25% preserved	4	0
RIGHT	Section	Lateral extremity	1	2
		Shaft: Complete 3/3	8	1
		Shaft: Proximal 1/3	1	2
		Shaft: Middle 1/3	0	0
		Shaft: Distal 1/3	0	0
		Medial extremity	3	0
	Complete		14	3
		TOTAL elements	27	8
		75% - 100% preserved	23	2
		25% - 75% preserved	1	3
		1%-25% preserved	0	0
UNKNOWN	Section	Lateral extremity	0	0
		Shaft: Complete 3/3	0	0
		Shaft: Proximal 1/3	0	0
		Shaft: Middle 1/3	0	0
		Shaft: Distal 1/3	0	0
		Medial extremity	0	0
	Complete		0	0
		TOTAL elements	0	0
		75% - 100% preserved	0	0
		25% - 75% preserved	0	0
		1%-25% preserved	0	0
		MNI (Adult vs. sub-adult)	23	5
		MNI (Total for clavicle)#	**28**	

Sum of maximum adult and maximum sub-adult MNI for specific bone
[dashed box] = Maximum MNI possible for specific bone based on this total

Table 4.9: Number of adult and sub-adult scapulae indicating side, section and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult: Scapula	Sub-adult: Scapula
LEFT	Section	Acromion process	2	0
		Coracoid process	2	0
		Glenoid cavity	6	1
		Spinous process	4	0
		Body	1	1
	Complete		8	2
		TOTAL elements	23	4
		75% - 100% preserved	8	2
		25% - 75% preserved	5	0
		1%-25% preserved	2	2
RIGHT	Section	Acromion process	5	0
		Coracoid process	4	0
		Glenoid cavity	8	0
		Spinous process	9	0
		Body	2	0
	Complete		7	3
		TOTAL elements	35	3
		75% - 100% preserved	11	3
		25% - 75% preserved	5	0
		1%-25% preserved	0	0
UNKNOWN	Section	Acromion process	0	0
		Coracoid process	0	0
		Glenoid cavity	0	0
		Spinous process	4	0
		Body	0	0
	Complete		0	0
		TOTAL elements	4	0
		75% - 100% preserved	0	0
		25% - 75% preserved	0	0
		1%-25% preserved	4	0
		MNI (Adult vs. sub-adult)	11	3
		MNI (Total for scapula)#	**14**	

Sum of maximum adult and maximum sub-adult MNI for specific bone
= Maximum MNI possible for specific bone based on this total

Table 4.10: Number of adult and sub-adult <u>hip bones</u> indicating side, section and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description		Adult: Hip bone	Sub-adult: Hip bone
LEFT	Section	Ilium	5	3
		Ischium	2	0
		Pubis	0	0
		Acetabulum	4	0
	Complete		5	2
		TOTAL elements	16	5
		75% - 100% preserved	8	3
		25% - 75% preserved	2	2
		1%-25% preserved	0	0
RIGHT	Section	Ilium	4	1
		Ischium	0	0
		Pubis	0	0
		Acetabulum	3	0
	Complete		9	0
		TOTAL elements	16	1
		75% - 100% preserved	11	0
		25% - 75% preserved	1	1
		1%-25% preserved	1	0
UNKNOWN	Section	Ilium	2	2
		Ischium	0	0
		Pubis	0	2
		Acetabulum	3	1
	Complete		0	0
		TOTAL elements	5	5
		75% - 100% preserved	0	0
		25% - 75% preserved	0	1
		1%-25% preserved	5	3
		MNI (Adult vs. sub-adult)	11	3
		MNI (Total for hip bone)#	**14**	

Sum of maximum adult and maximum sub-adult MNI for specific bone
[ ] = Maximum MNI possible for specific bone based on this total

Table 4.11: Number of adult and sub-adult (pooled) patellae, calcanei and tali indicating side and % preservation represented in the Monk's Kop commingled remains collection.

Side	Description	Adult and sub-adult		
		Patella	Calcaneus	Talus
LEFT	**TOTAL elements**	20	34	23
	75% - 100% preserved	17	26	19
	25% - 75% preserved	3	5	3
	1%-25% preserved	0	3	1
RIGHT	**TOTAL elements**	19	25	24
	75% - 100% preserved	19	24	20
	25% - 75% preserved	0	0	4
	1%-25% preserved	0	1	0
UNKNOWN	**TOTAL elements**	3	1	0
	75% - 100% preserved	0	1	0
	25% - 75% preserved	2	0	0
	1%-25% preserved	1	0	0
MNI (Total for respective bones)		**19**	**26**	**20**

[dashed box] = Maximum MNI possible for specific bone based on this total

Table 4.12: Number of adult and sub-adult (pooled) carpals, metacarpals, tarsals, metatarsals and phalanges represented in the Monk's Kop commingled remains collection.

Description	Adult and Sub-adult (pooled)				
	Carpals	Metacarpals	Tarsals*	Metatarsals	Phalanges#
TOTAL near complete elements	160	222	148	251	590
MNI (Total for respective hand and foot bones)	**10**[1]	**15**[2]	**22**[3]	**25**[4]	**11**[5]

* Excluding calcaneus and talus (refer to table 4.11)
\# Include hand and foot phalanges

1 = Total number of near complete (75%-100%) elements / 16 (Maximum number of carpals present in an individual)

2 = Total number of near complete (75%-100%) elements / 10 (Maximum number of metacarpals present in an individual)

3 = Total number of near complete (75%-100%) elements / 5 (Maximum number of tarsals [excl. calcaneus and talus] present in an individual)

4 = Total number of near complete (75%-100%) elements / 10 (Maximum number of metatarsals present in an individual)

5 = Total number of near complete (75%-100%) elements / 56 (Maximum number of phalanges present in an individual)

Table 4.13: Summary of the sex distribution and ancestry of all individuals studied.

Collection	Ancestry		Sex			
			Female	Male	Indeterminate	Total
Monk's Kop*	African	*n*	**20**	**17**	**6**	**43**
		%	46.5	39.5	14.0	100.0
Ashford	African	*n*	**3**	**2**	**2**	**7**
		%	42.9	28.6	28.6	100.0
Dambarare	European	*n*	1	13	0	**14**
		%	7.1	92.9	0.00	35.0
	African	*n*	5	2	0	**7**
		%	71.3	28.6	0.00	17.5
	Indeterminate	*n*	1	2	16	**19**
		%	5.3	10.5	84.2	47.5
	Subtotal	*n*	**7**	**17**	**16**	**40**
		%	17.5	42.5	40.0	
Total	European	*n*	1	13	0	**14**
		%	7.1	92.9	0.00	15.6
	African	*n*	28	21	8	**57**
		%	49.1	36.9	14.0	63.3
	Indeterminate	*n*	1	2	16	**19**
		%	5.3	10.5	84.2	21.1
	Total	*n*	30	36	24	**90**
		%	**33.3**	**40.0**	**26.7**	

* MNI (based on mandibles and skulls)

Table 4.14: Summary of age at death of all individuals studied.

			Specific age range #							Non-specific age range ^				
Collection	**Ancestry**		0-4 years	5-9 years	10-14 year	15-19 years	20-34 years	35-45 years	46+ years	Sub-adults	Young adults	Middle-aged adults	Old adults	
Monk's Kop*	African	*n*	**1**	**0**	**1**	**0**	**3**	**7**	**7**	**1**	**8**	**8**	**7**	**43**
		%	2.3	0.0	2.3	0.0	7.0	16.3	16.3	2.3	18.6	18.6	16.3	
Ashford	African	*n*	**0**	**2**	**0**	**1**	**0**	**2**	**2**	**-**	**-**	**-**	**-**	**7**
		%	0.0	28.6	0.0	14.2	0.0	28.6	28.6	-	-	-	-	
Dambarare	European	*n*	0	0	0	1	6	1	6	-	0	0	0	14
		%	0.0	0.0	0.0	7.1	42.9	7.1	42.9	-	0.0	0.0	0.0	
	African	*n*	0	0	0	3	0	3	1	-	0	0	0	7
		%	0.0	0.0	0.0	42.9	0.0	42.9	14.2	-	0.0	0.0	0.0	
	Indeterminate	*n*	2	0	0	2	0	1	1	-	9	4	0	19
		%	10.5	0.0	0.0	10.5	0.0	5.2	5.2	-	47.4	21.2	0.0	
	Total	*n*	**2**	**0**	**0**	**6**	**6**	**5**	**8**	**-**	**9**	**4**	**0**	**40**
		%	5.0	0.0	0.0	15.0	15.0	12.5	20.0	-	22.5	10.0	0.0	
Total	European	*n*	0	0	0	1	6	1	6	-	0	0	0	14
		%	0.0	0.0	0.0	7.1	42.9	7.1	42.9	-	0.0	0.0	0.0	
	African	*n*	1	2	1	4	3	12	10	1	8	8	7	55
		%	1.8	3.6	1.8	9.1	3.6	21.8	18.1	1.8	14.5	14.5	9.1	
	Indeterminate	*n*	2	0	0	2	0	1	1	-	9	4	0	19
		%	10.5	0.0	0.0	10.5	0.0	5.2	5.2	-	47.4	21.2	0.0	
	Total	*n*	3	2	1	7	9	14	17	1	17	12	7	**90**
		%	**3.3**	**2.2**	**1.1**	**7.8**	**10.0**	**15.6**	**18.9**	**1.1**	**18.9**	**13.3**	**7.8**	

* MNI (based on mandibles and skulls)
# Individuals were placed in the closest matching age group range
^ Individuals who could not be aged as belonging to a specific age range due to poor preservation of skeletal material were placed in the non-specific age range category

Table 4.15: Comparison of the Dambarare individuals as reported by De Villiers and this study.

Individual	Ancestry		Sex		Age		Burial information
	de Villiers#	This study	de Villiers#	This study	de Villiers#	This study	de Villiers#
D_AA1	Caucasoid	European	Male	Male	Adult	40-55 years	Inside church area: Stratum 9
D_AA2	Caucasoid	European	Male	Male	Immature	25-35 years	Inside church area: Stratum 9
D_AA3	Hybrid	European	Male	Male	Young adult	25-35 years	Inside church area: Stratum 12
D_AA4	Indeterminate	Indeterminate	Indeterminate	Male	Adult	30-50 years	Outside church area: Stratum 12
AA5	Indeterminate	Not applicable	Indeterminate	Not applicable	Adult	Not applicable	No elements with AA5 accession number found in collection. Possibly one of the miscellaneous individuals identified by the author.
AA6	Indeterminate	Not applicable	Indeterminate	Not applicable	Adult	Not applicable	No elements with AA6 accession number found in collection. Possibly one of the miscellaneous individuals identified by the author.
AA7	Indeterminate	Not applicable	Indeterminate	Not applicable	Adult	Not applicable	Identified in situ, but not excavated.
AA8	Indeterminate	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Identified in situ, but not excavated.
D_AAMisc1*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Middle-aged adult	Not applicable
D_AAMisc2*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	14-18 years	Not applicable
D_AAMisc3*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Middle-aged adult	Not applicable
D_AAMisc4*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc5*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc6*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc7*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc8*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc9*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc10*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc11*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_AAMisc12*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Middle-aged adult	Not applicable
D_A1	Caucasoid	European	Male	Male	Young adult	16-20 years	Inside church area: Stratum 6
D_A2	Caucasoid	European	Male	Male	Mature adult	40-55 years	Inside church area: Stratum 6
D_A3	Caucasoid	European	Male	Male	Mature adult	45-55 years	Inside church area: Stratum 6
D_A4	Indeterminate	European	Indeterminate	Female	Immature	20-30 years	Outside church area: Stratum 6
D_A5	Hybrid	European	Male	Male	Young adult	20-30 years	Inside church area: Stratum 6
D_A6	Caucasoid	European	Male	Male	Mature adult	40-50 years	Inside church area: Stratum 6
D_A7	Caucasoid	European	Male	Male	Mature adult	40-55 years	Inside church area: Stratum 9
D_A8	Not applicable	Indeterminate	Not applicable	Male	Not applicable	45-60 years	Reported to possibly be post-cranial elements of D_A6. Could not be confirmed.
D_A9	Not applicable	European	Not applicable	Male	Not applicable	20-35 years	Reported to possibly be post-cranial elements of D_A5. Could not be confirmed.
D_AMisc1*	Not applicable	Indeterminate	Not applicable	Female	Not applicable	14-19 years	Not applicable

Tabled 4.15 continued: Comparison of the Dambarare individuals as reported by H de Villiers and this study.

Individual	Ancestry		Sex		Age		Burial information / Comments
	de Villiers#	This study	de Villiers#	This study	de Villiers#	This study	
AW1	Caucasoid	Not applicable	Male	Not applicable	Adult	Not applicable	Reported as extremely decayed and fragmented. No elements with AW1 accession number found in collection.
AW2	Indeterminate	Not applicable	Indeterminate	Not applicable	Adult	Not applicable	Reported as extremely decayed and fragmented. No elements with AW2 accession number found in collection.
D_B1	Negro	African	Female	Female	Mature adult	45-60 years	Outside church area: Stratum 6
D_B2	Hybrid	African	Female	Female	Adult	18-20 years	Outside church area: Stratum 9
D_B3	Negro	African	Female	Female	Mature adult	15-20 years	Outside church area: Stratum 9. Postcranial remains labelled as B4. Excavation note indicating accidental comingling.
D_B4	Negro	African	Female	Female	Immature	45-60 years	Outside church area: Stratum 9. Postcranial remains labelled as B3. Excavation note indicating accidental comingling.
D_B5	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Infant	1-2 years	Outside church area: Stratum 9
D_BMisc1*	Not applicable	Indeterminate	Not applicable	Indeterminate	Not applicable	Young adult	Not applicable
D_C1	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Child	Middle-aged adult	Outside church area: Stratum 8A
D_C2	Caucasoid	European	Male	Male	Mature adult	45-55 years	Outside church area: Stratum 5
D_C3	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Child	1-2 years	Outside church area: Stratum 6
D_C4	Negro	African	Female	Female	Young adult	30-40 years	Outside church area: Stratum 8A
D_C5	Caucasoid	European	Male	Male	Mature adult	55-70 years	Outside church area: Stratum 8A
D_C6	Caucasoid	European	Male	Male	Mature adult	25-40 years	Outside church area: Stratum 8A
D_C7	Caucasoid	African	Male	Male	Adult	35-55 years	Outside church area: Stratum 8A
D_E1	Negro	African	Male	Male	Young adult	30-45 years	Outside church area: Stratum 13B

Shaded areas: These individuals were part of the H de Villiers report, but were not found in the collection during this study, thus does not form part of this study
As published in the de Villiers report in Garlake, 1969
* Miscellaneous elements not marked as specific individual but associated with Dambarare excavation. These elements were renamed during the current study, thus were not reported on by De Villiers

Table 4.16: Summary of estimated antemortem stature for males and females of Dambarare individuals studied.

Collection	Ancestry	Sex	Estimated stature			
			Minimum	Maximum	Mean	SD
Dambarare	European#	Male	157.83	171.01	164.88	4.14
		Female	-	-	154.52	-
	African^	Male	-	-	-	-
		Female	146.5	165.43	152.99	10.78

SD = Standard deviation
Antemortem stature of individuals calculated utilising De Mendonca (2000)
^ Antemortem stature of individuals calculated utilising Lundy & Feldsman (1987)

Table 4.17: Factor loadings after varimax rotation for craniometric analyses.

Variable	Male analysis			Female analysis		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
GOL	0.731	0.127	0.190	0.749	0.267	0.372
XCB	0.612	-0.476	0.128	0.811	-0.274	0.037
BBH	0.733	0.078	-0.051	0.755	0.256	-0.067
BNL	0.692	0.522	0.091	0.645	0.500	0.312
BPL	0.270	0.782	0.083	0.229	0.752	0.326
NLB	-0.022	0.719	0.074	-0.007	0.770	-0.057
OBH	-0.116	0.231	0.874	-0.040	0.031	0.888
NPH	0.391	-0.097	0.781	0.497	0.187	0.655

= Values >0.7

Table 4.18: One-way analyses of variance of large comparative group differences on factor scores obtained from the craniometric factor analyses.

Analysis	Factors	*n*	F	Significance level	L	Comparative groups	Significant differences between groups
Males	1	196	46.60	***	Not significant	Basuku Bahutu Madagascans Europeans	Basuku & Madagascans / Europeans Bahutu & Madagascans / Europeans Europeans & all Madagascans & Basuku / Bahutu
	2		24.47	***	Not significant		Basuku & Europeans Bahutu & Europeans Madagascans & Europeans
	3		12.56	***	Not significant		Basuku & Bahutu / Madagascans Bahutu & all Madagascans & Basuku / Bahutu Europeans & Bahutu
Females	1	196	56.12	***	**	Venda Basuku Bahutu Madagascans Europeans	Venda & Basuku / Madagascans / Europeans Basuku & all Bahutu & all Madagascans & Venda / Basuku / Bahutu Europeans & Venda / Basuku / Bahutu
	2		20.02	***	*		Venda & Bahutu / Europeans Basuku & Madagascans / Europeans Bahutu & Venda / Madagascans / Europeans Madagascans & Basuku / Bahutu / Europeans Europeans & all
	3		24.73	***	Not significant		Venda & Basuku / Madagascans / Europeans Basuku & Venda / Bahutu Bahutu & Basuku / Madagascans / Europeans Madagascans & Venda / Madagascans / Europeans Europeans & Venda / Bahutu

n = sample size
F = one-way test
*p < 0.05
**p < 0.01
***p < 0.001
L = Levene's test of homogeneity of variances

Table 4.19: Proximity matrices of squared Euclidean distances derived from the craniometric analyses between archaeological specimens (Zimbabwe. South Africa and Botswana) and comparative group means.

Collection	Period	Accession number	Sex	Males Analysis					Females Analysis				
				Venda	Basutu	Bahutu	Madagascans	Europeans	Venda	Basutu	Bahutu	Madagascans	Europeans
Monk's Kop	Pre-contact	M_200	M	-	-	-	-	-					
		M_292	M	-	-	-	-	-					
		M_296	M	-	-	-	-	-					
		M_297	M	0.318	0.451	0.449	0.159	0.623					
		M_473	M	0.729	0.798	0.734	0.178	0.507					
		M_430a	M	0.363	0.172	0.095	0.193	0.205					
		M_199	F						0.234	0.311	0.133	0.275	0.174
		M_286	F						0.352	0.005	0.326	1.025	0.988
		M_291	F						-	-	-	-	-
		M_293	F						-	-	-	-	-
		M_295	F						0.171	0.542	0.530	0.572	1.058
		M_416	F						0.420	0.822	0.577	0.096	0.291
Ashford		A_2	M	0.435	0.339	0.166	0.066	0.143					
		A_4	M	0.206	0.573	0.393	0.193	0.879					
		A_1	F						-	-	-	-	-
		A_3	F						-	-	-	-	-
		A_7	F						0.065	0.546	0.240	0.159	0.439
Dambarare	Post-contact	D_A2	M	0.989	0.735	0.313	0.497	0.244					
		D_A5	M	0.990	1.013	0.664	0.093	0.207					
		D_AA2	M	0.759	0.359	0.182	0.630	0.329					
		D_AA3	M	0.705	0.522	0.557	0.261	0.322					
		D_C6	M	-	-	-	-	-					
		D_B1	F						-	-	-	-	-
		D_B3	F						0.075	0.151	0.050	0.437	0.452
		D_B4	F						0.206	0.334	0.032	0.726	0.612
Mpungubwe/ K2	Pre-contact	A1714	M										
		A1730	F						0.492	1.483	0.964	0.365	1.036
		A1722	F						0.134	0.425	0.345	0.261	0.543
		A1715	F						0.067	0.638	0.125	0.288	0.476
		A1701	F						-	-	-	-	-
Toutswe		5(1)	M	0.397	0.662	0.726	0.348	1.021					
		16	M	0.266	0.621	0.353	0.701	1.355					
		3	M	0.595	0.397	0.144	0.196	0.101					
		25	F						0.367	0.900	0.227	0.852	0.850

Table 4.20: Descriptive statistics of the buccolingual (BL) and mesiodistal (MD) dimensions of the posterior teeth of the maxillae of all the collections studied.

Collection	Ancestry		Maxilla: Tooth type									
			P1		P2		M1		M2		M3	
			BL	MD	BL	MD	BL	MD	BL	MD	BL	MD
Monk's Kop	African	*n*	19	19	18	18	22	22	20	20	19	20
		Mean	9.51	7.21	9.62	7.04	11.08	10.52	11.27	10.22	11.20	8.74
		SD	0.60	0.43	0.68	0.72	0.79	1.03	0.67	0.96	1.12	1.05
Ashford	African	*n*	2	1	2	2	4	4	3	3	4	4
		Mean	9.16	6.99	9.79	7.25	11.54	10.94	10.85	11.19	11.12	10.61
		SD	0.48	0.00	0.21	0.05	0.38	0.47	0.18	0.30	0.32	0.64
Dambarare	European	*n*	15	15	12	12	13	13	18	17	7	6
		Mean	8.80	7.16	8.96	6.87	11.57	10.64	10.94	10.34	11.00	9.82
		SD	0.57	0.61	0.44	0.61	0.90	0.69	0.79	1.05	1.08	1.07
	African	*n*	7	8	12	12	11	11	11	11	3	3
		Mean	9.43	7.24	8.85	7.16	10.96	10.71	11.09	10.29	11.70	9.30
		SD	0.27	0.69	0.59	1.15	0.83	0.82	0.75	0.90	0.47	0.48
	Total	*n*	22	23	24	24	24	24	29	28	10	9
		Mean	9.00	7.19	8.90	7.02	11.29	10.68	11.00	10.32	11.21	9.64
		SD	0.57	0.63	0.51	0.91	0.91	0.73	0.77	0.98	0.97	0.91

n = Number of teeth investigated per tooth type
SD = Standard deviation

Table 4.21: Descriptive statistics of the buccolingual (BL) and mesiodistal (MD) dimensions of the posterior teeth of the mandibles of all the collections studied.

Collection	Ancestry		P1 BL	P1 MD	P2 BL	P2 MD	M1 BL	M1 MD	M2 BL	M2 MD	M3 BL	M3 MD
Monk's Kop	African	*n*	28	28	25	25	34	34	40	40	33	33
		Mean	8.07	7.20	8.57	7.44	10.74	11.23	10.44	10.58	10.22	10.39
		SD	0.66	0.54	0.97	1.22	0.71	0.84	0.64	0.92	0.78	0.98
Ashford	African	*n*	2	2	5	5	4	4	5	5	7	7
		Mean	8.84	7.71	8.31	7.82	10.90	11.35	10.83	10.80	10.74	11.00
		SD	0.66	0.64	0.81	0.23	0.38	0.19	0.53	0.30	0.60	0.84
Dambarare	European	*n*	11	11	13	13	12	12	16	16	10	10
		Mean	7.66	7.06	8.02	7.11	10.32	11.58	9.81	10.42	10.17	10.76
		SD	0.60	0.45	0.60	0.54	0.76	0.61	0.59	0.71	1.02	0.91
	African	*n*	3	3	5	5	5	5	8	8	5	5
		Mean	7.93	6.75	7.97	7.58	10.54	11.41	9.99	10.65	10.06	10.71
		SD	0.38	0.90	0.27	1.03	0.61	0.85	0.65	0.76	0.70	0.71
	Total	*n*	14	14	18	18	17	17	24	24	15	15
		Mean	7.72	6.99	8.01	7.24	10.38	11.53	9.87	10.50	10.13	10.74
		SD	0.56	0.54	0.56	0.71	0.71	0.67	0.60	0.72	0.90	0.82

Mandible: Tooth type

n = Number of teeth investigated per tooth type
SD = Standard deviation

Table 4.22: Comparison of Penrose shape distances of pooled (male and female) groups for the posterior teeth of the maxillae of all the collections studied and that of various comparative populations.

		African								European	
		Monk's Kop	Ashford	Dambarare	Mapungubwe [1]	K2 [1]	Toutswe [2]	Venda [3]	South Africa [4]	Dambarare	South Africa [5]
African	Monk's Kop	-	0.640	0.178	0.457	0.088	0.137	0.087	0.163	0.446	0.330
	Ashford		-	0.683	1.898	0.875	0.990	0.623	0.995	0.304	0.310
	Dambarare			-	0.819	0.255	0.505	0.312	0.401	0.414	1.437
	Mapungubwe [1]				-	0.423	0.264	0.591	0.417	1.516	1.374
	K2 [1]					-	0.158	0.150	0.147	0.482	0.288
	Toutswe [2]						-	0.110	0.077	0.667	0.732
	Venda [3]							-	0.069	0.337	0.500
	South Africa [4]								-	0.516	0.623
European	Dambarare									-	1.390
	South Africa [5]										-

1 = A.D. 1000-1300 (Steyn, 1994)
2 = A.D. 700-1250 (Mosothwane, 2004)
3 = 20th Century (L'Abbé, 2005)
4 = Contemporary (Jacobson, 1982)
5 = Contemporary (Kieser, 1990)

Table 4.23: Comparison of Penrose shape distances of pooled (male and female) groups for the posterior teeth of the mandibles of all the collections studied and that of various comparative populations.

		African								European	
		Monk's Kop	Ashford	Dambarare	Mapungubwe [1]	K2 [1]	Toutswe [2]	Venda [3]	South Africa [4]	Dambarare	South Africa [5]
African	Monk's Kop	-	0.270	0.280	0.386	0.122	0.051	0.087	0.060	0.310	0.137
	Ashford		-	0.481	0.390	0.357	0.231	0.181	0.245	0.553	0.335
	Dambarare			-	0.788	0.286	0.254	0.298	0.271	0.187	0.350
	Mapungubwe [1]				-	0.368	0.333	0.180	0.354	0.696	0.743
	K2 [1]					-	0.136	0.179	0.207	0.284	0.121
	Toutswe [2]						-	0.068	0.029	0.268	0.212
	Venda [3]							-	0.067	0.297	0.151
	South Africa [4]								-	0.253	0.197
European	Dambarare									-	0.225
	South Africa [5]										-

1 = A.D. 1000-1300 (Steyn, 1994)
2 = A.D. 700-1250 (Mosothwane, 2004)
3 = 20th Century (L'Abbé, 2005)
4 = Contemporary (Jacobson, 1982)
5 = Contemporary (Kieser, 1990)

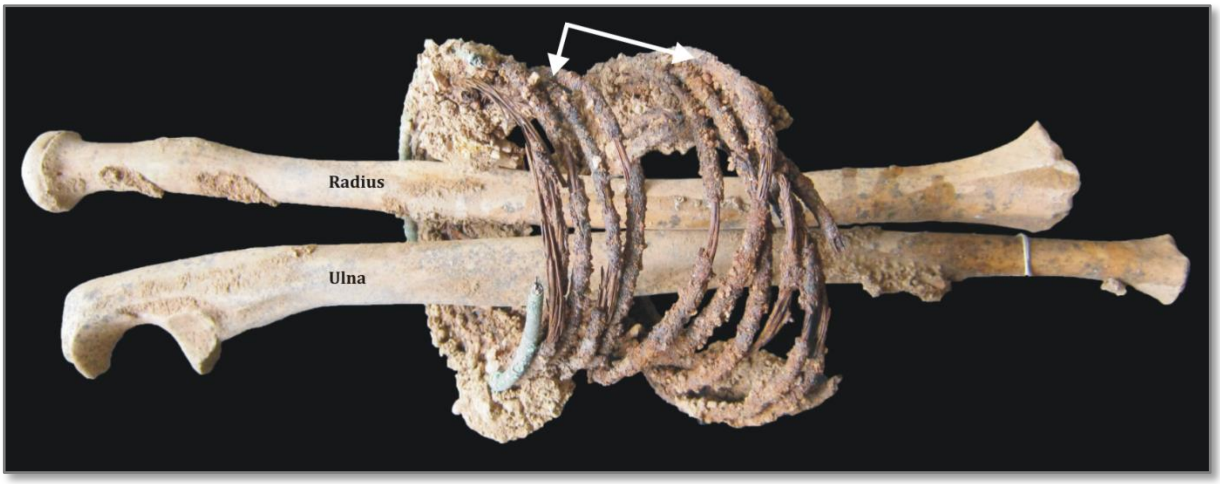


Figure 4.1: Individual from sub-collection M_430b: Copper bangles associated with right upper limb of sub-adult of unknown sex.

Figure 4.2: The entrance of the Monk's Kops ossuary as identified during re-investigation of the Monk's Kop site. (Taken from Nienaber et al., Submitted)

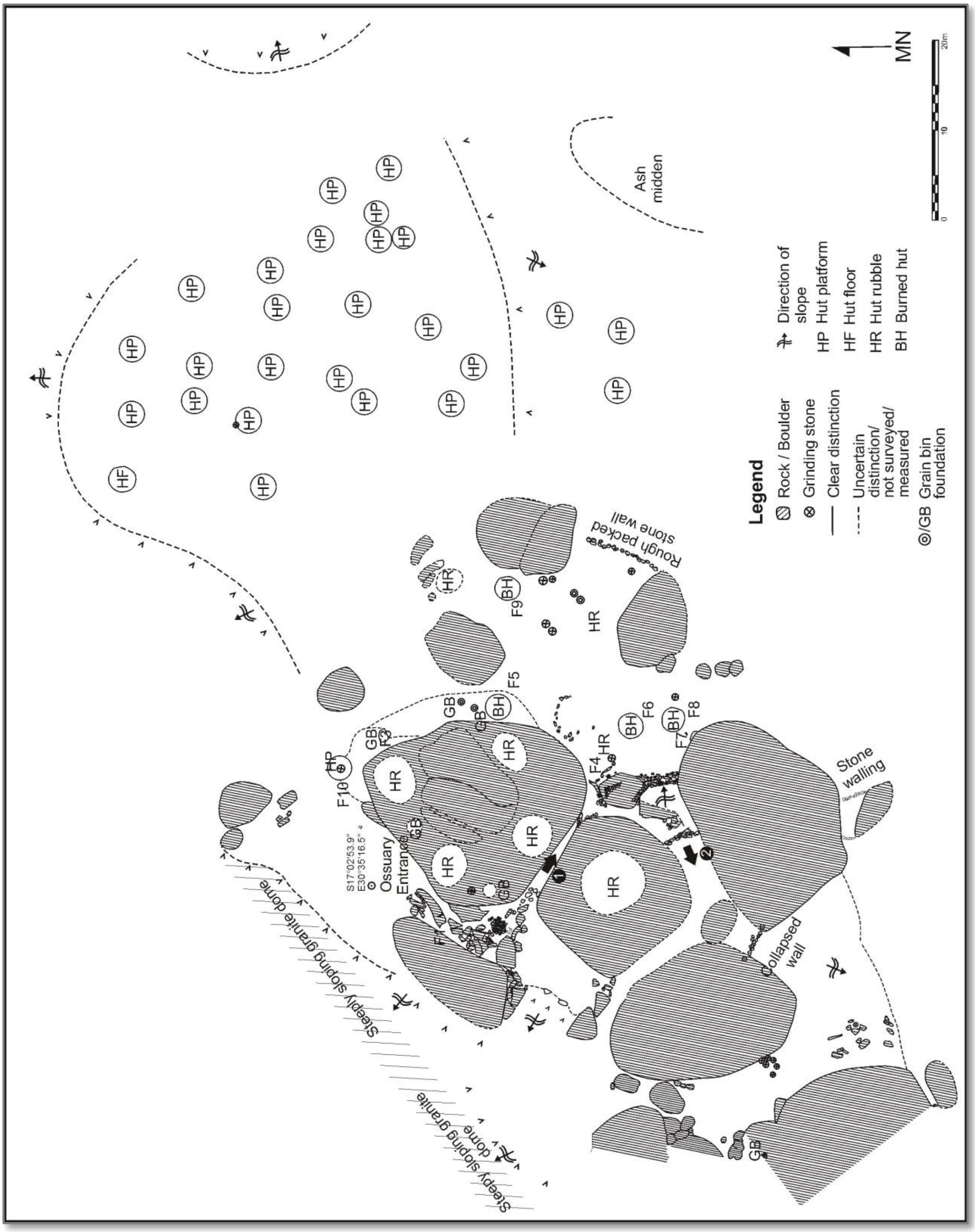


Figure 4.3: Site map of the Monk's Kop upon re-investigation (Taken from Nienaber et al., Submitted)

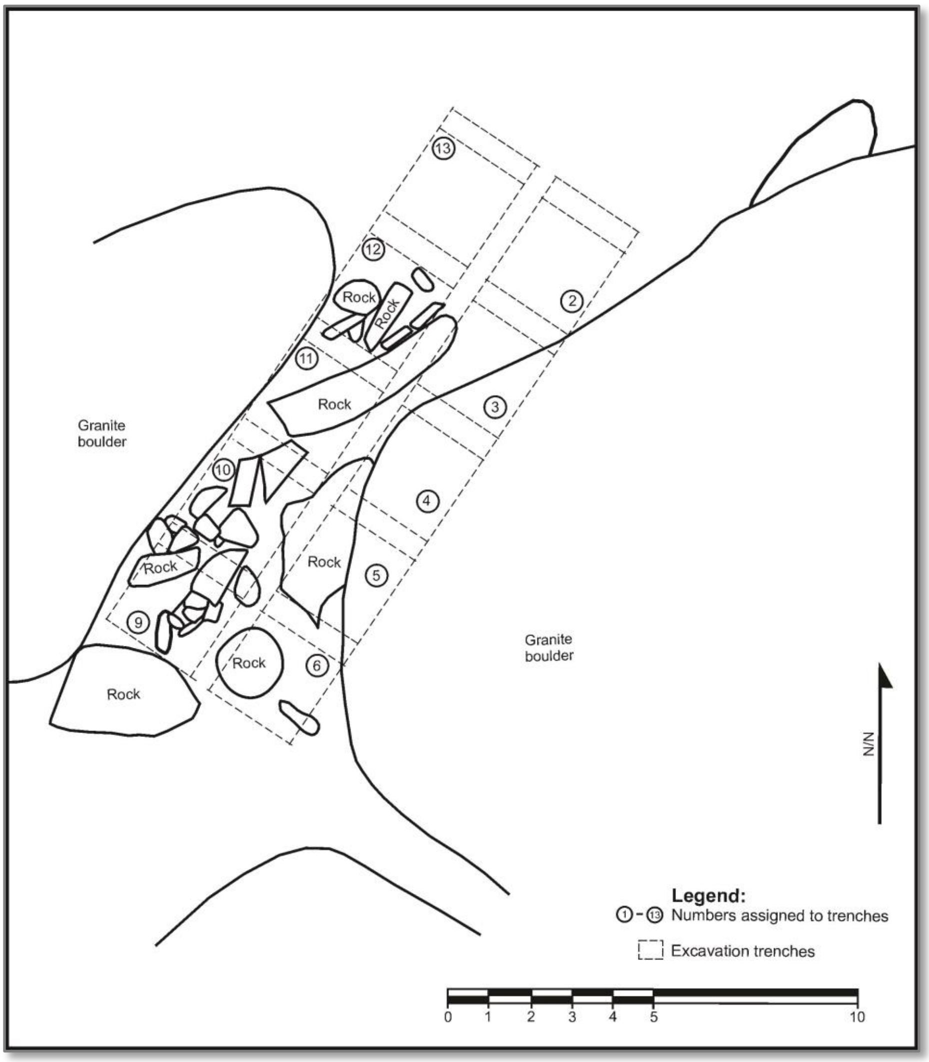


Figure 4.4: Proposed location of excavation trenches of Crawford (1967) superimposed from site map (Taken from Nienaber et al., Submitted)

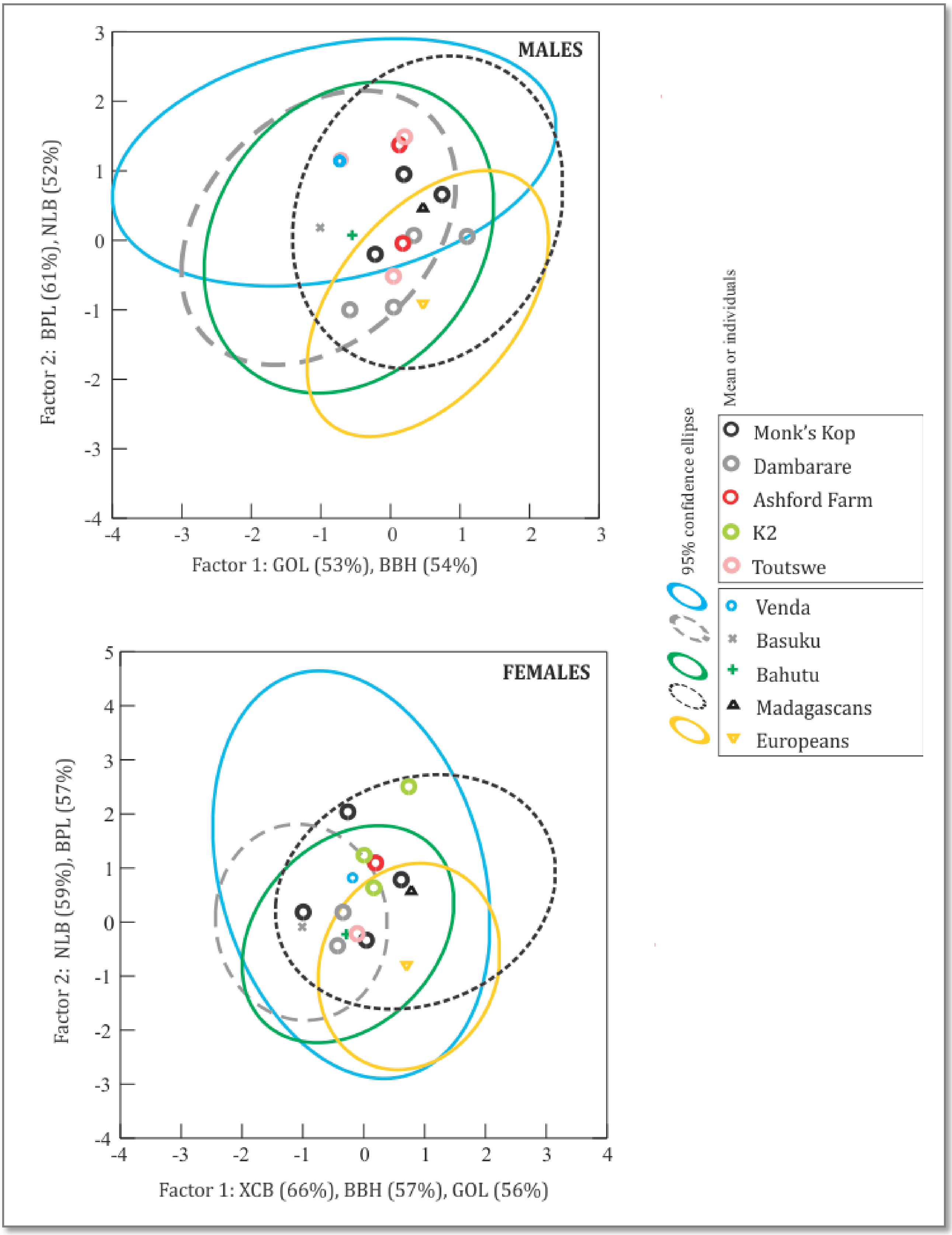


Figure 4.5: Factor analysis (Males only 67% total variance expressed and females 72%).

CHAPTER 5: SKELETAL HEALTH

5.1 Introduction

Skeletal material of all three populations studied were investigated for signs of pathology. This included a minimum number of 43 Monk's Kop individuals (17 males; 20 females; 6 of indeterminate sex), 7 Ashford Farms individuals (2 males; 3 females; 2 of indeterminate sex) and a total of 43 individuals from the Dambarare collection which included remains from European descent (13 males; 1 female), African descent (2 males; 5 females) and individuals of indeterminate ancestry (2 males; 1 female; 16 of indeterminate sex). Some of the above individuals were not eligible for investigation because they were too incomplete. Cribra orbitalia, for example, can only be detected in skulls that present with observable orbits and therefore skeletal remains without this pre-requisite were excluded from the maximum number of possible individuals.

Due to the commingled nature and poor preservation of specifically the Monk's Kop, but also the Dambarare collection, there were a number of bony elements that could not be allocated to or be identified as belonging to an existing or additional individual. These bony elements were, however, also analysed for skeletal signs of pathology. The results of Monk's Kop and Dambarare will therefore include all accession numbers, whether allocated as an individual or not. Any pathological observations identified on these remains were listed accordingly, but were not utilised when calculating the number of individuals affected by a certain condition.

A total of 39 individuals in all collections studied presented with skeletal lesions of which the accession numbers are listed in Table 5.1. The Ashford Farms and African Dambarare individuals who exhibited skeletal lesions presented with only one type of pathologic lesion per individual. The Dambarare individuals of European descent, however, were often recorded as suffering from more than one pathological condition. The Monk's Kop collection yielded one individual who displayed skeletal changes suggestive of multiple pathological conditions. Most individuals did, however, present with a dental condition or pathology as well. This will be discussed in Chapter 6.

Pathological alterations identified on the remains studied included evidence of a possible infectious disease (treponemal disease), degenerative changes such as osteoarthritis and osteophyte formation, non-specific sub-periosteal lesions, cribra orbitalia, enamel hypoplasia, Schmorl's nodes, trauma and limited developmental anomalies. Miscellaneous observations with no clinical significance were also recorded (Table 5.1).

The above pathological conditions are discussed separately in this chapter by firstly listing the individuals affected per skeletal collection studied, inclusive of their ancestry, sex and age (wherever possible) in table format. Dependant on the condition, the affected bones (or teeth) of every affected individual are also indicated. The prevalence of a specific bone being affected as a percentage of the total bones affected by the specific condition is also calculated. Secondly, the prevalence of a specific condition is tabulated for each of the skeletal collections by means of a percentage of individuals affected per the total number of individuals investigated per sample. As part of the tables, the three collections studied are compared with the results of applicable populations, which in most cases comprised of the Mapungubwe/K2, Venda and Toutswe populations. Chi^2 statistical analyses were performed in these comparisons and are reflected as both a χ^2 and corresponding *p*-value in these comparative tables. A *p*-value of less than 0.05 was recorded as being statistically significant. All significant differences are clearly highlighted in all tables.

Due to the dual ancestry of the Dambarare population, three variables are listed for each condition for this population. These include the individuals from European and African descent which are listed separately and the third variable includes all individuals, i.e. those of African and European descent, but also any individual who could not be determined as belonging to a specific ancestry. The total number of Dambarare individuals therefore reflects a sum of the European and African individuals of this population, but also those who were of indeterminate ancestry.

All descriptions of pathological conditions identified in this study are presented by means of the tables described above, but also includes an applicable photograph which depicts an example of the specific condition of one of the individuals identified as being affected by the specific condition. All individuals identified in this study are also described in detail in the skeletal reports shown in Appendices A to C.

Although enamel hypoplastic lesions are observed on teeth, it will be discussed as part of the skeletal health chapter as it is a non-specific indicator of disease which reflects conditions during the growing years of an individual.

Unfortunately the limited number and incomplete skeletal remains associated with sub-adults in all three collections prohibited any skeletal growth investigation and this is therefore not included in this study.

5.2 Significant cases with pathology

Two individuals investigated (M_450 of the Monk's Kop site and D_B4 of the Dambarare site) showed significant skeletal lesions or presented with several signs of skeletal pathology. These two cases will therefore be described in detail as separate case studies.

5.2.1 Individual M_450

Individual M_450 is estimated to have been a 9-11 year old African child and presents with an asymmetric skull, cribra orbitalia, enamel hypoplasia and possibly retained deciduous teeth (combined with severe space restriction for both the maxillary and mandibular teeth). The remains of this individual are currently housed in the Raymond A. Dart collection at the University of the Witwatersrand, South Africa and comprises of only a fractured, incomplete skull and complete, well-preserved mandible. Due to the multiple pathological observations recorded on these skeletal elements, a more comprehensive discussion of the results of this African child will be provided.

Figure 5.1 depicts the anterior view of the skull which clearly shows asymmetry, particularly in the cranial vault, with the left side being noticeably smaller than the right side. The poor preservation of the skull unfortunately prohibited any estimation of cranial capacity, but measurements of the right and left parietal area of the skull showed a slight variation. It could not be confirmed that the face was also asymmetrical due to the fractured left side of the skull. The measurements of the parietal area only showed a slight variance between the sides and cranial capacity may have therefore not been diminished, and if so only slightly. This would have had an impact on brain development due to the decreased space allocation – of course the opposite is also possible namely that the side of the skull was reduced because of suboptimal brain growth. The cause of the asymmetry could not be confirmed; however no evidence of trauma was observed in that area of the skull, and thus this was most probably a developmental anomaly. Asymmetry in skulls can be attributed to many congenital and genetic disorders and syndromes. These include deletion or duplication of specific chromosomes (such as chromosomes 4, 4p, 7, 11 and 15q), syndromes (such as Armendrares, Oculopalatoskeletal, Sturge-Weber and WAGR, Foetal Alcohol Syndrome) as well as deficiencies (such as aspartielglucosaminidase) (Kliegman, 2007). All these developmental anomalies incorporate multiple diagnostic criteria of which very little can be seen as lesions in skeletal remains. Therefore a differential diagnosis was not possible by only considering the asymmetry of the skull of individual M_450.

As can be seen from a lateral view (Figure 5.2), the skull seems to be flattened in the inter-orbital area, which is suggestive of a hypoplastic maxilla or midfacial region. It has been suggested that both Crouzon syndrome (Kliegman, 2007) and Foetal alcohol syndrome (FAS) is associated with an underdeveloped maxilla (İşcan and Steyn, 2013). The case study of possible FAS in Işcan and Steyn (2013) shows a combination of pathological lesions which include a hypoplastic maxilla.

This individual also showed abnormal development of the maxillary and mandibular teeth. Although the possibility of supernumerary teeth was investigated, it was confirmed that the maxilla rather presents with possible retained deciduous dentition with severe space restriction which caused crowding of teeth (Figure 5.3) which could be associated with a variety of developmental abnormalities and congenital conditions. An X-ray of the maxilla in Figure 5.4 shows the reduced space availability for the erupting teeth.

The left maxillary incisor 1 seems to have been fractured at the incisal edge, although the possibility of weak or abnormal enamel in this area should be considered. The damage could be the result of overuse, trauma or possibly an unsuccessful modification attempt. Tooth modification was, however, only apparent in the mandibular incisors of this population, thus making it a less likely cause of the fracture. Congenital syphilis was investigated as a possible cause of the deformity on incisor 1, as this condition often involves the first incisors (known as Hutchinson's incisors) as well as abnormal formation of the molars often referred to as Moon molars (Hillson et al., 1998). A Hutchinson's incisor is however characterised by a smooth crescentic notch, rather than the rough, unstructured deformity visible on the maxillary incisor of individual M_450. Also, no "Moon" molars were identified. Congenital syphilis was thus not considered as a possible diagnosis for individual M_450, especially taking into consideration that no postcranial remains were present to confirm such a possibility.

The mandible showed less structural abnormality in comparison to the skull, but there were clear evidence of crowding of teeth as well as multiple linear hypoplastic lesions on the anterior, permanent dentition (Figure 5.5). This case was the only individual of the Monk's Kop population that exhibited any enamel hypoplastic lesions. Enamel hypoplasia reflects periods of metabolic stress experienced during childhood which interrupts ameloblastic (enamel formation) physiology. This could have been the case in individual M_450 as the insult was seen by the body as a life-threatening situation and therefore redirected resources to vital systems, rather than maintaining processes such as tooth and bone growth the body (Aufderheide and Rodriguez-Martin, 1998). Causes of the specific metabolic insult experienced by individual M_450 could have been due to a nutritional deficiency or a possible childhood disease such as measles (Roberts and Manchester, 2010).

This child also showed signs of healed cribra orbitalia in roofs of both orbits as can be seen in Figure 5.6. Due to the poor preservation of the orbits (fractured and incomplete), it was difficult to score. The area affected could not be scored according to the Steckel et al. (2005) scoring system as it could not be confirmed whether the area affected was larger than 1 cm^2. The severity of the lesion did however match the "medium" scoring level as described by Stuart-Macadam (1985) system due to the foramina clearly showing links to form a trabecular network.

Individual M_450 therefore showed multiple skeletal lesions evident of cranial asymmetry, abnormal maxillary / midfacial development, enamel hypoplasia and cribra orbitalia.

The possibility of Crouzon syndrome is supported by the hypoplastic maxilla and crowding of teeth present in individual M_450, but due to the fact that the most noticeable characteristic of Crouzon syndrome, craniosynostosis, is absent in this individual, it is a highly unlikely diagnosis. Foetal Alcohol Syndrome has been reported to include craniofacial asymmetry, abnormal head shape, cribra orbitalia and enamel hypoplasia in a previous case study where this condition was included in the differential diagnosis (İşcan and Steyn, 2013). Although individual M_450 fits the above criteria, the skeletal changes related to FAS have yet to be clearly established (Shuler and Schroeder, 2013; İşcan and Steyn, 2013). Therefore FAS could have been a possible cause of the skeletal observations present in this African child, but cannot be confirmed.

Taking into consideration the infinite possibilities of developmental, congenital and genetic disorders and diseases associated with some or all of the lesions present in the skeletal remains of individual M450, as well as the the poor preservation and absence of any postcranial elements, it is unfortunately very difficult to provide a differential diagnosis. The multiple developmental anomalies and the evidence of possible prenatal insults do however suggest that this Monk's Kop individual could have suffered from any of a variety of diseases or syndromes that also continued throughout the childhood years, eventually leading to an early death.

5.2.2 Individual D_B4

Individual D_B4, an African female who is estimated to have died between the ages of 45 and 60 years, presented with a healed lesion on the superior aspect of the skull Figure 5.7.

Upon first analysis, the age at death estimation based on the postcranial remains (estimation 16-20 years) labelled as belonging to this individual did not match those of the skull (estimation of 45-60 years). Upon investigation, an excavation note was found confirming that the postcranial remains of individuals D_B3 and D_B4 were incorrectly labelled and therefore at first swopped during analysis. When the analysis was completed, the postcranial remains were stored with the applicable cranial remains.

The postcranial remains of this individual were in a poor state of preservation and comprised of fractured and incomplete upper limb long bones, incomplete clavicles, sternum (manubrium and body) as well as miscellaneous ribs. The vertebral column was represented by only fragments of vertebral bodies and the only remnant of the lower limbs were two incomplete hip bones. Some of the upper limb long bones, especially the left radius, exhibited green discoloration which was probably due to the wearing of copper bangles.

The healed lesion on the skull of this individual was situated roughly 2 cm posterior to the bregma directly on the sagittal suture (Figure 5.8). The lesion was approximately 0.7 cm x 1 cm with a sharp edge posteriorly and a smooth, rounded, but guttered edge anteriorly (Figure 5.9). This lesion could be a healed case of trephination, which indicates that the individual had survived the procedure. The different types of trephination described in literature include 1) Grooving (boring or cutting), where the defect is vertical or steeply bevelled); 2) Scraping where the defect is broad and shallow; 3) Rectangular intersecting incisions where removal of bone took place by means of linear grooves where the defect is rectangular with clear circumcised bone; 4) Drilling, where the defect is circular and connected by means of small holes (Lisowski, 1967; Aufderheide and Rodriguez-Martin, 1998). The posterior edge of the lesion in individual D_B4 suggests the use of a sharp object to initially cut the bone, where after possible scraping took place to remove the piece of bone entirely.

Craniostenosis of the sagittal suture could be observed directly posterior to the lesion which might have been the result of the damage to the suture during the procedure. However, one might also argue that the procedure was possibly done due to the craniostenosis as a means of relieving possible increased pressure associated with the early closure of the sagittal suture. The open sagittal suture anterior to the possible trephined area in comparison to the closed nature of the suture posterior to the lesion suggests that the craniostenosis was a result of the procedure and not the opposite. The left side of the coronal suture is however also closed, which may suggest that this individual suffered from a condition that involved premature closure of the sutures. It is however uncertain what the cause of the closed suture is.

An occipital projection as well as abnormal suture formation in the occipital region was also observed (Figure 5.10 and Figure 5.11). The craniostenosis posterior to the lesion could have resulted in the overcompensation of growth in the occipital region. The large fracture on the right parietal bone, visible on the photographs, is due to post-mortem damage and is not associated with the described lesion.

The trephined area is uncommonly situated in an area which was normally avoided due to fear of excessive bleeding due to the close proximity of the dural venous sinuses in this region (Lisowski, 1967; Majno, 1991; El Khamlichi, 1998). This may implicate that the "surgeon" could have been inexperienced at the time of Individual D_B4's procedure, although similar cases have been reported in literature (Lisowski, 1967; El Khamlichi, 1998).

It is unclear whether the procedure was conducted by the Portuguese or the indigenous population. The patient in this case did survive the procedure, and lived to reach a mature age. There are very few reported cases of trephination in early Europe (Crubézy et al., 2001) and these numbers declined even more after the expansion of Islam and completely disappear from European collections during medieval periods (Aufderheide and Rodriguez-Martin, 1998). Trephination was, however, the very first neurosurgery performed in Africa (El Khamlichi, 1998) and there are multiple cases as evidence of African tribe healers performing this procedure from the Middle Ages until the middle twentieth century (El Khamlichi, 1998).

The healed lesion of individual D_B4 could indicate either a therapeutic or magical intervention dependant on the 'surgeon'. The craniostenosis in this individual as well as the presence of occipital protrusion could suggest problems with raised intracranial pressure or other neurological conditions which might have resulted in a variety of symptoms such as headaches, vertigo, coma, or convulsions which trephination was said to treat (Lisowski, 1967). It is, however, reported that the main motivation for trephination from African evidence seems to have been to treat headaches or wounds after head injuries (El Khamlichi, 1998). Females also often resorted to trephination to relieve symptoms associated with the aftermath of continuous physical abuse in relationships (Majno, 1991). Although it should be considered that the lesion on the skull of individual D_B4 could have been the result of any type of trauma, the structure of the lesion and presence of craniostenosis (thus motivation for trephination) suggest that the lesion is a result of a trephination procedure rather than random trauma.

5.3 Pathology

5.3.1 Treponemal disease

Skeletal material of all collections were investigated for possible signs of infectious disease, and signs of possible treponemal disease were found. Treponemal disease is characteristically evident on cranial remains as gummatous lesions whereas postcranial remains exhibit sub-periosteal growth on the tibia, also known as sabre-shin. Monk' Kop, Ashford Farms and the Dambarare individuals of African descent did not present with any affected individuals. Two Dambarare individuals, both of European ancestry, were identified with signs of possible treponemal disease (Table 5.2).

Individual D_AA3, a young male of 25-35 years, presented with four possible healed gummatous lesions on the skull, specifically on the parietal bones (Figure 5.13 and Figure 5.14). This individual also had slight periostitis of the fibulae and tibiae on both sides. Individual D_AA3 also presented with enamel hypoplasia on permanent dentition and a fused rib 1 and 2 on the left side. The combination of possible gummatous lesions and periostitis in the lower limb bones therefore suggests the possibility of treponemal disease. The enamel hypoplasia and developmental anomalies are, however, most likely unrelated to the possibility of the identified infectious disease.

An adult of age at death of 55-70 years, (individual D_C5) showed mild periostitis in left and right fibulae as well as possible sabre-shin tibiae on both sides. Due to the lack of additional signs in the rest of the skeleton (such as gummatous lesions in the skull); this individual could have suffered from any of the treponemal syndromes or any type of infection that could have led to the subperiosteal bone deposition. Individual D_C5 also presented with enamel hypoplasia and fractures of metacarpals III, IV and V of the right hand which resulted in a bowed appearance due to misalignment during healing. The enamel hypoplasia and fractures are also most probably unrelated to the possibility that this individual could have suffered from treponemal disease.

An additional tibia of unknown ancestry and sex which could not be successfully paired to any of the Dambarare individuals also showed sabre-shin deformities, but again due to lack of additional evidence, the specific condition could not be confirmed.

Figure 5.15 is a close up image of the left femur of a Dambarare individual (D_AAMisc6) of unknown sex and ancestry showing an unknown partially-healed lesion on the posterior aspect of this long bone. The type of lesion compares well with examples of possible yaws cases in a Swahili population recently investigated by (Morris et al., 2014), however the lesion can also possibly be attributed to a wound that could have become septic. Due to the fact that this femur is the only specimen representing this individual, it is difficult to provide a differential diagnosis. Due to this fact, individual D_AAMisc6 was also not added as a possible case of treponemal disease.

As can be seen in Table 5.3, a total of 5.0% (Na=2; n=40) of the total Dambarare skeletal collection (European and African) showed evidence of treponemal disease, of which both cases were individuals of European descent (Na=2; n=14). No African individuals of any of the three studied populations showed any signs of treponemal activity. Only one individual in each of the Mapungubwe/K2 (n=106) and Venda (n=113) populations exhibited skeletal lesions suggestive of treponemal disease, thus the European individuals of Dambarare showed a significantly higher (14.3%) prevalence of treponemal disease when compared to the Venda (χ^2=9.70; p=0.0018) and Mapungubwe/K2 (χ^2=15.40; p=0.0018) collections.

5.3.2 Degenerative conditions

Remarkably few individuals with degenerative changes were observed. Arthritic changes were observed in two individuals from Monk's Kop only (Table 5.4). No signs of arthritic disease were observed in the Ashford Farms or Dambarare collections. It should however be kept in mind that the Ashford Farms collection comprised of only cranial remains.

A clear case of osteoarthritis can be seen in sub-collection M_113b. The patella associated with this group of bones showed both severe eburnation on the lateral articulating facet as well as osteophyte formation on all patellar borders and pitting, which are typical features of this disease (Figure 5.16). Due to the fact that this patella was part of the commingled remains, it could not be allocated as belonging to a specific individual.

Individual M_257 showed sclerotic bone formation as well as osteophytic growths on the joint margin at the condylar processes of the mandible which suggests temporomandibular joint involvement. This individual was only represented by the mandible, thus no skull was available for further confirmation.

As can be seen in Table 5.5, the prevalence of 2.3% (Na=2) of Monk's Kop individuals (n=43) presenting with skeletal signs of arthritic involvement compares well with the Mapungubwe/K2 population at 1.9% (Na=2) and thus showed no statistically significant difference ($\chi^2 = 0.03$; $p = 0.8628$). The Venda population showed a slightly higher prevalence of 7.1% (Na=8) of individuals affected, but was not significantly different to that of Monk's Kop ($\chi^2=0.03$; $p=0.8628$). Toutswe, however showed evidence of half (Na=11) of its applicable population (n=22) being affected by arthritic changes, thereby resulting in this site being significantly different to all populations investigated in this study as well as Mapungubwe/K2 and Venda. A significant statistical difference between the affected Monk's Kop population and that of Toutswe at a p-value of 0.0001 ($\chi^2=21.97$), most probably due to the older average age at death of the Toutswe skeletal remains (Mosothwane, 2004).

The formation of osteophytes was only observed in the Monk's Kop collection, thus this type of lesion was not observed in either the Ashford Farms or Dambarare populations (Table 5.6). Five sub-collections presented with, in some cases, multiple osteophyte formations which resulted in a total of 12 specimens in total being affected by these lesions. The vertebral column presented with the most affected specimens at 41.7% (Na=5) whereas the sacrum and lower limb specimens were represented by two affected elements each (16.7%). The ribs, upper limb and hip bones were only represented by one specimen each (8.3%).

Individual M_37b, a sub-collection of adult bones of unknown sex, showed severe osteophytic growths on the body of lumbar vertebra 1 as can be seen in Figure 5.17.

Osteophytosis in individuals with vertebrae are shown in Table 5.7 and compared with other skeletal populations. It is important to note that the number of affected individuals from Monk's Kop indicated in this table was based on the fact that two L1 vertebrae displayed osteophytic growths. The two L1 vertebrae indicated therefore that at least two of the 17 minimum number of individuals investigated with observable vertebrae were affected by this condition. The 11.8% (Na=2) prevalence of the Monk's Kop collection compares well with that of 16.8% of the Venda population (Na=19; n=119) and therefore no statistical differences were found between these two populations. Mapungubwe/K2, however, showed a substantially higher prevalence of 44.4% (Na=4; n=9) of individuals presenting with osteophytosis (Table 5.7), which resulted in a significant difference observed between the population of Mapungubwe/K2 and the Dambarare individuals of European descent (χ^2=6.11; p=0.0134) as well as the Venda population (χ^2=4.16; p=0.0414).

5.3.3 Non-specific periostitis

Periosteal lesions were observed in the Dambarare skeletal collection in individuals of African and European origin, but none were identified in the Monk's Kop and Ashford Farms populations. Once again it should be kept in mind that Ashford Farms only comprised of cranial remains.

Table 5.8 provides details regarding the bones affected by sub-periosteal reactions and provides a prevalence related to which bones were most affected. Only adult male individuals showed signs of this non-specific indicator of pathology. The fibula was affected most frequently (50%), followed by the tibia (33%) and lastly only one case of a humerus (16.7%). Individual D_A8, a male of indeterminate ancestry, showed extensive involvement as can be seen in Figure 5.18.

The Dambarare analysis resulted in a prevalence of 21% (Na=3) for the Europeans (n=14) and 14% (Na=1) for the African population (n=7). Both figures are substantially higher than that of the 5.7% (Na=6) affected individuals of Mapungubwe/K2 (n=106) and the 6.2% (Na=7) affected individuals of Venda (n=113). Only the European contingent of the Dambarare population that showed statistically significant differences to the comparative populations of Mapungubwe/K2 (χ^2=4.43; p=0.0353), Toutswe (χ^2=11.46; p=0.0007) and Venda (χ^2=4.43; p=0.0353) as can be seen in Table 5.9. Monk's Kop and Ashford Farms however compare well with Toutswe as no skeletal evidence of non-specific periostitis was found at either of these two sites.

5.3.4 Cribra orbitalia

Individuals with observable orbits from all three skeletal collections studied were investigated for the presence of cribra orbitalia. The total of 45 individuals comprised of 16 Monk's Kop individuals, seven Ashford Farms individuals, 13 Dambarare individuals of European descent, seven Dambarare individuals of African descent and two individuals of unknown ancestry from the Dambarare collection. There were only two (12.5%) Monk's Kop individuals that presented with the porosity of the orbital roof as evidence of possible cases of healed cribra orbitalia (Table 5.10). Neither Dambarare (χ^2=2.90; p=0.0884) nor Ashford Farms individuals showed any signs of this condition; however, it was not statistically significantly different to that of Monk's Kop due to the small sample sizes (Table 5.11).

Individual M_430a is a young African male of age at death 18-22 years who presented with cribra orbitalia in both orbits (Figure 5.19). The right orbit showed a combination of small and larger foramina, clustered together in the superior-lateral aspects of the orbit. This orbit can be scored as "medium" (Stuart-Macadam, 1985) as it presents with small and large isolated foramina that have linked to form a trabecular structure. It can also be scored as a "3" (Steckel et al., 2005) as it covers more than 1 cm^2 with clustered foramina of various sizes. The left orbit presented with a smaller area of mostly larger foramina and although the severity of the lesions was slightly less than those of the right orbit, it can still be scored according to the Stuart-Macadam (1985) system as "medium". The affected area of the left orbit is however substantially smaller than that of the right orbit and can therefore be scored as "2" on the Steckel et al. (2005) scoring system as it covered an area less than 1 cm^2. The exterior of the skull did not present with any signs of porotic hyperostosis, as is often the case (Stuart-Macadam, 1989a; Walker et al., 2009).

This individual was only represented by a complete skull and mandible. Sub-collection M_430b, however, showed possible association with identified individual M_430a with respect to age estimation. The sub-collection M430b comprised of fractured, but present scapulae (medial border and inferior angle un-united), a right humerus (proximal epiphysis non-united), both ulnae (distal epiphysis non-united), radii (distal epiphyses non-united), fibulae (proximal epiphyses non-united), tibiae (proximal epiphyses non-united), non-united distal epiphyses of both femora, several vertebrae (annular rings non-united) as well as a few metacarpals and two ribs. These open and partial unions of the elements in sub-collection 430b correlated (Schaefer et al., 2008) with the age estimation of the cranial elements. Unfortunately it could not be confirmed that M_430a and M_430b did indeed belong to the same individual as no elements were present (such as C1) that could confirm the association. There was, however, no pathology identified on these postcranial remains which could shed more light on the cribra orbitalia of the skull of M_430a. The skull of this individual also did not show any other signs of pathology, except for the cribra orbitalia and therefore the cause of the cribra orbitalia could be due to a variety of factors including iron-deficiency anemia, periostitis, osteomyelitis, osteitis as well as secondary effects of diseases such as Vitamin C deficiency, scurvy, hemangioma and osteopenia. Diet has also been suggested to play a role in the presentation of cribra orbitalia, thus this individual's socio-economic status could also have possibly influenced his diet which in turn could have been a factor in the formation of this lesion (Ortner, 2003; Wapler et al., 2004; Walker et al., 2009; Brickley and Ives, 2010).

Individual M_450 (African child of 9-11 years) showed signs of slight, healed cribra orbitalia in both orbits, but also presented with various other signs of pathology which were discussed in detail previously. Due to the incomplete orbits the cribra could not be scored

As can be seen in Table 5.11, the prevalence (Na= 2; 12.5%) of cribra orbitalia in the Monk's Kop collection (n=16) is comparable to that of Toutswe (Na=6; 17.1%), but substantially less than that from Mapungubwe/K2 (Na=14; 37.8%). However, there was no statistical difference between Monk's Kop and Mapungubwe/K2 (χ^2=3.40; p=0.0651) or the Toutswe populations (χ^2=0.18; p=0.6726). Due to the Venda population resulting in no cases of cribra orbitalia, there is a significant difference between this population and Monk's Kop (χ^2=5.56; p=0.0183). Neither Ashford Farms, (pre-European contact site) nor Dambarare and Venda (post-European contact sites) showed any evidence of cribra orbitalia.

5.3.5 Enamel hypoplasia

All individuals were investigated for the presence of enamel hypoplasia. As can be seen in Table 5.1, it is clear that the Dambarare population was most affected by this condition (7 individuals), whereas Ashford Farms had two individuals showing enamel hypoplastic lesions and Monk's Kop only one.

Table 5.12 compares the prevalence of enamel hypoplasia of all three collections by providing the prevalence of enamel hypoplasia using the total number of teeth investigated as well as the teeth that presented with enamel hypoplastic lesions per tooth type. The following descriptives will be used to describe the different types of prevalence:

NTA/n = Prevalence of the number of teeth affected by enamel hypoplasia (TNA) in relation to the total number of teeth investigated (n) in the sample per tooth type.

$NTA/TNTA$ = Prevalence of the number of teeth affected by enamel hypoplasia (TNA) in relation to the total number of teeth affected by enamel hypoplasia ($TNTA$) per tooth type.

A total prevalence of teeth affected (irrespective of tooth type) in relation to the total number of teeth affected will also be provided, as well as the percentage of individuals affected (calculated out of the total number of individuals with permanent teeth). No enamel hypoplasia was observed on deciduous teeth; therefore the quoted figures and statistics only include permanent dentition.

All lesions observed in all the collections studies were linear and in many cases were represented by multiple lines as can be seen in Figure 5.20. This figure shows the right mandibular canine and both premolars of individual D_A2 affected by this condition, as an example.

The Monk's Kop collection showed involvement of only one individual (M_450), where the anterior teeth of the mandible of this individual, i.e. all four incisors, both canines and first premolars (Figure 5.5) were affected. Multiple enamel hypoplastic lesions could be observed. As can be seen in Table 5.12, this resulted in a NTA/n

prevalence of 21.1% (*NTA*=2; *n*=19) for incisor 1, 14.7% (*NTA*=2; *n*=34) for incisor 2, 14.9% (*NTA*=2; *n*=47) for the canine and only 1.8% (*NTA*=2; *n*=57) for the first premolar. Due to the equal representation of anterior teeth being affected per total teeth affected by enamel hypoplasia, the NTA/TNTA prevalence for the incisors, canines and premolar 1 was 25.0% (*NTA*=2; *TNTA*=8). In total, there were thus only 1.9% (*NTA*=8) of the teeth investigated in the Monk's Kop collection (*n*=423) that showed evidence of enamel hypoplasia (Table 5.12).

The Ashford Farms collection displayed the highest total prevalence (11.3%) of teeth affected (*NTA*=6) per number of teeth investigated (*n*=53) and interestingly only affected the posterior teeth. Premolars were affected at 20% (*NTA*=1; *n*=5) and 33% (*NTA*=3; *n*=9) for first premolar and second premolar respectively, and at 13% (*NTA*=2; *n*=15) for the first molar. As can be seen in Table 5.12, the second premolar was the tooth type that was mostly affected by enamel hypoplastic lesions in this skeletal collection at a *TNA*/*TNTA* prevalence of 50.0% (*NTA*=3; *TNTA*=6).

The total prevalence of teeth affected per number of teeth investigated in the Dambarare collection was 4.6% (*NTA*=19; *n*=413). The European population, however, had a significantly (χ^2=4.89; *p*=0.0270) higher prevalence of 6.1% (*NTA*=17; *n*=277) compared to the individuals of African ancestry of 1.5% (*NTA*=2; *n*=136). In the European population the canines were mostly affected with prevalences of 3.2% (*NTA*=1; *n*=31), 27.8% (*NTA*=10; *n*=36), 13.2% (*NTA*=5; *n*=28) and 2.7% (*NTA*=1; *n*=37) for the second incisor, canine and two premolars respectively. The African population were only represented by two affected first incisors with a *TNA*/*n* prevalence of 20.0% and a 100.0% prevalence for *NTA*/*TNTA* (Table 5.12).

Due to the single individual affected in the Monk's Kop population (2.6%; n=38), this collection was statistically less affected than Ashford (χ^2=9.51; *p*=0.0020), Dambarare (χ^2=14.7; *p*=0.0001), Mapungubwe/K2 (χ^2=35.78; *p*=0.0001) and Toutswe (χ^2=10.97; *p*=0.0009) as can be seen in Table 5.13. The prevalence in the Venda population (Na=12), however, did not differ statistically (χ^2=3.35; *p*=0.00671) from the Monk's Kop population (Table 5.13).

As explained above, two of the five individuals (40.0%) of the Ashford Farms population were affected by this condition and only showed a significant difference to the Monk's Kop collection (Table 5.13).

The European individuals of Dambarare (n=13) showed the highest prevalence of enamel hypoplasia at 53.8% (Na=7), which was significantly different from the much lower prevalences of the Monk's Kop (2.6%) and Venda (13.3%) populations (Table 5.13). A total of 28.6% of the Dambarare individuals of African descent were affected by enamel hypoplasia, and although lower than that of the European individuals, this difference was not statistically significant (χ^2=1.17; *p*=0.2785). More than half of the Mapungubwe/K2 individuals (63.3%) displayed evidence of hypoplasia, which compares to that of the European Dambarare individuals (Table 5.13).

5.3.6 Schmorl's nodes

Rounded depressions in the superior and inferior surfaces of the vertebral bodies, known as Schmorl's nodes, were only identified in the European population of Dambarare. Two male individuals, D_A1 and D_A3, as well as an adult male of 25-35 years of age (individual D_AA2,) presented with possible Schmorl's nodes on the thoracic and lumbar vertebrae as can be seen in the example in Figure 5.21. Lumbar vertebrae were the mostly affected (60%) whereas the involvement of thoracic vertebrae was lower at 40%. Monk's Kop and Ashford Farms showed no evidence of Schmorl's nodes (Table 5.14).

Table 5.15 compares the prevalence of Schmorl's nodes of all three populations as well as the Venda population which was the only comparative site affected by this type of lesion. The individuals from Dambarare were significantly more affected than those of Monk's Kop (χ^2=5.19; *p*=0.0227) and the Venda population (χ^2=10.60; *p*=0.0011) which had a substantially lower prevalence of 3.5% (*Na*=4, *n*=113). The individual prevalence was calculated utilising only individuals investigated with observable vertebrae. In the case of Monk's Kop, the minimum number of individuals (MNI) as described in Chapter 4 was used. The high prevalence of Schmorl's nodes in the Dambarare skeletal collection is not comparable to any of the comparative sites as it is only Venda that presented with a small number of individuals (3.5%) being affected by this vertebral lesion. All pre-contact sites therefore showed no evidence of Schmorl's node formation.

5.4 Trauma

5.4.1 Fractures

Evidence of fractures, mostly healed, was found in both the Monk's Kop and Dambarare collections (Table 5.16). Figure 5.22 shows the possible healed fractures of the metacarpals III, IV and V of the right hand of individual D_C5, an adult male of European ancestry between the ages of 55 and 70. Although there is clear evidence of healing and new bone formation, these multiple fractures have resulted in the abnormal bowed appearance and subsequent misalignment of the affected metacarpals. Individual M_232 of the Monk's Kop collection had a healed rib fracture with accompanying callus formation. D_A7 and D_CMiscElem7 also provided evidence of healed factures of the fibula and humerus, respectively. The fibula of individual D_A7 showed very little mal-alignment after healing, however a large amount of bone deposition took place around the affected area. The humerus of D_CMiscElem7, however did not heal optimally, subsequently resulting in the angle between the head and shaft being accentuated.

Table 5.17 compares the prevalence of fractures in the three studied sites with that of comparative populations. The prevalence of fractures of the Monk's Kop population was 2.3% (Na=1; n=43) and is similar to that of Toutswe at 2.4% (*Na*=4; *n*=84), whereas the complete Dambarare population showed a prevalence of 5.0% (*Na*=2; *n*=40) similar to that of the Venda population at 7.1% (*Na*=8; *n*=113). If, however, the individuals of Dambarare of European descent are inspected separately, a prevalence of 14.3% (*Na*=2; *n*=14) is higher than that of Monk's Kop (2.3%), but still did not prove to be statistically significant (χ^2=3.03; *p*=0.0817). One must therefore keep in mind that the small population size might give a distorted view of the prevalence. The European sample does however differ significantly with that of the 8.3% (χ^2=9.03; *p*=0.0027) prevalence of the Mapungubwe/K2 population as well as with the 4.8% (χ^2=4.34; *p*=0.0371) of the Toutswe collection. Although the European sample is also much more affected (14.3%) as compared to the Venda population (7.1%), this difference was not statistically significant (χ^2=0.89; p=0.3450).

5.4.2 Sub-luxations

Sub-luxations were only evident in once case of the Monk's Kop population (M_160). Figure 5.23 shows a possible case of chronic dislocation of the acromio-clavicular joint evident from the additional bone formation on the lateral extremity of the right clavicle. Unfortunately the associated scapula was not present for investigation and ultimate confirmation of this case.

5.4.3 Unknown traumatic injuries

Possible trauma of unknown cause is evident in two cases in the Monk's Kop population and one case in the Dambarare collection. Sub-collection M_154, from the Monk's Kop collection displays an unknown indentation which could either be attributed to trauma or osteomyelitis (possible cloacae). The tibia of this individual shows two affected areas of which one is an irregular foramen (approximately 1 cm x 0.5 cm) situated on the anterior distal aspect of the shaft, whereas the other is a shallow indentation more proximally on the shaft. This specimen unfortunately showed a large amount of post-mortem damage from both the excavation and animal activity, thus a differential diagnosis of the cause of the pathology could not be determined.

The posterior edge of the foramen magnum of sub-collection M_297 has an abnormal cut-like appearance which can clearly be seen in Figure 5.24, but is of unknown cause.

Possible traumatic injury of a femur shaft was observed in individual D_AAMisc6 of unknown sex and ancestry – this case was also mentioned as a possible case of yaws under section 5.3.1. Due to the poor preservation and commingled nature of this specimen, this individual was only represented by this left femur. The specimen clearly involved new bone growth but the lesion was associated with secondary infection. This is might therefore possibly be a case of open wound trauma with new bone formation evident, but was also previously discussed as a possible case of yaws and the cause remains inconclusive.

The cases described in this section could not be confirmed as traumatic lesions, thus were therefore not included in any statistical analyses of trauma.

5.5 Developmental anomalies

Two cases were identified where the individual did not reach adult age and were identified with a possible developmental anomaly.

Individual M_285 of Monk's Kop, an individual of unknown sex and approximate age of 3-5 years, displayed an open anterior fontanelle (Figure 5.25). The anterior fontanelle closes on average between 12 and 24 months, but should be completely obliterated by the age of 2 (Schaefer et al., 2008; İşcan and Steyn, 2013). The metopic suture of individual M_285 was completely closed and the anterior fontanelle only slightly open, as can be seen in Figure 5.25. This individual showed no other signs of pathology and was represented by only the skull. Poor health, chronic illness, genetic abnormalities, malnutrition and endocrine disorders have been suggested to be possible causes of delayed or persistent open fontanels (Steyn et al., 2002; Ortner, 2003; Kliegman, 2007). Due to the small size of this open fontanelle and the fact that there are no other pathological lesions, it is unlikely that this individual suffered of a genetic, congenital or endocrine abnormality. This individual however did not reach adult age and although it cannot be confirmed, the presence of an open fontanelle could imply poor health, chronic illness or malnutrition during childhood. The incomplete remains and limited pathological observations however prevented further analysis.

Individual M_450, an individual of unknown sex and age at death of 9-11 years, displayed a defect in the left parietal bones which resulted in an asymmetric cranium. This individual presented with various other skeletal lesions as discussed in detail earlier in this chapter. No cases of spina bifida were observed.

5.6 Miscellaneous findings

A summary and brief description of miscellaneous findings in all three collections studied can be seen in Table 5.18. These findings would have had no detrimental effect on the life expectancy of the particular individual.

Sub-collection M_288 from Monk's Kop, an adult of unknown age, showed evidence of an unfused transverse line between sections 3 and 4 of the body of the sternum which resulted in a sternal foramen. Due to the small size of the foramen, it has no clinical significance and the individual was most likely not aware of this developmental abnormality.

A unilateral mandibular torus was observed on the left inner aspect of the mandible of individual M_290, an adult female of the Monk's Kop population. This individual was only represented by the mandible and also showed dental crowding.

Two of the Europeans of Dambarare showed anomalies related to the thorax as individual D_A7 (male, approximate age 40-55) presented with a manubrium with full articulation facets on the manubrium for ribs 1 and 2, as well as a demi-facet for rib 3. Individual D_AA3, a male individual of approximate age at death 25-35 years, presented with a unilateral defect as ribs 1 and 2 on the left side were fused.

5.7 Skeletal health comparison of individuals of African ancestry

Table 5.19 provides a summary of all skeletal indicators of pathology, trauma and developmental anomalies of the individuals of African descent and therefore compares the skeletal health of the three skeletal collections. This summary specifically attempts to compare the health status of the African populations from northern Zimbabwe in an era prior to European contact to that of the period post-European contact. For this reason, the Monk's Kop and Ashford Farms data were combined to represent the pre-European Zimbabwe period which was then compared to the post-European contact site of Dambarare (African individuals only). Unfortunately the sample sizes for statistical analysis are not equal for the two periods, and are small.

No specific infectious diseases were identified in any of the African individuals. Arthritic changes were displayed in only one individual in the pre-European contact period, but did not result in a statistically significant difference (χ^2=0.14; p=0.7058). The same situation occurred with regard to the sub-periosteal lesions where only one individual in the post-European contact period was affected. Cribra orbitalia was identified in two possible cases in the pre-contact period which resulted in no statistical significant difference (χ^2=0.65; p=0.4193) between the pre-and post- European contact periods.

Enamel hypoplastic lesions were present in both groupings, with the post-European contact group showing a higher prevalence at 28.6% (*Na*=2; *n*=7) in comparison to the 7.0% (*Na*=3; *n*=43) for the pre-European contact sites. However, this difference was not statistically significant (χ^2 = 3.12; p=0.0774). Schmorl's nodes were not present in any of the populations of African descent. Osteophytic growths were found in only the pre-European contact site, as two of the possible 17 Monk's Kop individuals presented with osteophytosis. This could possibly be related to the fact that the Monk's Kop population had a higher average age at death than that of the other two populations.

Traumatic injuries were identified in both contact periods; however the post-European contact period had a higher prevalence of 14.3% (Na=1; n=7) in comparison with the 2% (Na=4; n=50) in the pre-European contact period. This difference was not statistically significant (χ^2=2.74; p=0.0980).

In summary, the African post-European contact population of Dambarare seemed to have been less healthy as only 57.1% (n=7) of individuals did not display any skeletal manifestations in comparison to the seemingly healthier pre-European contact sites of Monk's Kop and Ashford Farms at 82% (n=50). Although the prevalence of pathological manifestations are higher in the Dambarare individuals of African descent, there is no statistical difference between the numbers of individuals affected (χ^2=2.28; p=0.1308). Small sample sizes played a role. Osteoarthritis and Schmorl's nodes are, however, related to lifestyle and age-related changes, rather than a demonstration of poor health.

Table 5.1: A summary of accession numbers presenting with skeletal lesions in all collections studied.

Collection (Ancestry)	Skeletal observation									
	Treponemal disease	**Arthritic changes**	**Sub-periosteal lesions**	**Cribra orbitalia**	**Enamel hypoplasia**	**Schmorl's nodes**	**Osteophytosis**	**Trauma**	**Developmental anomalies**	**Miscellaneous findings**
Monk's Kop (African)	-	M_113b* M_257	-	M_430a **M_450**	**M_450**	-	M_37b M_160* M_167* M_300* M_400b* M_401	M_154* M_160* M_232* M_297	**M_450** M_285	M_288 M_290
Ashford (African)	-	-	-	-	A_2 A_7	-	-	-	-	-
Dambarare (European)	**D_AA3** **D_C5**	-	**D_A2** **D_A3** **D_C5**	-	**D_A1** D_AA1 **D_AA2** **D_AA3** **D_A2** D_C2 **D_C5**	**D_A1** **D_A3** **D_AA2**	-	**D_A7** **D_C5**	-	**D_AA3** **D_A7**
Dambarare (African)	-	-	D_E1	-	D_B2 D_B3	-	-	D_B4	-	-
Dambarare (Indeterminate)	D_C_MiscElem7*	-	D_A8	-	-	D_AA4	-	D_AAMisc6 D_CMiscElem7*	-	-
Individuals affected	**2**	**1**	**5**	**2**	**12**	**4**	**2**	**5**	**2**	**4**

*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)
Bolded accession numbers: Individuals presenting with skeletal lesions related to multiple pathological conditions

Table 5.2: The prevalence of treponemal disease and the bones presenting with signs of the condition in all collections studied

Collection	Ancestry	Collection number	Sex	Age	Bones affected		
					Skull	Tibia	Fibula
Monk's Kop	African	-	-	-			
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Ashford	African	-	-	-			
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Dambarare	European	D_AA3	Male	25-35	1	1	1
		D_C5	Male	55-70		1	
	African	-	-	-			
	Indeterminate	D_C_MiscElem7*	Unknown	Adult		1	
				Total	**1**	**3**	**1**
				% (*Na* =5)	**20.0**	**60.0**	**20.0**

Na = Total number of bones presenting with signs of treponemal disease in the specific collection
% = The prevalence of the specific bone presenting with signs of treponemal disease in relation to the total number of bones (*Na*) presenting with signs of the same condition in the specific collection
*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)

Table 5.3: The prevalence of treponemal disease observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare			Mapungubwe K2	Venda
						European	African	Total		
Monk's Kop*	This study 13th -15th Century Zimbabwe	African: ***n* = 43**	χ^2		-	6.37	-	2.20	0.41	0.38
		% (*Na* = 0) = 0.0	*p*		-	0.0116	-	0.1377	0.5228	0.5360
Ashford	This study 14th - 15th Century Zimbabwe	African ***n* = 7**	χ^2			-	-	0.37	0.07	0.06
		% (*Na* = 0) = 0.0	*p*			-	-	0.5454	0.7963	0.8026
Dambarare	This study 17th Century Zimbabwe	European ***n* =14**	χ^2				1.11		15.40	9.70
		% (*Na* = 2) = 14.3	*p*				0.2931		0.0001	0.0018
		African ***n* = 7**	χ^2						0.07	-
		% (*Na* = 0) = 0.0	*p*						0.7963	-
		Total ***n* = 40**	χ^2						2.37	2.60
		% (*Na* = 2) = 5.0	*p*						0.1233	0.1067
Mapungubwe K2	(Steyn, 1994) 11th -14th Century South Africa	African ***n* = 106**	χ^2							0.94
		% (*Na* = 1) = 0.9	*p*							0.3317
Venda	(L'Abbé, 2005) 20th Century South Africa	African ***n* = 113**	χ^2							
		% (*Na* = 1) = 0.9	*p*							

n = Total number of individuals investigated
* MNI (based on mandibles) used for all calculations incorporating total individuals for collection
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.4: The prevalence of arthritic changes and the bones presenting with signs of such changes in all collections studied.

Collection	Ancestry	Collection number	Sex	Age	Bones affected		
					Patella	Phalanx	TMJ
Monk's Kop	African	M_113b*	Unknown	Adult	1	1	
		M_257	Male	Adult			1
				Total	**1**	**1**	**1**
				% (*Na* =3)	**33.3**	**33.3**	**33.3**
Ashford	African	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Dambarare	European	-	-	-	-	-	-
	African	-	-	-	-	-	-
	Indeterminate	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**

Na = Total number of bones presenting with signs of arthritic change in the specific collection
% = The prevalence of the specific bone presenting with signs of arthritic change in relation to the total number of bones (*Na*) presenting with signs of the same condition in the specific collection
*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)

Table 5.5: The prevalence of arthritic changes observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Mapungubwe K2	Toutswe	Venda
Monk's Kop*	This study 13th-15th Century Zimbabwe	African: **n = 43** **% (Na = 1) = 2.3**	χ^2		-	0.33	0.17	0.94	0.03	21.97	1.29
			p		-	0.5648	0.6836	0.3319	0.8628	0.0001	0.2551
Ashford	This study 14th - 15th Century Zimbabwe	African **n = 7** **% (Na = 0) = 0.0**	χ^2			-	-	-	0.13	5.64	0.53
			p			-	-	-	0.1739	0.0176	0.4662
Dambarare	This study 17th Century Zimbabwe	European **n =14** **% (Na = 0) = 0.0**	χ^2				-		0.27	10.08	1.06
			p				-		0.6043	0.0015	0.3037
		African **n = 7** **% (Na = 0) = 0.0**	χ^2						0.13	5.64	0.53
			p						0.7139	0.0176	0.4662
		Total **n = 40** **% (Na = 0) = 0.0**	χ^2						0.77	24.31	2.99
			p						0.3817	0.0001	0.0839
Mapungubwe K2	(Steyn, 1994) 11th-14th Century South Africa	African **n = 106** **% (Na = 2) = 1.9**	χ^2							46.22	3.38
			p							0.0001	0.0658
Toutswe	(Mosothwane, 2004) 8th -13th Century Botswana	African **n = 22** **% (Na = 11) = 50.0**	χ^2								28.05
			p								0.0001
Venda	(L'Abbé, 2005) 20th Century South Africa	African **n = 113** **% (Na = 8) = 7.1**	χ^2								
			p								

n = Total number of individuals investigated
* MNI (based on mandibles) used for all calculations incorporating total individuals for collection
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.6: The prevalence of osteophytosis and the areas presenting with such lesions in all collections studied.

Collection	Ancestry	Collection number	Sex	Age	Areas affected: Vertebrae	Sacrum	Ribs	Upper limb	Hip	Lower limb
Monk's Kop	African	M_37b	Unknown	Adult	1					
		M_160*	Unknown	Adult	1					
		M_167*	Unknown	Adult	1					
		M_300*	Unknown	Adult			1			1
		M_400b*	Unknown	Adult	1	1			1	
		M_401	Male	Adult	1	1		1		1
				Total	**5**	**2**	**1**	**1**	**1**	**2**
				% (*Na* =12)	**41.7**	**16.7**	**8.3**	**8.3**	**8.3**	**16.7**
Ashford	African	-	-	-	-	-	-	-	-	-
				Total	**0**	**0**	**0**	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Dambarare	European	-	-	-	-	-	-	-	-	-
	African	-	-	-	-	-	-	-	-	-
	Indeterminate	-	-	-	-	-	-	-	-	-
				Total	**0**	**0**	**0**	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Na = Total number of areas presenting with osteophytes in the specific collection
% = The prevalence of the specific areas presenting with osteophytes in relation to the total number of areas (*Na*) presenting with such growths in the specific collection
*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)

Table 5.7: The prevalence of osteophytosis observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Mapungubwe K2	Toutswe	Venda
Monk's Kop*	This study 13th-15th Century Zimbabwe	African: **n = 17**	χ^2		-	1.39	0.39	1.88	3.54	-	0.28
		% (Na^1 = 2) = 11.8	p		-	0.2378	0.5312	0.1701	0.0599	-	0.5979
Ashford	This study 14th - 15th Century Zimbabwe	African **n = 0**	χ^2			-	-	-	-	-	-
		% (Na = 0) = 0.0	p			-	-	-	-	-	-
Dambarare	This study 17th Century Zimbabwe	European **n =11**	χ^2				-		6.11	-	2.18
		% (Na = 0) = 0.0	p				-		0.0134	-	0.1394
		African **n = 3**	χ^2						2.00	-	0.60
		% (Na = 0) = 0.0	p						0.01573	-	0.4373
		Total **n = 15**	χ^2						8.00	-	2.96
		% (Na = 0) = 0.0	p						0.0047	-	0.0853
Mapungubwe K2	(Steyn, 1994) 11th-14th Century South Africa	African **n = 9**	χ^2							-	4.16
		% (Na = 4) = 44.4	p							-	0.0414
Venda	(L'Abbé, 2005) 20th Century South Africa	African **n = 113**	χ^2								
		% (Na = 19) = 16.8	p								

n = Total number of individuals investigated with vertebrae
* MNI (based on mandibles) used for all calculations incorporating total individuals for collection
Na = Number of individuals affected by the condition
Na^1 = Number is based on the fact that two L1 vertebrae were affected, which confirms a minimum number of two individuals affected
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.8: The prevalence of non-specific sub-periosteal lesions and the bones presenting with such lesions in all collections studied.

Collection	Ancestry	Collection number	Sex	Age	Bones affected		
					Humerus	Tibia	Fibula
Monk's Kop	African	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Ashford	African	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Dambarare		D_A2	Male	40-55	1		
	European	D_A3	Male	45-55			1
		D_C5	Male	55-70		1	1
	African	D_E1	Male	30-45		1	
	Indeterminate	D_A8	Male	45-60			1
				Total	**1**	**2**	**3**
				% (*Na* =6)	**16.7**	**33.3**	**50.0**

Na = Total number of bones presenting with signs of non-specific sub-periosteal lesions in the specific collection
% = The prevalence of the specific bone presenting with signs of non-specific sub-periosteal lesions in relation to the total number of bones (*Na*) presenting with signs of the same lesions in the specific collection

Table 5.9: The prevalence of non-specific sub-periosteal lesions observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Mapungubwe K2	Toutswe	Venda
Monk's Kop*	This study 13th -15th Century Zimbabwe	African: ***n* = 43** **% (*Na* = 0) = 0.0**	χ^2		-	9.73	6.27	5.72	2.54	-	2.79
			p		-	0.0018	0.0123	0.0168	0.1113	-	0.0949
Ashford	This study 14th - 15th Century Zimbabwe	African ***n* = 7** **% (*Na* = 0) = 0.0**	χ^2			1.75	1.08	0.98	0.42	-	0.46
			p			0.1859	0.2994	0.3224	0.5177	-	0.4974
Dambarare	This study 17th Century Zimbabwe	European ***n* =14** **% (*Na* = 3) = 21.4**	χ^2				0.15		4.43	11.46	3.99
			p				0.6944		0.0353	0.0007	0.0459
		African ***n* = 7** **% (*Na* = 1) = 14.3**	χ^2						0.84	7.41	0.69
			p						0.3592	0.0065	0.4050
		Total ***n* = 40** **% (*Na* = 5) = 12.5**	χ^2						1.95	6.75	1.62
			p						0.1626	0.0094	0.2024
Mapungubwe K2	(Steyn, 1994) 11th -14th Century South Africa	African ***n* = 106** **% (*Na* = 6) = 5.7**	χ^2							3.00	0.03
			p							0.0832	0.08673
Toutswe	(Mosothwane, 2004) 8th -13th Century Botswana	African ***n* = 51** **% (*Na* = 0) = 0.0**	χ^2								3.30
			p								0.0693
Venda	(L'Abbé, 2005) 20th Century South Africa	African ***n* = 113** **% (*Na* = 7) = 6.2**	χ^2								
			p								

n = Total number of individuals investigated
* MNI (based on mandibles) used for all calculations incorporating total individuals for collection
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.10: The prevalence of cribra orbitalia in all collections studied.

Collection	Ancestry	Collection number	Sex	Age	Orbits Left	Orbits Right
Monk's Kop	African	M_430a	Male	18-22	Present	Present
		M_450	Unknown	9-11	Present	Present
				Total (*Na*)	2	2
				% (*n* =16)	**12.5**	**12.5**
Ashford	African	-	-	-	-	-
				Total (*Na*)	0	0
				% (*n* =7)	**0.00**	**0.00**
Dambarare	European	-	-	-	-	-
	African	-	-	-	-	-
	Indeterminate	-	-	-	-	-
				Total (*Na*)	0	0
				% (*n* =19)	**0.00**	**0.00**

n= Total number of individuals investigated with observable orbits
Na = Total number of left or right orbits presenting with signs of cribra orbitalia in the specific collection
% = The prevalence of left or right orbits presenting with signs of cribra orbitalia in relation to the total number of individuals investigated with observable orbits in the specific collection

Table 5.11: The prevalence of cribra orbitalia observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Mapungubwe K2	Toutswe	Venda
Monk's Kop	This study 13th-15th Century Zimbabwe	African: ***n* = 16**	χ^2		0.96	1.75	0.96	2.90	3.40	0.18	5.56
		% (*Na* = 2) = 12.5	*p*		0.3276	1.865	0.3276	0.0884	0.0651	0.6723	0.0183
Ashford	This study 14th - 15th Century Zimbabwe	African ***n* = 7**	χ^2			-	-	-	3.88	1.40	-
		% (*Na* = 0) = 0.0	*p*			-	-	-	0.0487	0.2367	-
Dambarare	This study 17th Century Zimbabwe	European ***n* =13**	χ^2				-		6.38	2.55	-
		% (*Na* = 0) = 0.0	*p*				-		0.0090	0.1105	-
		African ***n* = 7**	χ^2						3.88	1.40	-
		% (*Na* = 0) = 0.0	*p*						0.0487	0.2367	-
		Total ***n* = 22**	χ^2						10.91	4.22	-
		% (*Na* = 0) = 0.0	*p*						0.0010	0.0401	-
Mapungubwe K2	(Steyn, 1994) 11th-14th Century South Africa	African ***n* = 37**	χ^2							3.84	19.72
		% (*Na* = 14) = 37.8	*p*							0.0501	0.0001
Toutswe	(Mosothwane, 2004) 8th-13th Century Botswana	African ***n* = 35**	χ^2								7.99
		% (*Na* = 6) = 17.1	*p*								0.0047
Venda	(L'Abbé, 2005) 20th Century South Africa	African ***n* = 43**	χ^2								
		% (*Na* = 0) = 0.0	*p*								

n = Total number of individuals investigated with observable orbits
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.12: The prevalence of enamel hypoplasia and the teeth presenting with such lesions in all collections studied.

Collection	Ancestry		Tooth type I1	I2	C	P1	P2	M1	M2	M3	Total
Monk's Kop	African	*n*	19	34	47	57	56	74	76	60	423
		NTA	2	2	2	2	0	0	0	0	8 (*TNTA*)
	%	*NTA/n*	**10.5**	**5.9**	**4.3**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**	**1.9**
		NTA/TNTA	**25.0**	**25.0**	**25.0**	**25.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-**
Ashford	African	*n*	0	0	4	5	9	15	9	12	53
		NTA	0	0	0	1	3	2	0	0	6 (*TNTA*)
	%	*NTA/n*	**0.0**	**0.0**	**0.0**	**20.0**	**33.3**	**13.3**	**0.0**	**0.0**	**11.3**
		NTA/TNTA	**0.0**	**0.0**	**0.0**	**16.7**	**50.0**	**33.3**	**0.0**	**0.0**	**-**
Dambarare	European	*n*	32	31	36	38	37	32	38	73	277
		NTA	0	1	10	5	1	0	0	0	17 (*TNTA*)
	%	*NTA/n*	**0.0**	**3.2**	**27.8**	**13.2**	**2.7**	**0.0**	**0.0**	**0.0**	**6.1**
		NTA/TNTA	**0.0**	**5.9**	**58.8**	**29.4**	**5.9**	**0.0**	**0.0**	**0.0**	**-**
	African	*n*	10	12	15	17	21	24	23	14	136
		NTA	2	0	0	0	0	0	0	0	2 (*TNTA*)
	%	*NTA/n*	**20.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.5**
		NTA/TNTA	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-**
	Total	*n*	42	43	51	55	58	56	61	87	413
		NTA	2	1	10	5	1	0	0	0	19 (*TNTA*)
	%	*NTA/n*	**4.8**	**2.3**	**19.6**	**9.1**	**1.7**	**0.0**	**0.0**	**0.0**	**4.6**
		NTA/TNTA	**10.5**	**5.3**	**52.6**	**26.3**	**5.3**	**0.0**	**0.0**	**0.0**	**-**

n = Total number of each tooth type available in the specific collection
NTA = Number of each tooth type presenting with enamel hypoplastic lesions
TNTA = Total number of each tooth type presenting with enamel hypoplastic lesions
NTA/n = The prevalence of the specific tooth type presenting with enamel hypoplastic lesions in relation to the total number of teeth available in the specific collection
NTA/TNTA = The prevalence of the specific tooth type presenting with enamel hypoplastic lesions in relation to the total number of teeth presenting with such lesions in the specific collection

Table 5.13: The prevalence of enamel hypoplasia observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Mapungubwe K2	Toutswe	Venda
Monk's Kop	This study 13th-15th Century Zimbabwe	African: ***n* = 38**	χ^2		9.51	19.21	6.39	14.70	35.78	10.97	3.35
		% (*Na* = 1) = 2.6	*p*		0.0020	0.0001	0.0115	0.0001	0.0001	0.0009	0.0671
Ashford	This study 14th - 15th Century Zimbabwe	African ***n* = 5**	χ^2			0.28	0.17	0.00	1.06	0.19	2.68
		% (*Na* = 2) = 40.0	*p*			0.5987	0.6788	0.9702	0.3028	0.6616	0.1016
Dambarare	This study 17th Century Zimbabwe	European ***n* =13**	χ^2				1.17		0.14	2.42	12.39
		% (*Na* = 7) = 53.8	*p*				0.2785		0.5236	0.1195	0.0004
		African ***n* = 7**	χ^2						3.15	0.01	1.22
		% (*Na* = 2) = 28.6	*p*						0.0760	0.9203	0.2691
		Total ***n* = 22**	χ^2						3.31	0.73	8.82
		% (*Na* = 9) = 40.9	*p*						0.0689	0.3931	0.0030
Mapungubwe K2	(Steyn, 1994) 11th-14th Century South Africa	African ***n* = 60**	χ^2							11.28	40.5
		% (*Na* = 38) = 63.3	*p*							0.0008	0.0001
Toutswe	(Mosothwane, 2004) 8th -13th Century Botswana	African ***n* = 46**	χ^2								5.76
		% (*Na* = 14) = 30.4	*p*								0.0164
Venda	(L'Abbé, 2005) 20th Century South Africa	African ***n* = 90**	χ^2								
		% (*Na* = 12) = 13.3	*p*								

n = Total number of individuals investigated with observable teeth
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.14: The prevalence of Schmorl's nodes and the vertebral regions presenting with such lesions in all collections studied.

Collection	Ancestry	Collection number	Sex	Age	Vertebral regions affected		
					Cervical	Thoracic	Lumbar
Monk's Kop	African	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Ashford	African	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Dambarare	European	D_A1	Male	16-20		1	
		D_A3	Male	45-55			1
		D_AA2	Male	25-35		1	1
	African	-	-	-			
	Indeterminate	D_AA4	Male	30-50			1
				Total	**0**	**2**	**3**
				% (*Na* =5)	**0.0**	**40.0**	**60.0**

Na = Total number of vertebral regions presenting with Schmorl's nodes in the specific collection
% = The prevalence of the vertebral regions presenting with Schmorl's nodes in relation to the total number of vertebral regions (*Na*) presenting with such lesions in the specific collection

Table 5.15: The prevalence of Schmorl's nodes observed in the collections studied compared to that of applicable comparative population.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare			Venda
						European	African	Total	
Monk's Kop	This study 13th -15th Century Zimbabwe	African: ***n* = 17**	χ^2		-	5.19	-	5.18	0.62
		% (*Na* = 0) = 0.0	*p*		-	0.0227	-	0.0228	0.4307
Ashford	This study 14th - 15th Century Zimbabwe	African ***n* = 0**	χ^2			-	-	-	-
		% (*Na* = 0) = 0.0	*p*			-	-	-	-
Dambarare	This study 17th Century Zimbabwe	European ***n* =11**	χ^2				1.04		10.60
		% (*Na* = 3) = 27.3	*p*				0.3075		0.0011
		African ***n* = 3**	χ^2						0.11
		% (*Na* = 0) = 0.0	*p*						0.7402
		Total ***n* = 15**	χ^2						12.09
		% (*Na* = 4) = 26.7	*p*						0.0005
Venda	(L'Abbé, 2005) 20th Century South Africa	African ***n* = 113**	χ^2						
		% (*Na* = 4) = 3.5	*p*						

n = Total number of individuals investigated with vertebrae
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.16: The prevalence of trauma in all collections studied.

Collection	Ancestry	Collection number	Sex	Age	Trauma		
					Fracture	Luxation	Other
Monk's Kop	African	M_154*	Unknown	Adult			1
		M_160*	Unknown	Adult		1	
		M_232*	Unknown	Adult	1		
		M_297	Male	55-70			1
				Total	**1**	**1**	**2**
				% (*Na* =4)	**25.0**	**25.0**	**50.0**
Ashford	African	-	-	-	-	-	-
				Total	**0**	**0**	**0**
				% (*Na* =0)	**0.0**	**0.0**	**0.0**
Dambarare	European	D_A7	Male	40-55	1		
		D_C5	Male	55-70	1		
	African	D_B4	Female	45-60			1
	Indeterminate	D_CMiscElem7*	Unknown	Adult	1		
		D_AAMisc6	Unknown	Adult			1
				Total	**3**	**0**	**1**
				% (*Na* =4)	**0.75**	**0.0**	**0.25**

Na = Total number of bones presenting with signs of trauma in the specific collection
% = The prevalence of the specific type of trauma in relation to the total number of different trauma types (*Na*) in the specific collection
*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)

Table 5.17: The prevalence of fractures observed in the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Mapungubwe K2	Toutswe	Venda
Monk's Kop*	This study	African:	χ^2		0.17	3.03	0.17	0.43	0.44	0.00	1.29
	13th-15th Century	***n* = 43**									
	Zimbabwe	**% (*Na* = 1) = 2.3**	*p*		0.6836	0.0817	0.6836	0.5142	0.5065	0.9845	0.2551
Ashford	This study	African	χ^2			1.11	-	0.37	0.07	0.17	0.53
	14th - 15th Century	***n* = 0**									
	Zimbabwe	**% (*Na* = 7) = 0.0**	*p*			0.2931	-	0.5454	0.7963	0.6797	0.4662
Dambarare		European	χ^2				0.00		9.03	4.34	0.89
		***n* =14**									
		% (*Na* = 2) = 14.3	*p*				1.000		0.0027	0.0371	0.3450
	This study	African	χ^2						0.07	0.17	0.53
	17th Century	***n* = 7**									
	Zimbabwe	**% (*Na* = 0) = 0.0**	*p*						0.7963	0.6797	0.4662
		Total	χ^2						2.37	0.60	0.21
		***n* = 40**									
		% (*Na* = 2) = 5.0	*p*						0.1233	0.4403	0.6474
Mapungubwe K2	(Steyn, 1994)	African	χ^2							0.62	5.23
	11th-14th Century	***n* = 106**									
	South Africa	**% (*Na* = 1) = 0.9**	*p*							0.4299	0.0223
Toutswe	(Mosothwane, 2004)	African	χ^2								2.21
	8th-13th Century	***n* = 84**									
	Botswana	**% (*Na* = 2) = 2.4**	*p*								0.1373
Venda	(L'Abbé, 2005)	African	χ^2								
	20th Century	***n* = 113**									
	South Africa	**% (*Na* = 8) = 7.1**	*p*								

n = Total number of individuals investigated with vertebrae
* MNI (based on mandibles) used for all calculations incorporating total individuals for collection
Na = Number of individuals affected by the condition
% = Percentage of individuals affected by the condition
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 5.18: Description of skeletal miscellaneous findings in the collections studied.

Collection	Ancestry	Collection number	Sex	Age	Bone affected	Miscellaneous finding
Monk's Kop	African	M_290	Female	Adult	Mandible	Mandibular torus formation on left side only.
		M_288*	Unknown	Adult	Sternum	Partial fusion of body of sternum at transverse line. (Sternal foramen.
Ashford	African	-	-	-	-	-
Dambarare	European	D_A7	Male	40-55	Sternum	Full articulation for ribs 1 and 2 and half of rib 3.
		D_AA3	Male	25-35	Rib	Fusion of rib 1 and rib 2.
	African	-	-	-	-	-
	Indeterminate	-	-	-	-	-

*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)

Table 5.19: Summary of the skeletal health observed in all the collections studied of African ancestry compared per contact period.

Contact period	Collection		Treponemal disease	Arthritic changes	Sub-periosteal lesions	Cribra orbitalia	Enamel hypoplasia	Schmorl's nodes	Osteophytosis	Trauma	Developmental anomalies	No skeletal pathology
			Skeletal Health									
Pre-European	Monk's Kop*	*n*	43	43	43	16*	38**	17^	17^	43	43	43
		Na	0	1	0	2	1	0	2	1	2	37
		%	0.0	2.3	0.0	12.5	2.6	0.0	11.8	2.3	4.7	86.0
	Ashford	*n*	7	7	7	7*	5**	0^	0^	7	7	7
		Na	0	0	0	0	2	0	0	0	0	4
		%	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	57.1
	Sub-total	*n*	50	50	50	23*	43**	17^	17^	50	50	50
		Na	0	1	0	2	3	0	2	1	2	41
		%	**0.0**	**2.0**	**0.0**	**8.7**	**7.0**	**0.0**	**11.8**	**2.0**	**4.0**	**82.0**
Post-European	Dambarare	*n*	7	7	7	7*	7**	3^	3^	7	7	7
		Na	0	0	1	0	2	0	0	1	0	4
		%	**0.0**	**0.0**	**14.3**	**0.0**	**28.6**	**0.0**	**0.0**	**14.3**	**0.0**	**57.1**
	Total	*n*	57	57	57	30*	50**	20^	20^	50	57	57
		Na	0	1	1	2	10	0	2	2	2	47
		%	0.0	1.8	1.8	6.7	20.0	0.0	10.0	4.0	3.5	82.5
		χ^2	-	0.14	7.27	0.65	3.12	-	0.39	2.74	0.29	2.28
		p	-	0.7058	$\boxed{0.0070}$	0.4193	0.0774	-	0.5312	0.0980	0.5901	0.1308

n = Total number of individuals investigated
* = Total number of individuals investigated with observable orbits
** = Total number of individuals investigated with observable teeth
^ = Total number of individuals investigated with observable vertebrae
Na = Number of individuals affected by the respective condition
% = $\frac{\text{Total number of individuals affected by the respective conditions}}{\text{Total number of individuals investigated}}$ X 100

χ^2 = Chi-squared value comparing the contact periods for the respective condition
p = p-value
$\boxed{}$ Significant difference (df = 1; p-value < 0.05)

Figure 5.1: Individual M_450 (Anterior view of skull): 9-11 year old child with cribra orbitalia, asymmetric cranium, supernumerary teeth and enamel hypoplasia.

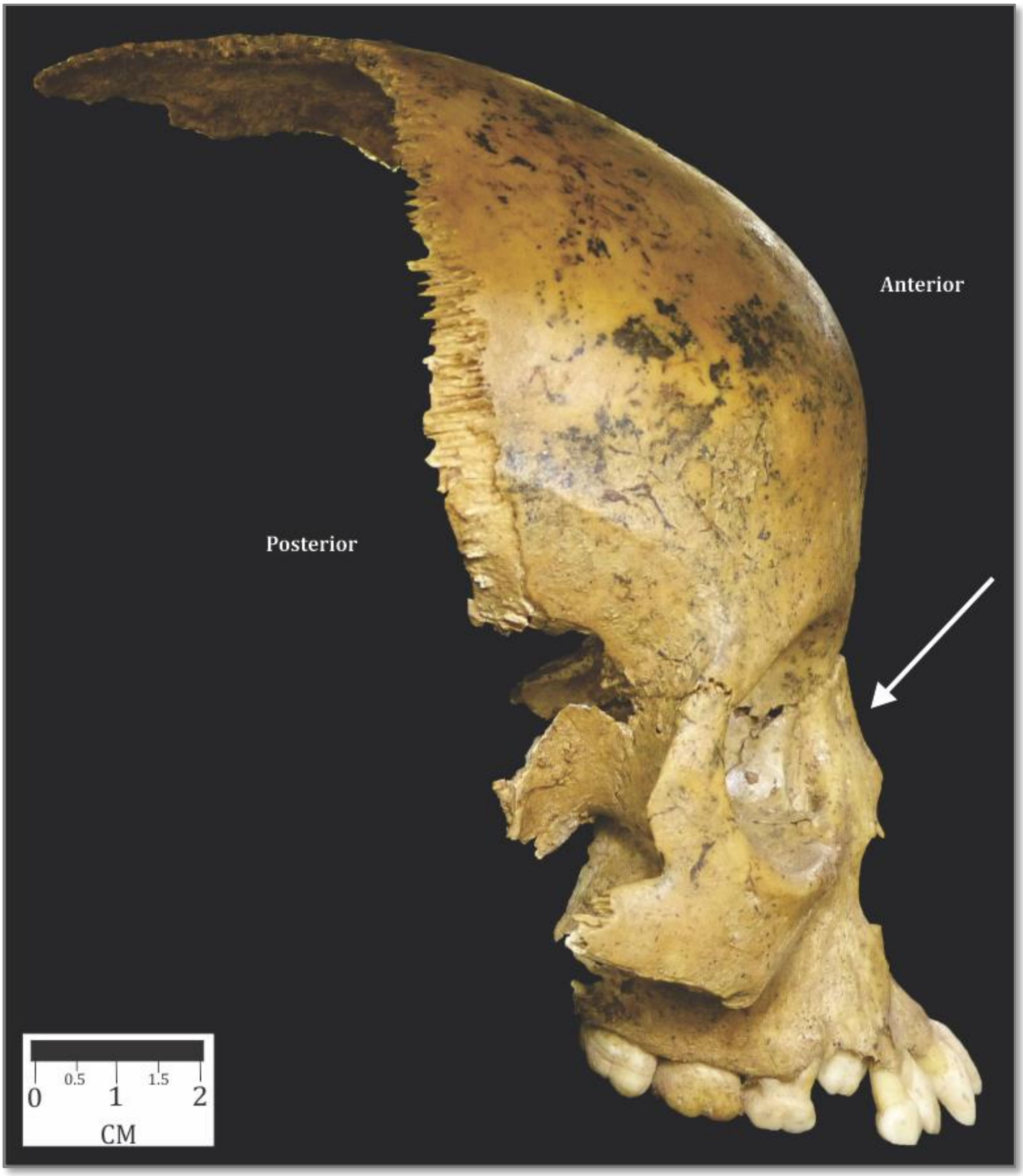


Figure 5.2: Individual M_450 (Lateral view of skull): 9-11 year old child with possible flattening of inter-orbital and nasal area suggestive of a hypoplastic maxilla or midfacial region.

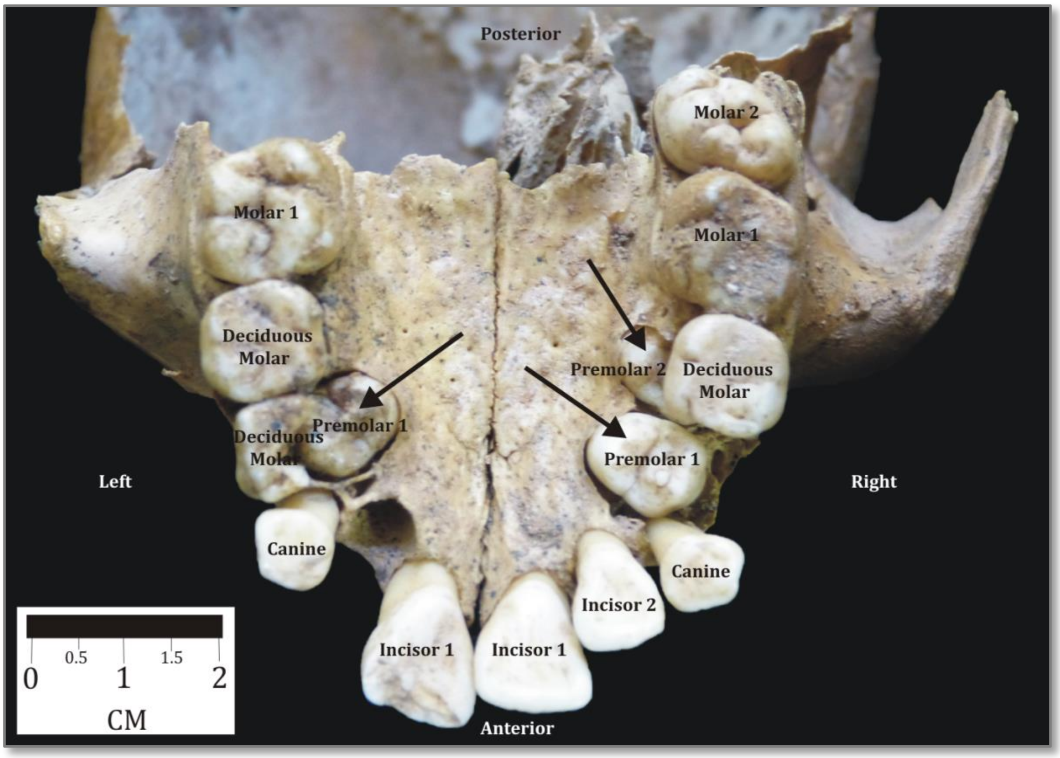


Figure 5.3: Individual M_450 (Inferior view of maxilla): Possible retained deciduous teeth and clear lack of space for normal dental development on the right maxillary region.

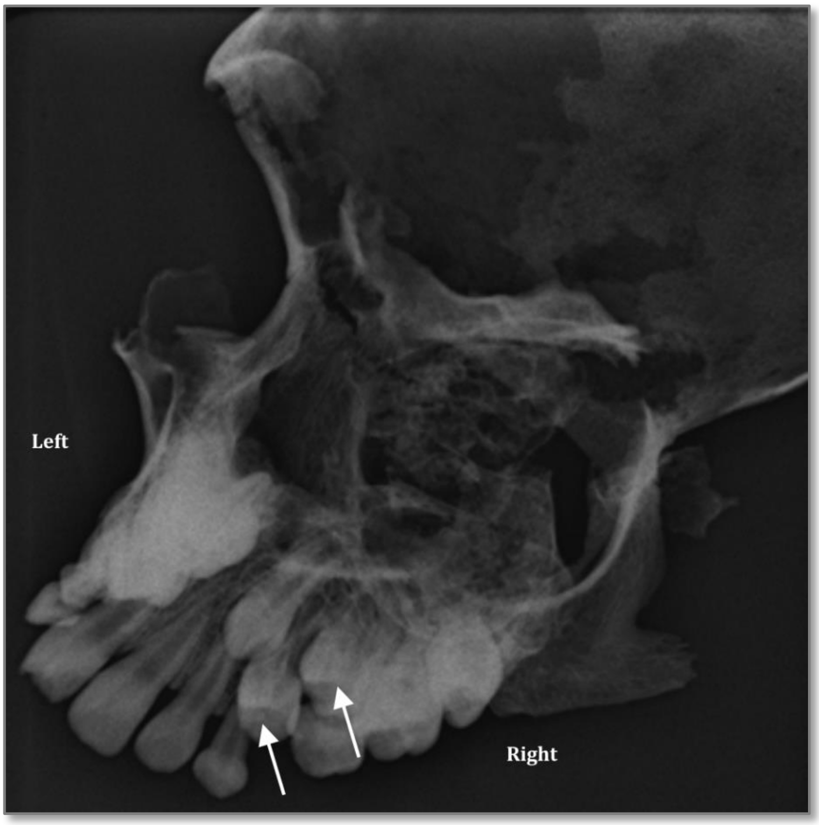


Figure 5.4: Individual M_450 (X-ray of maxilla): Possible retained deciduous teeth and lack of space for normal dental development on the right maxillary region.

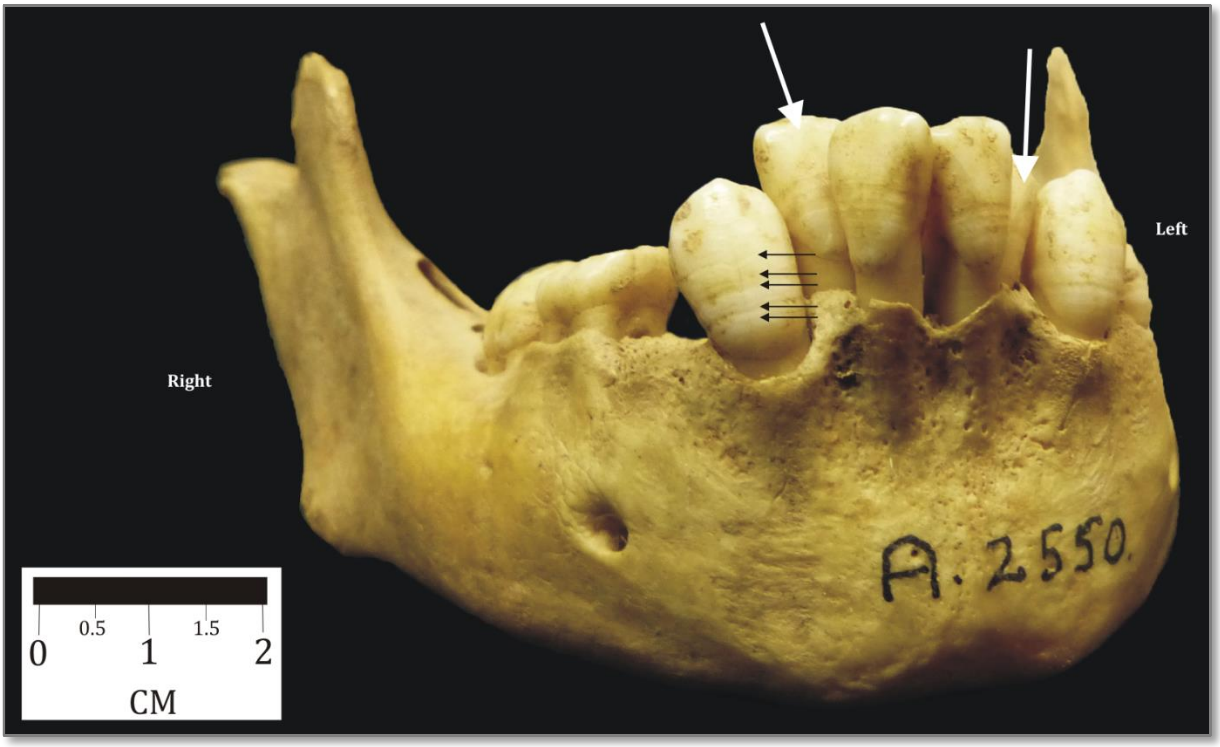


Figure 5.5: Individual M_450 (Antero-lateral view of mandible): Multiple enamel hypoplastic lesions (black arrows) on all teeth indicative of several metabolic insults throughout the growing year as well as evidence of tooth crowding (white arrows).

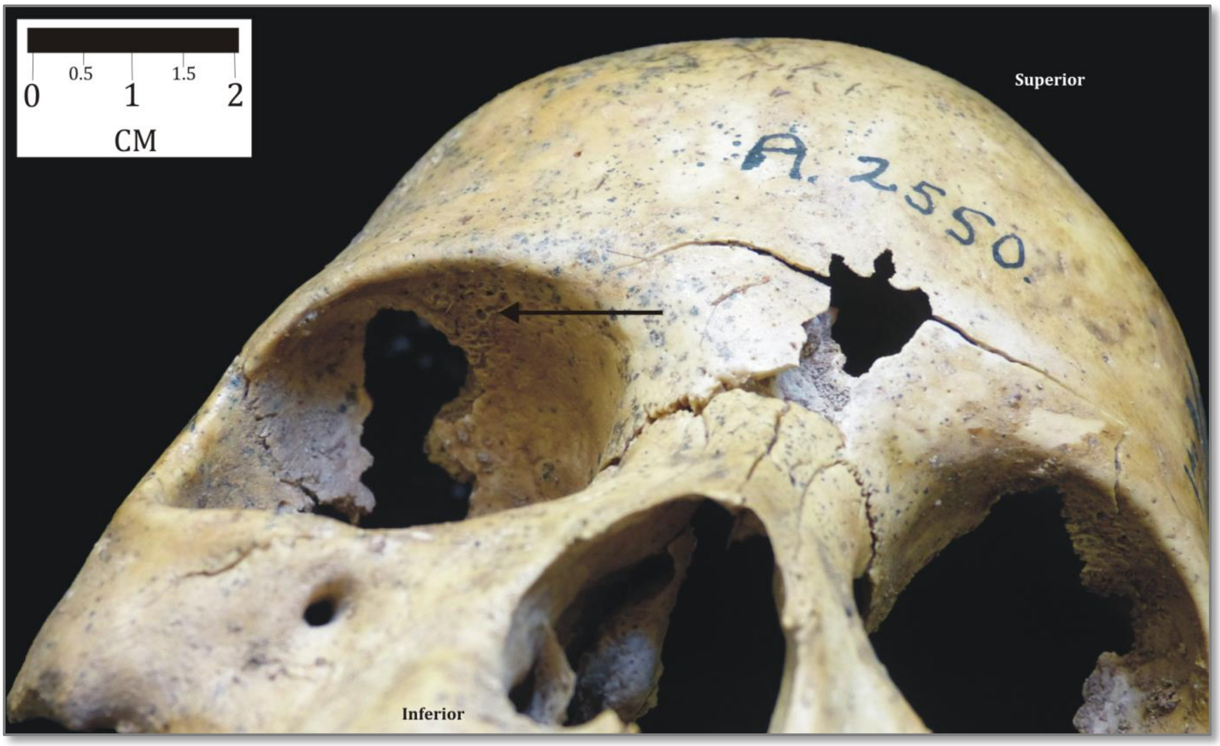


Figure 5.6: Individual M_450 (Antero-inferior view of skull): Evidence of slight cribra orbitalia in both orbits.

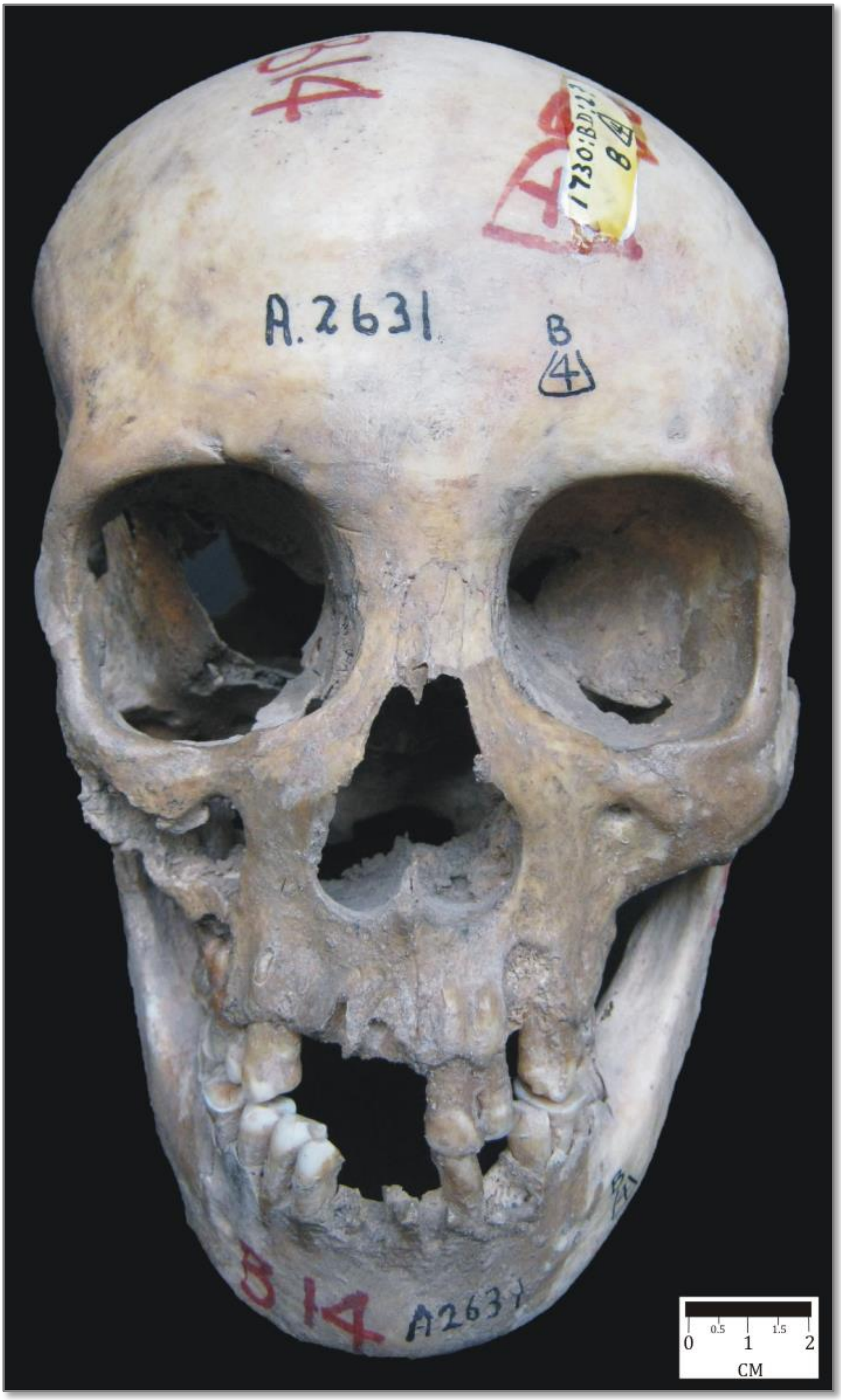


Figure 5.7: Individual D_B4 (Anterior view of skull): 45-60 year old female adult with possible trephined area on superior aspect of skull.

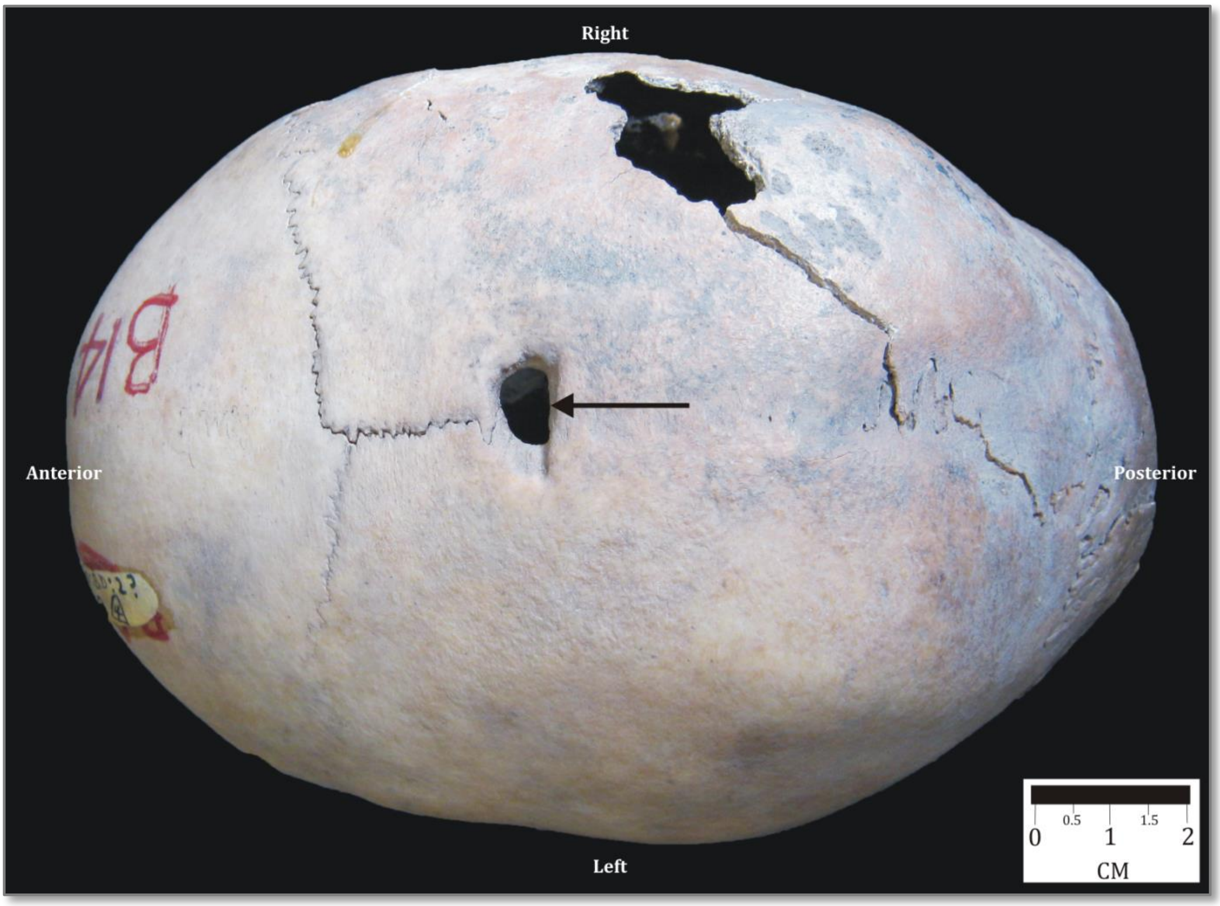


Figure 5.8: Individual D_B4 (Superior view of skull): Healed lesion posterior to the bregma directly on the sagittal suture indicative of a possible case of trephination.

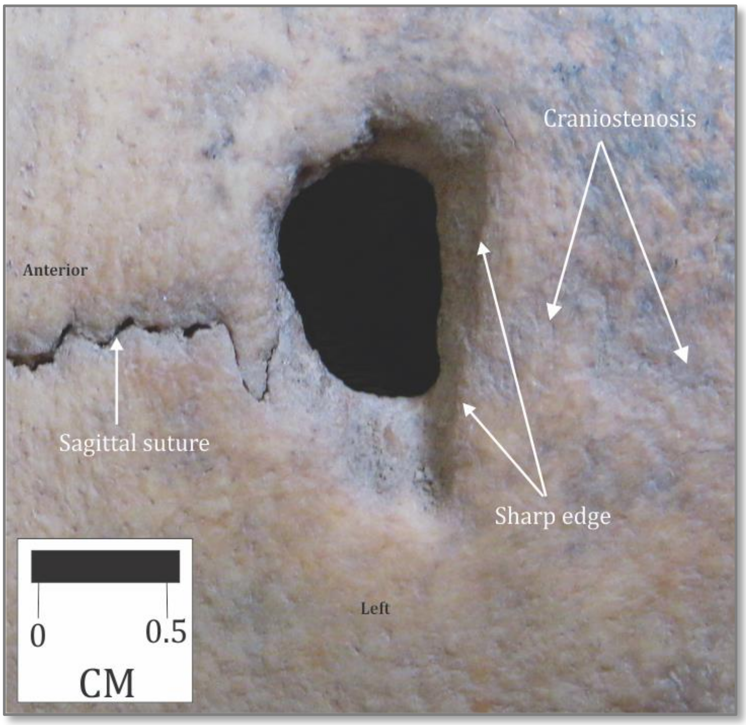


Figure 5.9: Individual D_B4 (Magnification of possible trephined area): Healed lesion (0.7 cm x 1 cm) with craniostenosis posterior to the lesion.

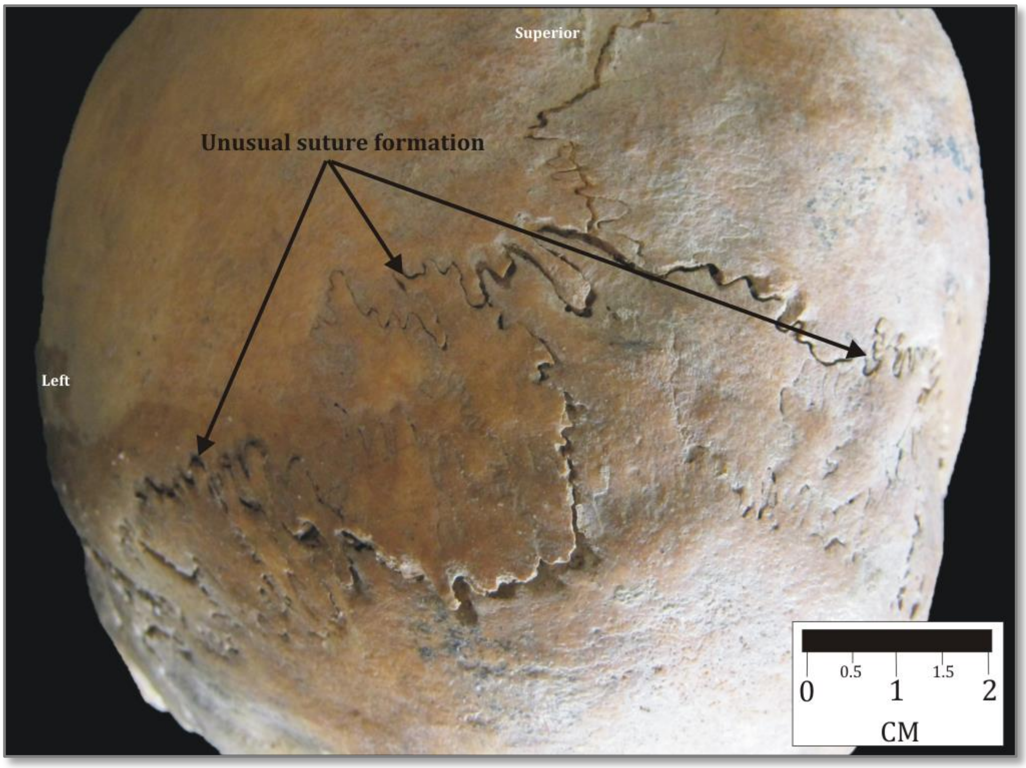


Figure 5.10: Individual D_B4 (Posterior view of skull): Unusual suture formation observed on the parietal and occipital bones.

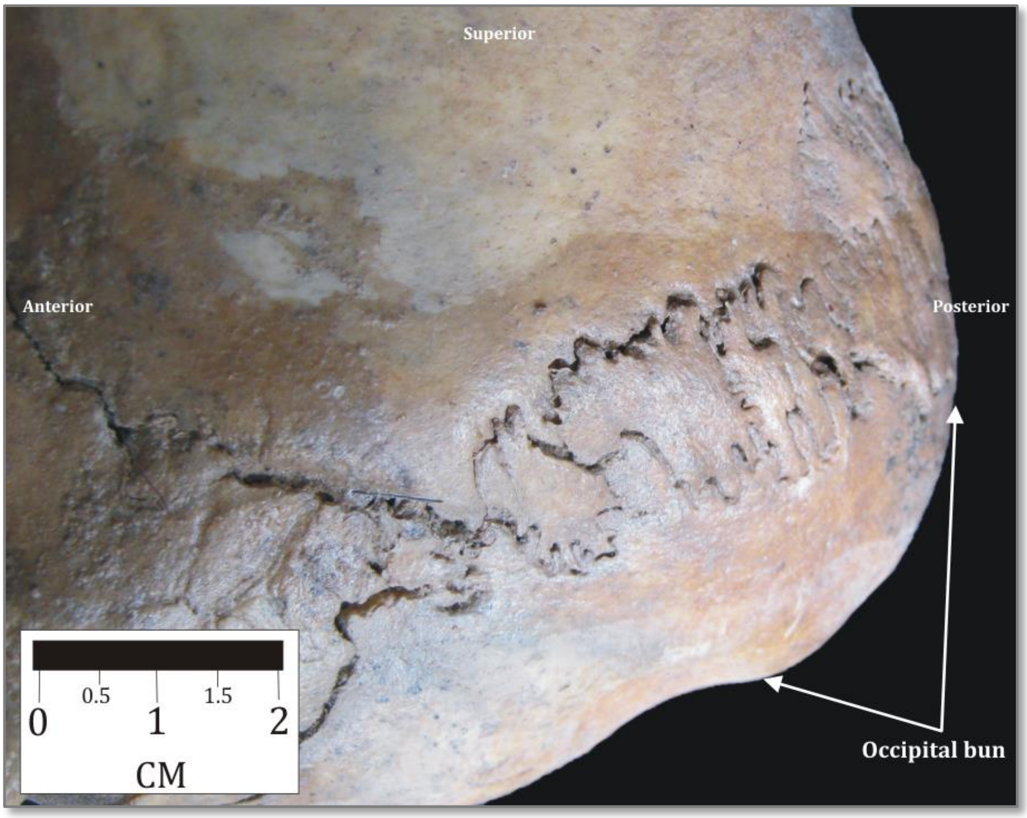


Figure 5.11: Individual D_B4 (lateral view of skull): "Occipital bun" observed in occipital region.

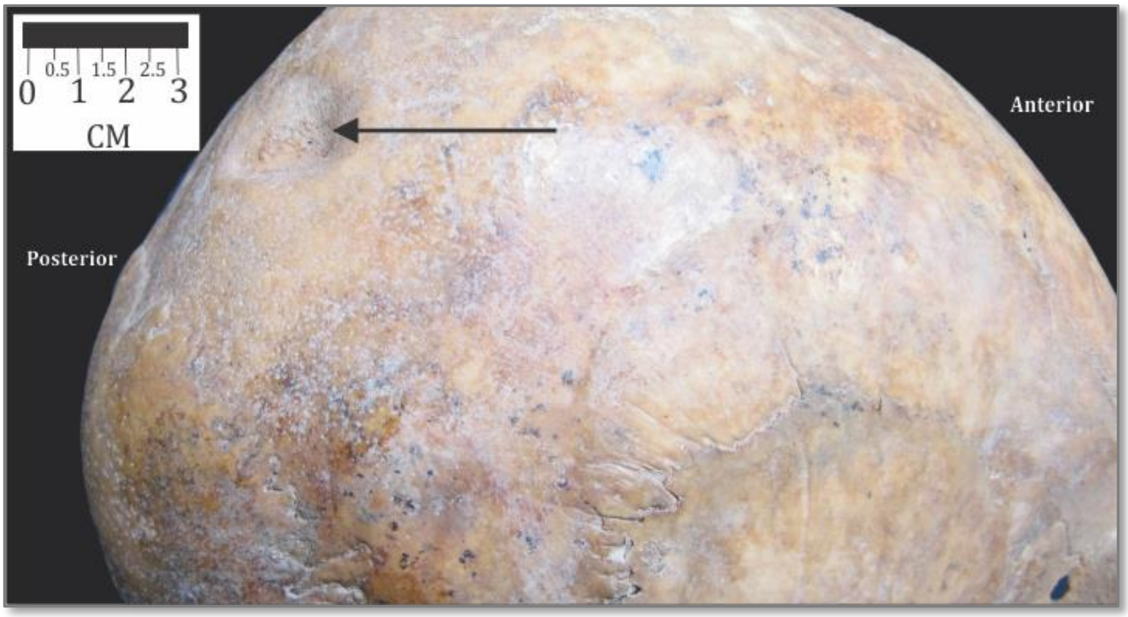


Figure 5.12: Individual D_AA3 (Postero-superior view of skull): Possible gummatous lesion on the right parietal bone of the skull suggestive of treponemal infection.

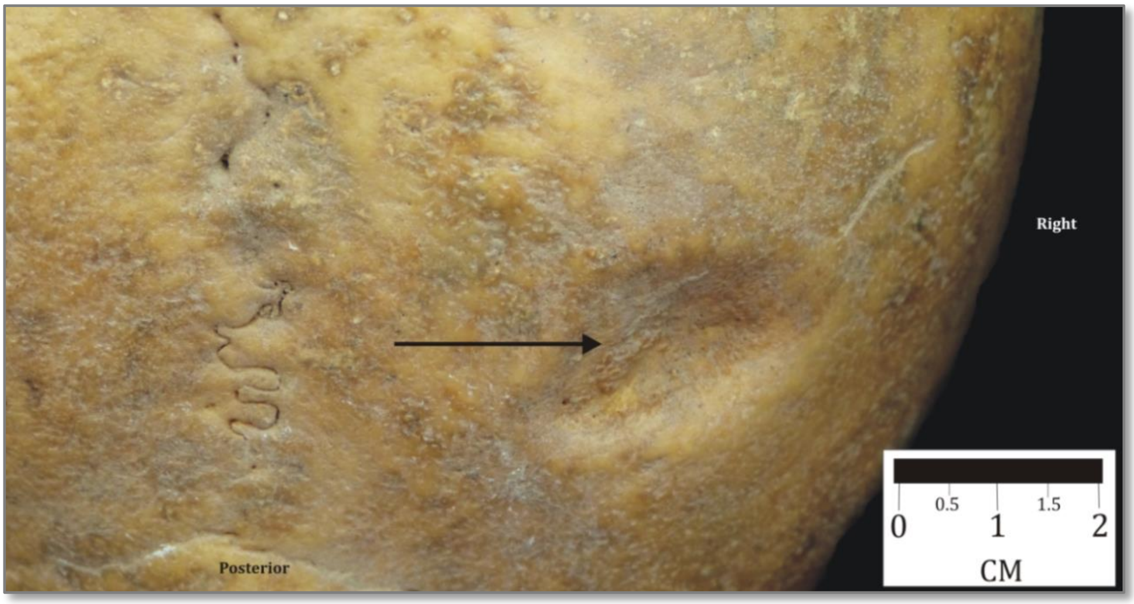


Figure 5.13: Individual D_AA3 (Lateral view of skull): Magnification of possible gummatous lesion on the right parietal bone of the skull suggestive of treponemal infection.

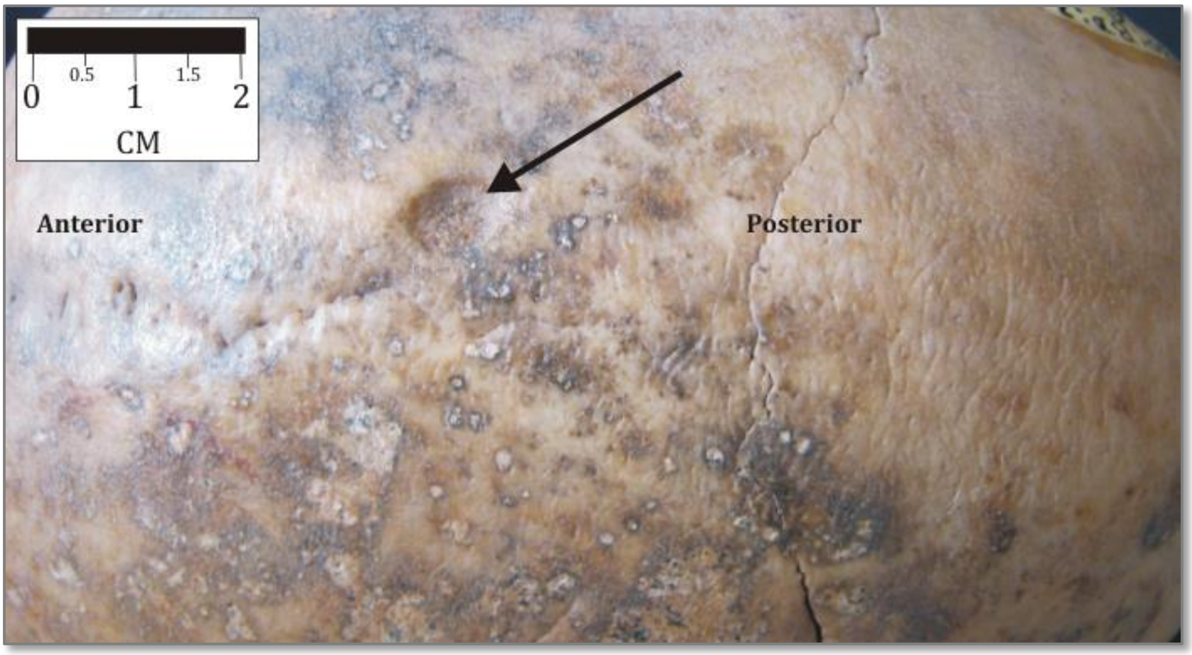


Figure 5.14: Individual D_AA3 (Superior view of skull): Additional possible gummatous lesion on the left parietal bone of the skull indicative of possible treponemal infection.

Figure 5.15: Individual D_AAMisc6 (Posterior view of left Femur): Unknown healed lesion possibly related to yaws or traumatic event.

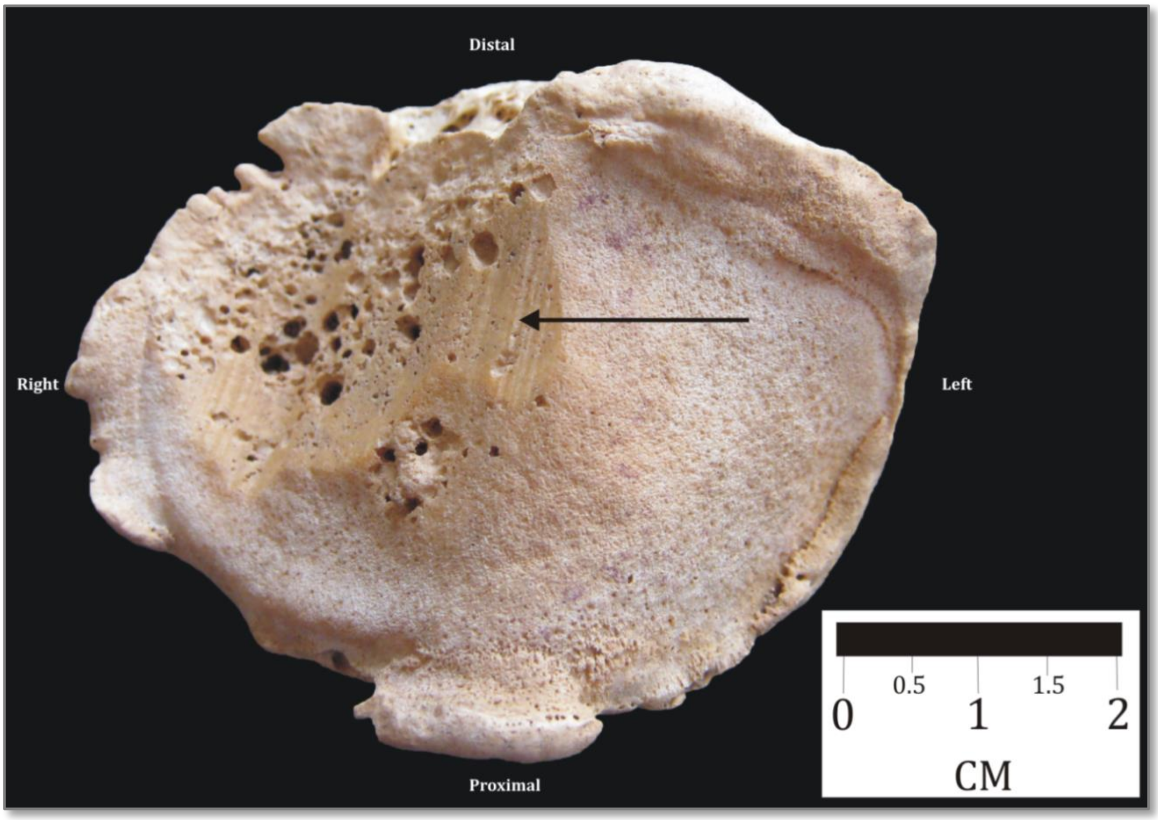


Figure 5.16: Individual of sub-collection M_113b (Posterior view of patella): Osteoarthritic changes, specifically showing eburnation on the articular surface and osteophyte formation of the right patella.

Figure 5.17: Individual M_37b (Superior view of vertebra): Osteophytic growths on the body of Lumbar vertebra 1.

Figure 5.18: Individual D_A8 (Posterior view of fibula): The posterior surface of the right fibular shaft showing evidence of non-specific periostitis.

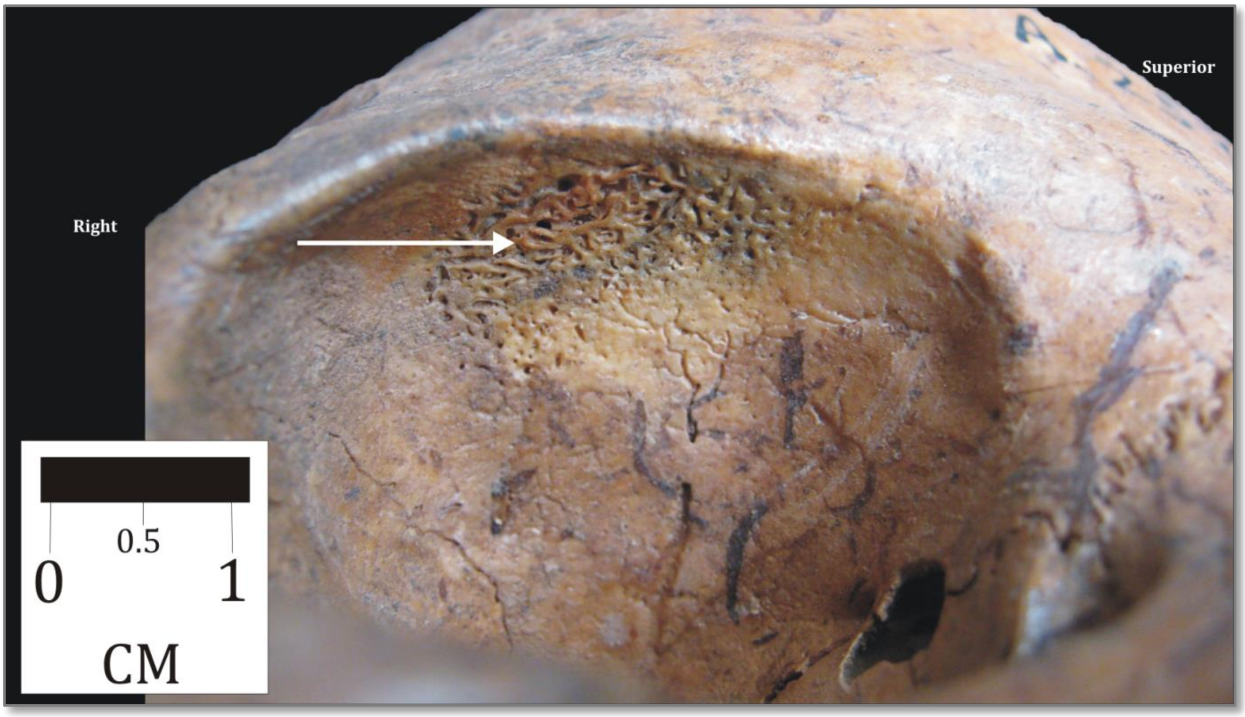


Figure 5.19: Individual M_430a (Antero-inferior view of skull): Evidence of healed cribra orbitalia in the right orbit.

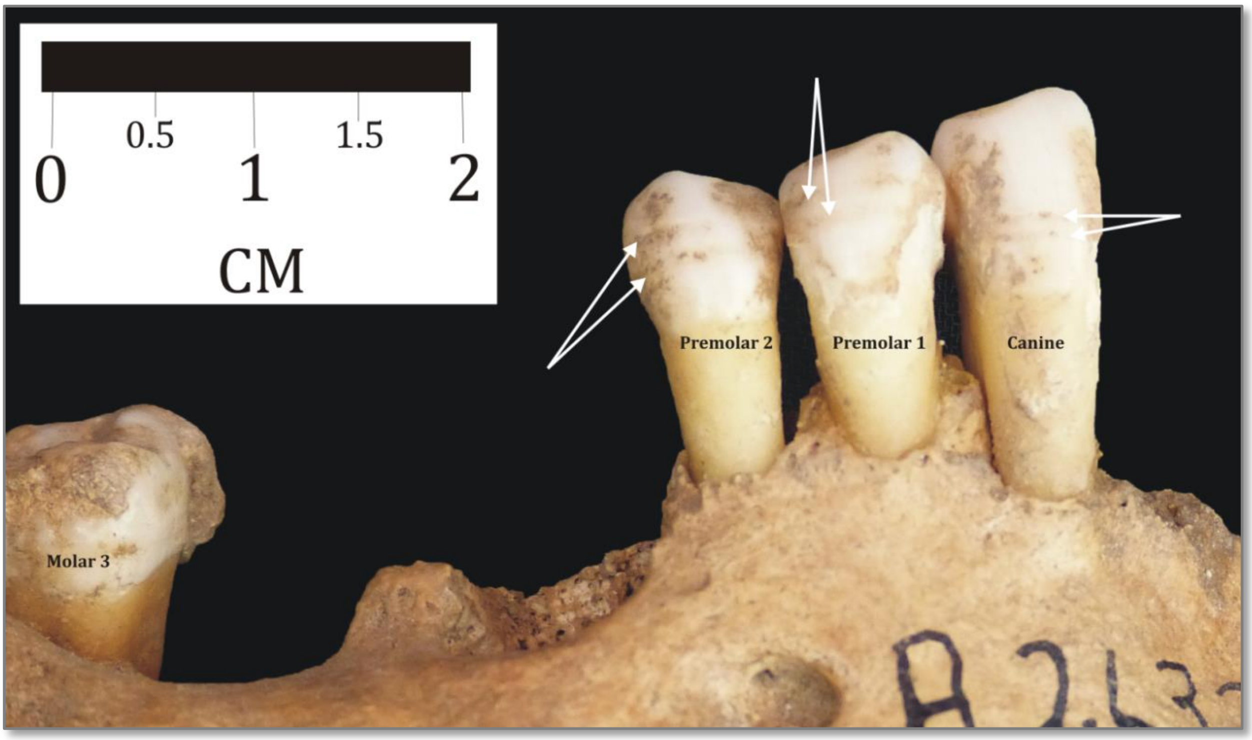


Figure 5.20: Individual D_A2 (Lateral view of mandible): Mandibular C, P1 and P2 showing multiple linear enamel hypoplastic lesions indicative of the experience of possible periods of metabolic stress.

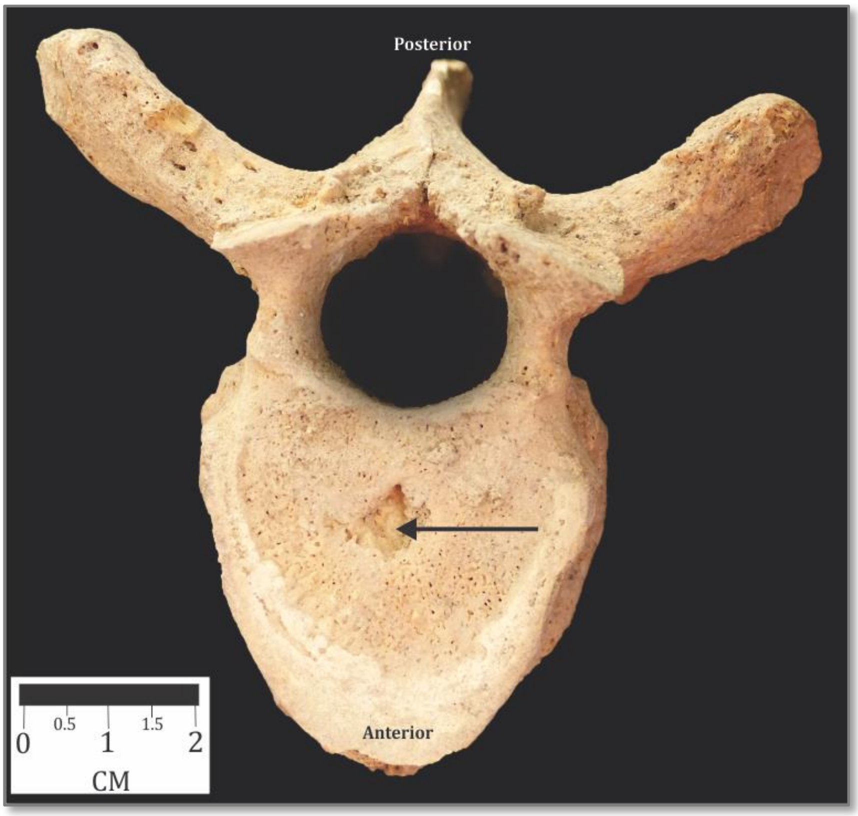


Figure 5.21: Individual D_AA2 (Superior view of vertebra): A typical Schmorl's node on the superior surface of Thoracic vertebra 7.

Figure 5.22: Individual D_C5 (Lateral view of metacarpals I-V): Possible healed fractures of metacarpals III, IV and V of the right hand.

Figure 5.23: Individual M_160 (Inferior view of clavicle): A possible case of chronic dislocation of the acromio-clavicular joint as can be seen by the additional bone formation at the lateral end of the right clavicle.

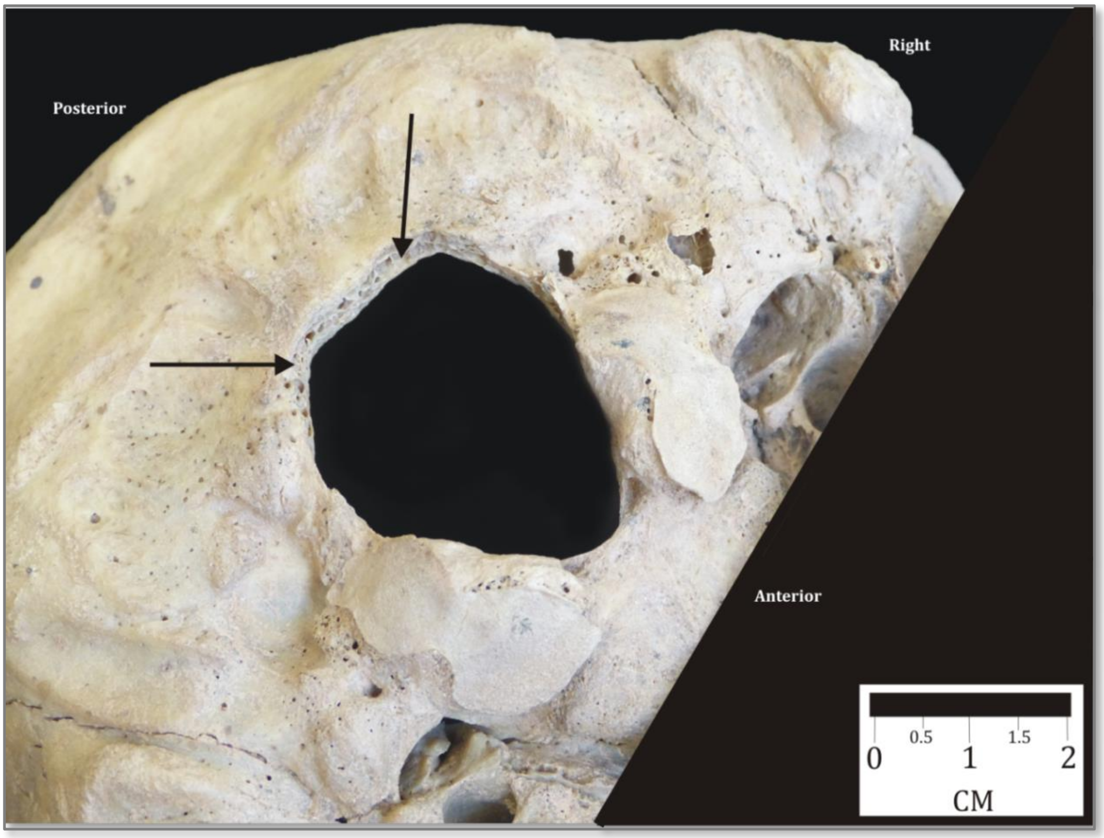


Figure 5.24: Individual M_297 (Inferior view of skull): Unknown trauma of foramen magnum.

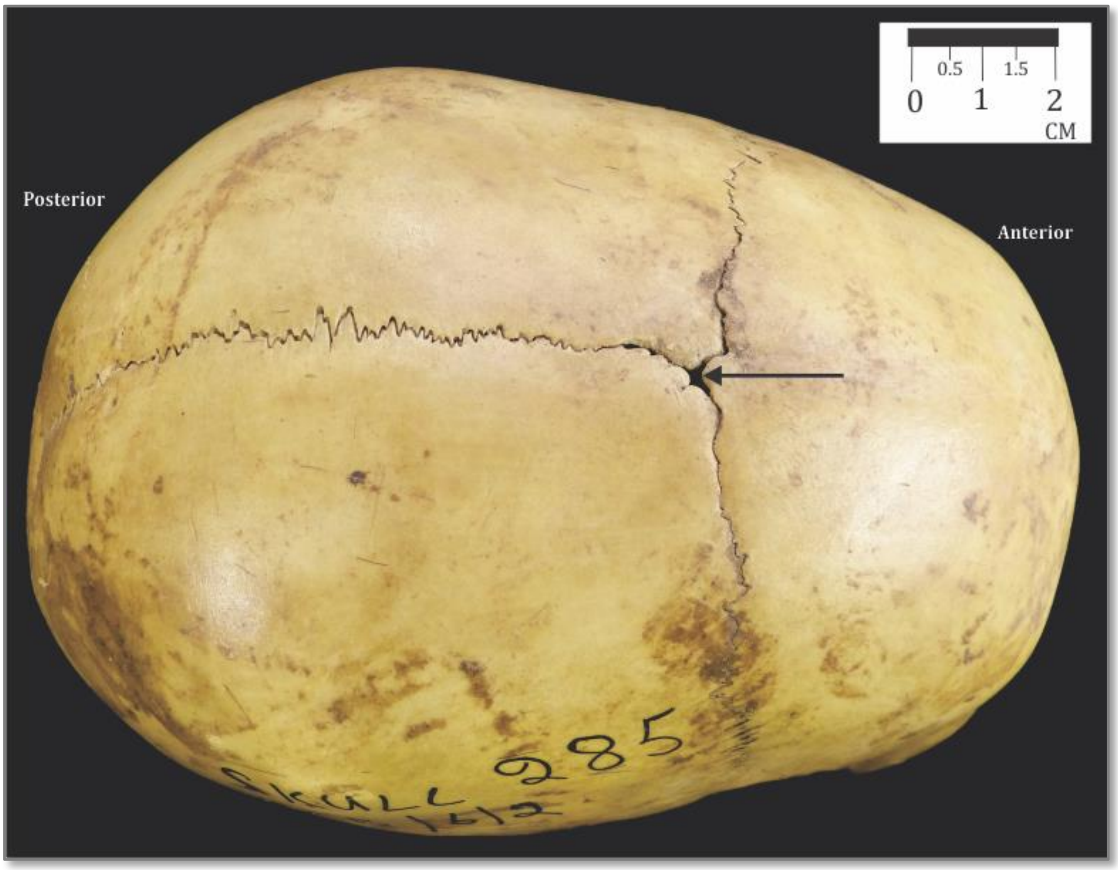


Figure 5.25: Individual M_285 (Superior view of skull): Slightly open anterior fontanelle.

CHAPTER 6: DENTAL HEALTH

6.1 Introduction

Skeletal material from all three populations were investigated for signs of dental pathology or abnormalities. This included a minimum number of 38 Monk's Kop individuals (16 males; 18 females; 4 of indeterminate sex), 5 Ashford Farms individuals (2 males; 3 females) and 20 individuals from the Dambarare collection which included remains from European descent (12 males; 1 female) and African descent (2 males; 5 females).

Due to the commingled nature and poor preservation of specifically the Monk's Kop, but also the Dambarare collection, there were a number of bony elements that could not be allocated to or be identified as belonging to an existing or additional individual. These bony elements were, however, also analysed for dental signs of pathology. The results of Monk's Kop and Dambarare will therefore include all accession numbers, whether allocated as an individual or not. Any dental pathology or abnormality that were identified on these remains were listed accordingly, but were not utilised when calculating the number of individuals affected by a certain condition.

A total of 44 individuals in all collections presented with dental pathology and another seven individuals with dental abnormalities of which the accession numbers are listed in Table 6.1. Some individuals were recorded as suffering from more than one dental pathological condition.

Dental pathological alterations identified on the remains studied included evidence of dental caries, antemortem tooth loss, abscesses, calculus formation and periodontitis. Miscellaneous observations with no clinical significance were also recorded and included the presence of supernumerary teeth, crowding as well as modifications of teeth. These dental observations were, however, just listed and not taken into account in calculations related to dental pathology.

The above dental pathological conditions are discussed separately in this chapter by firstly listing the individuals affected per skeletal collection studied, inclusive of their ancestry, sex and age (wherever possible) in table format. Dependant on the condition, the affected teeth of every affected individual are also indicated. The prevalence of a specific tooth being affected as a percentage of the total teeth affected by the specific condition is also calculated. Secondly, the prevalence of a specific condition is tabulated for each of the skeletal collections by means of a percentage of individuals affected per the total number of individuals investigated per sample. As part of the tables, the three collections are compared with the results of applicable populations, which in most cases comprised of the Mapungubwe/K2, Venda and Toutswe populations. Chi^2 statistical analyses were performed in these comparisons and are reflected as both a χ^2 and corresponding *p*-value in these comparative tables. A *p*-value of less than 0.05 was recorded as being statistically significant. All significant differences are clearly highlighted in the tables.

Three values are listed for each dental pathology for Dambarare due to the dual ancestry of this population. These include the individuals from European and African descent which are listed separately. The third variable includes all individuals, i.e. those of African and European descent, but also any individual who could not be determined as belonging to a specific ancestry. The total number of Dambarare individuals therefore reflects a sum of the European and African individuals of this population, but also those who were of indeterminate ancestry.

All descriptions of dental pathological conditions identified in this study are presented by means of the tables described above, but also includes an applicable photograph which depicts an example of the specific condition of one of the individuals identified as being affected by the specific condition. All individuals identified in this study are also described in detail in the skeletal reports shown in Appendices A to C.

All three populations studied had a high prevalence of dental pathology of which the statistical analyses will be described and discussed in the subsequent sections of specific dental pathologies observed.

6.2 Dental caries

Although most caries were situated on the occlusal surface of the affected tooth, some individuals such as individual M_401 presented with caries on the buccal surfaces of the second incisor, the canine and the first premolar as can be seen in the neck caries depicted in Figure 6.1.

Table 6.2 provides a summary of the prevalence of dental caries according to sex and tooth type of only permanent dentition. Furthermore, various calculations related to caries prevalence in a population are represented in Table 6.3. The following will be described for each of the populations studied:

NIA/n = Frequency of individuals affected (*NIA*) by caries related to the total number of individuals investigated (*n*). (*Individual caries frequency*)

NTA/n = Number of carious teeth (*NTA*) related to the total number of individuals investigated (*n*). (*Carious teeth per mouth*)

NTA/NT = Number of carious teeth (*NTA*) related to the total number of teeth investigated (*NT*). (*Caries intensity/tooth count*). This frequency will then also be compared to applicable populations of two basic subsistence economies namely hunter-gatherers and agriculturalists (Table 6.4 - 6.5).

All descriptions will be done per collection studied sorted by sex, thus a separate male and female prevalence will be depicted with a total for each population.

The Monk's Kop collection presented with seven individuals (*n*=38) with macroscopically observable carious lesions, while Ashford Farms showed no evidence of carious teeth. One European (*n*=13) and two African (*n*=7) Dambarare individuals presented with dental caries, of which all three were female. Prevalence of caries will therefore only be described hereafter for the Monk's Kop and Dambarare collections due to the absence of this dental pathology in the Ashford Farms skeletal remains. Ashford Farms will however be taken into account for the final assessment of the pre- and post-European contact differentiation in dental caries.

6.2.1 Tooth type affected

The prevalence of which tooth type were mostly affected by caries can be seen in Table 6.2. The Monk's Kop collection presented with 2.4% teeth (*Na*=10; *n*=423) being affected by caries, with mostly the canines, first and third molars being affected at 4.3% (*Na*=2; *n*=47), 4.1% (*Na*=3; *n*=74) and 5.0% (*Na*=3; *n*=60) respectively. The male individuals of this population displayed a slightly higher prevalence of total teeth affected of 3.2% (*Na*=5; *n*=154) in comparison with female individuals at 2.1% (*Na*=5; *n*=235). This difference was however not statistically significant (χ^2=0.61; *p*=0.4347). The only statistically significant difference between the male and female individuals of Monk's Kop related to tooth type affected, was the first molar (χ^2= 6.58; *p*=0.0103) that had a higher prevalence of 7.4% (*Na*=2; *n*=27) in males than females at 2.6% (*Na*=1; *n*=39).

The male Dambarare individuals of European descent showed no dental caries, whereas the one female individual had evidence of dental caries visible on the second premolar and first molar. Similarly, it was only the females of African ancestry that exhibited dental caries on the first premolar and second molar. Females of African descent showed a slightly lower prevalence at 3.1% (*Na*=3; *n*=96) than the individual European female at 6.5% (*Na*=2; *n*=31). The total prevalence of dental caries related to sex for the combined Dambarare population resulted in a statistically significant difference (χ^2=11.40; *p*=0.0007) between male and female individuals (Table 6.2).

6.2.2 Individual caries frequency

The individual caries frequency reflects the frequency of individuals affected (*NIA*) by caries related to the total number of individuals investigated (*n*) and can be seen in Table 6.3. The caries frequency of males and females were very similar in the Monk's Kop collection at 17.6% (*NIA*=3; *n*=16) and 20% (*NIA*=4; *n*=18) respectively.

The individual caries frequency of the Dambarare population for European and African females were 7.7% (*NIA*=1; *n*=13) and 28.6% (*NIA*=2; *n*=7) respectively which did not result in a significant difference (χ^2=1.83; *p*=0.1760).

The combined Dambarare frequency was similar (15.0%) to the Monk's Kop collection (18.4%). The African individuals of Dambarare, however, showed a higher (28.6%) frequency than the Monk's Kop individuals (18.4%), but it was not statistically significant (χ^2=0.38; *p*=0.5373).

6.2.3 Carious teeth per mouth

The carious teeth per mouth calculation represents the number of carious teeth (*NTA*) related to the total number of individuals investigated (*n*) and can be seen in Table 6.3. On average, both male (*NTA*=5; *n*=16) and female (*NTA*=5; *n*=18) individuals of the Monk's Kop population presented with 0.3 carious teeth per mouth.

The individuals of European descent presented with 0.2 (*NTA*=2; *n*=1) carious teeth per mouth, whereas the individuals of African descent showed a higher probability of 0.4 (*NTA*=3; *n*=5) carious teeth per individual. There was, however, no statistically significant difference between the individuals of different ancestry of this population (χ^2=1.56; *p*=0.2123).

The individuals of Dambarare (ancestry pooled) and Monk's Kop therefore showed the same number of carious teeth per mouth (0.3).

6.2.4 Caries intensity (Tooth count)

The calculated value of number of carious teeth (*NTA*) per the total number of teeth investigated (*NT*) are defined as the caries intensity or tooth count value. These values can be seen in Table 6.3. The Monk's Kop caries intensity resulted in a slightly higher prevalence of 3.2% (*NTA*=5; *NT*=154) for males compared to females with 2.1% (*NTA*=5; *NT*=235), but did not result in it being statistically significantly different (χ^2=0.47; *p*=0.4952).

The African Dambarare individuals showed a lower caries intensity at 3.1% (*NTA*=3; *NT*=96), whereas the European individuals were represented at a higher value of 6.5% (*NTA*=2; *NT*=31). This, however, also did not result in a statistical significant difference (χ^2=1.68; *p*=0.1950).

The caries intensity for Monk's Kop (2.4%) was similar to the Dambarare individuals of African ancestry (2.2%), while the European individuals showed a lower intensity of 0.7%. There were no statistical significant difference between the Dambarare individuals of European and African descent (χ^2=01.68; *p*=0.1950).

6.2.5 Comparative populations

Caries intensity of the three collections investigated was generally low and ranged between 0% (Ashford Farms) and 2.4% (Monk's Kop). These intensities were not significantly different between the three studied populations. Three hunter-gatherer subsistence economy sites were compared to the three populations studied with regard to the caries intensity (number of carious teeth per number of teeth investigated) observed in each population. The reported caries intensity rates for the hunter-gatherer populations ranged from 1.3% (Kakamas) to 17.7% (Oakhurst). Riet River is a Later Stone Age site, Kakamas is a 18th century population and Oakhurst represents a population that lived between 6000 B.P and 10000 B.P with a caries intensity of 4.3%. Oakhurst, with a much higher intensity, differed significantly from all populations studied as well as with Riet River and Kakamas (Table 6.4). Riet River also had significantly more caries than the European population of Dambarare (χ^2=8.29, p=0.0040). There were no significant differences between the Monk's Kop population and Riet River and Kakamas.

Populations representing mixed/traditional economies that mostly utilised agriculture as subsistence included Mapungubwe/K2 (11th-14th century South African site), Toutswe (8th-13th century Botswana site), Venda (20th century South African site), Maroelabult (19th-20th century South African site) as well as Ingombe llede (7th-15th century Zambian site). The three populations studied did not differ statistically with each other; however the Mapungubwe/K2 (18.3%) and Venda (7.8%) collections showed significant differences with all three sites studied as can be seen in Table 6.5. The European population of Dambarare (0.7%) showed significant differences with the 4.5% caries intensity of Maroelabult (χ^2=8.35; p=0.0039) as well as Ingombe llede with a 4.4% caries intensity (χ^2=7.91; p=0.0049). Toutswe, with a caries intensity of 3.4% only showed significant differences from the European individuals of Dambarare with a intensity of 0.7% (χ^2=5.47, p=0.0194).

It is thus clear that the three populations under study were less affected by caries than some of the comparative populations. The comparison to some of the hunter-gatherer and agricultural economic subsistence populations suggests that although these populations most probably relied on agriculture as a way of life (higher caries intensity related to increased intake of carbohydrates) they may have still relied on some hunter-gatherer customs when required, or consumed non-cariogenic food stuff as the caries intensity of all three populations were relatively low.

6.3 Antemortem tooth loss (AMTL)

The prevalence of antemortem tooth loss (AMTL) for all three sites (Dambarare ancestry pooled) were very similar with averages ranging from 14%-16% as can be seen in Table 6.6 which describes this dental observation according to sex and tooth type. Various calculations related to AMTL prevalence in a population are represented in Table 6.7. The following will be described for each of the populations studied:

NIA/n = Frequency of individuals with one or more teeth lost antemortem (*NIA*) related to the total number of individuals investigated (*n*). (*Individual AMTL frequency*)

NTA/n = Number of teeth lost antemortem (*NTA*) related to the total number of individuals investigated (*n*). (*AMTL per mouth*)

NTA/NT = Number of teeth lost antemortem (*NTA*) related to the total number of teeth investigated (*NT*). (*AMTL intensity/tooth count*). This frequency will then also be compared to applicable populations as shown in Table 6.8.

All descriptions will be done per collection studied sorted by sex, thus a separate male and female prevalence will be depicted with a total for each population.

The Monk's Kop collection presented with fifteen (*n*=38) individuals displaying antemortem tooth loss, while Ashford Farms (*n*=5) showed three individuals affected by this observation. Nine European (*n*=13) and two African (*n*=7) Dambarare individuals presented with dental caries, of which all three were female.

6.3.1 Tooth type affected

The prevalence of tooth type lost antemortem can be seen in Table 6.6. The Monk's Kop collection yielded a total 71 teeth (14.4%) being lost antemortem, with males at a slightly higher prevalence of 16.8% (*NTA*=31; *n*=185) than females at 14.5%

(*NTA*=40; *n*=275) (not significantly different, χ^2=0.41, *p*=0.5198). The first incisors were specifically affected as can be seen by the high percentage of male (83.3%) and female (53.8%) AMTL for this tooth type. The Monk's Kop collection did not result in any significantly different scenarios of AMTL between males and females for total AMTL or per tooth type.

As can be seen in Table 6.6, the Ashford Farms collection showed an average of 15.9% (*NTA* =10; *n*=63) prevalence with males affected more at 18.5% (*NTA*=5; *n*=27) than females at 13.9% (*NTA* =5; *n*=36). This, however, did not prove to be significantly different (χ^2=0.25, *p*=0.6187) between the two sexes. Incisors were, once again, the most common tooth to be lost in both sexes.

As can be seen in Table 6.7, Dambarare yielded a total of 484 possible tooth positions of which 71 was lost antemortem (14.7%). In contrast with the pre-European contact sites, AMTL mostly affected the molars in the Dambarare individuals with a prevalence of between 20% and 30% (Table 6.6). This can clearly be seen in Figure 6.2 where all mandibular molars have been lost antemortem on individual D_AA3, a European male, age 40-55 years at death. The only significant difference between the two sexes regarding tooth type affected, was that of the first molar with a substantially higher prevalence for males (32%) than females at 8.3% (χ^2=4.93; *p*=0.0263) as can be seen in Table 6.6.

The Monk's Kop population clearly shows a very high prevalence of antemortem loss of the first incisors and mostly those of the mandible, whilst the Dambarare individuals mostly lost posterior teeth. Tooth modification often result in irreparable damage to the tooth which ultimately leads to antemortem tooth loss (Gibbon and Grimoud, 2014). The high prevalence of lost first incisors (55.8%) of the Monk's Kop and also possibly Ashford Farms populations could therefore possibly be related to the custom practiced by this population of filing the first mandibular incisors to result in a V-shape space between the left and right side. It can also be the result of purposeful removal of the teeth for cultural purposes (L'Abbé, 2005). It has been shown that the loss of posterior teeth is usually the result of carious activity and is therefore more prevalent in most populations. The Dambarare population's antemortem tooth loss of mostly the posterior teeth (M1=32.0%; M2=23.1%; M3=20.9%) could therefore be related to carious activity.

6.3.2 Individual AMTL frequency

The individual AMTL frequency reflects the frequency of individuals affected (*NIA*) by tooth loss related to the total number of individuals investigated (*n*) and can be seen in Table 6.7. The individual frequency of AMTL for the Monk's Kop skeletal collection was 39.5% (*NIA*=15; *n*=38) and female individuals were affected more at 50% (*NIA*=9; *n*=18) while males had a slightly lower frequency at 37.5% (*NIA*=6; *n*=16). The difference in frequency between males and females were, however, not significantly different (χ^2=0.54; *p*=0.4637). The Ingombede llede population showed a similar individual AMTL frequency, while the Venda population showed a significantly higher number of affected individuals at 64.9%.

The individual frequency of AMTL in the Ashford Farms collection is considerably higher at 60% (*NIA*=3; *n*=5) than Monk's Kop at 39.5% (*NIA*=15; *n*=38) but compared with the Venda population (64.9%). This difference and similarity should however be treated with caution due to the small sample size available for the Ashford Farms collection. The difference in individual frequency of AMTL for females (66.7%) and males (50%) of the Ashford Farms collection did not prove to be significantly different (χ^2=0.14; p=0.7094).

The AMTL frequency was much higher in the European Dambarare individuals at 69.2% (*NIA*=2; *n*=13) which compares with the Venda population (64.9%). The Dambarare individuals of African origin showed only a 28.6% (*NIA*=2; *n*=7) individual AMTL frequency, but was not statistically different from the European population (χ^2=0.039; *p*=0.8431).

6.3.3 AMTL per mouth

The antemortem loss of teeth per mouth calculation represents the number of teeth lost antemortem (*NTA*) related to the total number of individuals investigated (*n*) and can be seen in Table 6.7. An average of 1.9 (*NTA*=71; *n*=38) teeth were lost per individual in the Monk's Kop population, with females at a slightly higher rate (2.2), than males (1.9). The Venda population yielded almost double the Monk's Kop figures at

3.6 teeth lost per mouth. The Ingombede llede population again showed a similar (2.1) AMTL per mouth scenario to that of Monk's Kop.

On average individuals from Ashford Farms would have lost 2.0 teeth antemortem per mouth, with males being higher at 2.5 (*NTA*=5; *n*=2) teeth per mouth than females at a lower rate of 1.3 (*NTA*=5; *n*=2). The Ashford Farms AMTL per mouth (2.0) therefore compared to Monk's Kop (1.9) and Ingombe llede (2.1), but differed substantially from the Venda population which was much higher at 3.6 teeth lost antemortem per individual investigated.

The individuals of European ancestry also showed an extremely high rate of 4.8 (*NTA*=62; *n*=13) teeth lost antemortem per mouth, in comparison with the Africans at 1.3 (*NTA*=9, *n*=7). The Europeans thus showed an even higher prevalence of total number of teeth per every individual investigated than Venda (3.6) and Ingombede llede (2.1). The African individuals of Dambarare showed the lowest antemortem tooth loss per mouth of all populations studied as well as compared to Venda and Ingombede llede.

6.3.4 AMTL intensity (Tooth count)

The calculated value of number of teeth lost antemortem (*NTA*) per the total number of teeth investigated (*NT*) are defined as the AMTL intensity or tooth count value. These values are shown in Table 6.7. The Monk's Kop AMTL intensity resulted in a slightly higher prevalence of 18.8% (*NTA*=31; *NT*=185) for males compared to females with 14.6% (*NTA*=40; *NT*=275), but did not result in it being statistically significantly different (χ^2=0.41; *p*=0.5198).

The Ashford Farms collection displayed the highest (15.9%) AMTL intensity of the three sites studied, but only significantly differed from the 6.2% intensity of the Dambarare individuals of African origin (χ^2=4.94; *p*=0.0262).

Overall the females of pooled ancestry (*NTA* =9; *NT* =136) of Dambarare showed a significantly lower AMTL intensity (6.6%) than males of pooled ancestry (*NTA* =62; *NT*=348) at 17.8% which resulted in a *p*-value of 0.0017 (χ^2=9.80). When taking ancestry into account, the European individuals showed a significantly higher

(χ^2=11.84; p=0.0006) AMTL intensity at 18.3% (NTA=62; NT=339) than those of African descent at 6.2% (NTA=9; I=145).

6.3.5 Comparative populations

The AMTL intensities of all collections studied were compared to Venda and Ingombe llede (Table 6.8). AMTL intensity of the three collections investigated was generally high and ranged between 14.4% (Monk's Kop) and 15.9% (Ashford Farms). The reported AMTL intensity rates were 17.2% for the Venda population and a lower 9.4% for the Ingombede llede collection. Data for Mapungubwe/K2 and Toutswe were not available. Due to the low antemortem tooth loss per number of possible tooth positions for the Dambarare individuals of African descent, there were significant differences between this population and Monk's Kop (χ^2=6.82; p=0.0090), Ashford Farms (χ^2=4.94; p=00262), the European Dambarare sample (χ^2=11.84; p=0.0006) as well as Venda (χ^2=11.91; p=0.0006). Ingombede llede, however, did not differ significantly from the African Dambarare individuals (χ^2=1.46; p=0.2271). The Monk's Kop population (14.4%), however, differed substantially from the Ingombede llede (9.4%) collection (χ^2=6.09; p=0.0136).

6.4 Other dental pathology

6.4.1 Abscesses

Skeletal evidence for dental abscesses could not be found in the Ashford Farms and Dambarare collections. Monk's Kop, however, had four of the possible 38 minimum number of individuals (10.5%) being affected by this condition as can be seen in Table 6.9. Males displayed a slightly higher prevalence (12.5%) than females (11.1%), but the difference was not significance (χ^2=0.02; p=0.9002). Individual M_257 showed signs of an dental abscess inferior to the right 1st mandibular molar, completely exposing the roots. This was most probably the same case on the other side as the left mandibular 1st molar was lost antemortem. The right 1st mandibular molar of individual M_296, also presented with signs of abscess involvement, although the roots of the affected tooth were not completely exposed as bone resorption had only started in this case. This individual also presented with antemortem tooth loss of the left 1st mandibular molar as well as caries of both the mandibular 1st molars. Signs of dental abscess formation below the left mandibular first molar are clearly visible in individual M_255 (Figure 6.3). The prevalence of abscesses in males and females are comparable at 12.5% and 11.1% respectively. Female individual M_432 showed limited evidence of dental abscess formation in the right canine root region of the mandible.

6.4.2 Calculus

Severe calculus formation was observed in only one case (5%) in the Dambarare collection and slight calculus formation in another case (2.6%) in the Monk's Kop collection (Table 6.9). Dambarare individual D_C2 is an adult male, age 45-55 and is of European ancestry. As can be seen in Figure 6.4, severe calculus formed on both the buccal and lingual aspects of specifically the maxillary molars. Individual M_420 of the Monk's Kop population was represented by only skull fragments and one molar and a few long bone fragments. The molar had evidence of severe calculus formation on mostly the buccal surface.

6.4.3 Periodontitis

Signs of alveolar bone resorption indicative of periodontitis were observed in all the collections, but most frequently in the Ashford farms and Dambarare collections at 60% and 65% prevalence respectively. The male individuals of the Monk's Kop population showed a higher prevalence of periodontitis at eight of the 16 individuals (50%) being affected, whereas the females had a lower prevalence of only six of the 18 females being affected. Severe periodontitis can be observed in the mandible of individual M_400a showing extensive bone resorption resulting in the exposure of the tooth roots (Figure 6.5). This may have been responsible for the antemortem tooth loss also presented in this individual. The male individuals showed a higher prevalence of periodontitis at 50% (*Na*=8, *n*=16) than the females 33% (*Na*=6; *n*=18), but did not result in a significant difference (χ^2=0.97; *p*=0.3243).

Both males of the Ashford Farms skeletal collection (A_2 and A_4) displayed evidence of slight periodontitis, whereas only one female (A_1) was affected. This difference between the two sexes was however not significant (χ^2=2.22; *p*=0.1360).

The Dambarare individuals of European descent yielded a high prevalence of 75% (*Na*=9; *n*=12) for males and 100% (*Na*=1; *n*=1) prevalence for females. The African males were however not affected, but three of the five (60%) females showed signs of different degrees of alveolar bone resorption. The European population therefore showed a substantially higher prevalence of periodontitis at 76.9% (*Na*=10, *n*=13) than the African population at 42.9% (*Na*=3; *n*=7), but did not result in a significant difference (χ^2=2.32; *p*=0.1276). When comparing the three populations it therefore seems that Monk's Kop had a substantially lower prevalence of periodontitis (36.8%) than that of Ashford Farms (60%) and the pooled Dambarare sample (65%). It was, however, only the Monk's Kop and pooled Dambarare population that showed to be statistically different (χ^2=4.18; *p*=0.0410).

6.5 Dental abnormalities

6.5.1 Supernumerary teeth

Additional teeth, also known as supernumerary teeth were confirmed in only one case in the Monk's Kop population as can be seen in Table 6.10. Neither the Ashford Farms nor Dambarare collections presented with any cases of supernumerary teeth. Individual M_367, an adult female of 30-50 years, showed unilateral supernumerary teeth on the left maxillary region, associated with the first premolar and molar (Figure 6.6). The additional tooth associated with the molar region is in contact with most of the lingual surface of the first molar and to some extent to the distal surface of the second molar. This tooth also shows similarities to the occlusal surfaces of molars, although it is smaller in size. The additional tooth associated with the premolar region of this individual, is sharp and is in contact with the distal surface of the first molar and the mesial surface of the second premolar. The second premolar is also absent on the side associated with the additional teeth. It does not seem that this developmental dental anomaly would have had any negative impact on the individual.

6.5.2 Crowding of teeth

Two cases of tooth crowding were observed in the Monk's Kop population, one in an adult female, M_290 (right lateral first incisor displaced posteriorly) and another in a sub-adult individual of indeterminate sex, M_450, aged 8-12 years (both first incisors displaced anteriorly). No individuals of Ashford Farms were affected by this dental occurrence (Table 6.10). The Dambarare population yielded only one case of dental crowding as can be seen in Figure 6.7. This adult male of 40-55 years from European descent (D_A2) shows displacement of all mandibular incisors.

6.5.3 Modifications of teeth

Only Monk's Kop showed evidence of tooth modification at a prevalence of five individuals of a possible 38 minimum number of individuals investigated with observable teeth (15.8%). The minimum number of individuals identified with tooth modifications is based on the fact that there were five right first incisors presenting with oblique filing. Table 6.10 shows that there were no examples of tooth modification present in the male individuals, however there were three female middle-aged individuals (M_201, M_255 and M_295) and at least two adult individuals of indeterminate sex, who had undergone dental modifications. Tooth modification in this population consisted of V-filing of specifically the mandibular first incisors. Figure 6.8 shows individual M_295, an African female, with mesial filing of the mandibular first incisors creating a V-shaped appearance. Many loose teeth clearly indicative of the same procedure were also observed but could not be linked to a specific individual (Figure 6.9). Thus the prevalence of this type of modification might be higher than indicated and therefore unfortunately no true comparison between the two sexes is possible.

Cultural modifications can be testament of a certain time in the individual's life, thus social identity (van Reenen and Briedenhann, 1986) or peer pressure (Friedling and Morris, 2005) or just used for enhancing appearance through decoration (Bachmayer, 1982; Jones, 1992; Roberts and Manchester, 2010). Purposes related to religion (Davies, 1963) and superstition (Halestrap, 1971) have also been reported. Due to tooth modifications only displayed in female individuals of this population, it could suggest that the purpose of the modification was related to the social identities of females or for decorative purposes.

The high frequency of antemortem tooth loss of the first incisors of the Monk's Kop population also suggests that the filing of teeth could have resulted in some individuals losing the filed tooth due to irreparable damage done by the procedure. Both Mapungubwe and Ingombede llede populations presented with V-filing tooth modifications, however in these cases the maxillary first incisors were modified.

6.6 Miscellaneous findings

The Monk's Kop collection did not present with any other dental or developmental dental pathology or anomaly.

The Ashford Farms collection had one individual affected by a developmental dental anomaly (A_1). This African female of approximately 45-55 years of age presented with a mesioangular impaction of the right M3 on the mandible.

The only African Dambarare developmental anomaly was that of individual D_B3 (female, approximate age 15-20) who presented with a peg-shaped left mandibular incisor.

6.7 Dental health comparison of individuals of African ancestry

Table 6.12 provides a summary that compares the dental health of the individuals of African ancestry only. This comparison therefore attempts to compare the northern Zimbabwean population's dental health prior to European contact and post European contact. For this purpose, the data from Monk's Kop and Ashford Farms were combined and served as a data base for the pre-European contact period, whereas Dambarare was representative of the post-European contact period.

Dental caries showed a considerably higher prevalence in the post-European contact period at 28.6% (*Na*=2; *n*=7) compared to that of the period before European contact at 16.3% (*Na*=7; *n*=43). Antemortem tooth loss, in contrast to the above was more prevalent under the populations who existed prior to European contact (41.9%)

than post-contact (28.6%). There was, however, no significant difference between the caries (χ^2=0.62; p=0.4324) or antemortem tooth loss (χ^2=0.44; p=0.5057) prevalences between the two contact periods. This may suggest that the diets largely remained unchanged following early European contact.

Skeletal signs of abscess formation were only observed in the pre-contact period at a prevalence rate of 9.3% (*Na*=4, *n*=43); not statistically significant at χ^2=0.71; p=0.4002. Calculus formation was entirely absent from both contact periods for individuals of African descent.

The prevalence of periodontitis was equally high in both the pre- and post-contact periods at 39.5% (*Na*=17, *n*=43) and 42.9% (*Na*=3, *n*=7) respectively which did not result in any significant difference (χ^2=0.03; p=0.8679). Supernumerary teeth, crowding of teeth and teeth modifications were only observed in the pre-contact period and only in a few cases, and therefore its prevalence was not significantly different within the three populations studied.

Table 6.1: A summary of accession numbers presenting with dental pathology or dental abnormalities in all collections studied.

Collection (Ancestry)	Dental observation							
	Dental caries	**Antemortem tooth loss**	**Abscesses**	**Calculus**	**Periodontitis**	**Supernumerary teeth**	**Crowding of teeth**	**Modifications of teeth**
Monk's Kop (African)	**M_199** **M_255** **M_257** **M_282** **M_296** M_401 **M_432**	**M_37b** M_91 M_117a **M_199** **M_255** **M_257** M_266 **M_282** **M_296** M_328 **M_416** M_421 **M_432** M_473 M_486	**M_255** **M_257** **M_296** **M_432**	M_420	**M_37b** **M_199** M_200 M_207 M_230 **M_255** **M_257** **M_282** **M_290** **M_296** M_357 **M_367** M_400a **M_416**	**M_367**	M_450 **M_290**	M_42* M_142* M_159* M_166b* M_201 **M_255** M_295
Ashford (African)	-	**A_2** A_7	-	-	A_1 **A_2** A_4	-	-	-
Dambarare (European)	**D_A4**	**D_AA1** D_A1 D_A6 D_A7 **D_C2** **D_C5** D_C6	-	**D_C2**	**D_AA1** D_AA2 D_AA3 **D_A2** D_A3 **D_A4** **D_C2** **D_C5**	-	**D_A2**	-
Dambarare (African)	**D_B1** D_C4	**D_B1** **D_B4** D_C7	-	-	**D_B1** D_B2 **D_B4**	-	-	-
Dambarare (Indeterminate)	-	-	-	-	-	-	-	-
Individuals affected	**10**	**27**	**4**	**2**	**28**	**1**	**3**	**5#**

*Skeletal element/sub-collection that is part of the commingled collection; thus does not represent a separate individual (MNI)
#Number of individuals based on observing 5 mandibular I1's of the right side showing V-filing
Bolded accession numbers: Individuals presenting with multiple dental pathology and/or abnormalities

Table 6.2: The prevalence of dental caries observed in adults in all the collections studied sorted by sex and tooth type (caries intensity per tooth type).

Collection	Ancestry	Sex		I1	I2	C	P1	P2	M1	M2	M3	Total
Monk's Kop	African	Male	*n*	2	10	21	19	21	27	30	24	154
			NTA	0	1	1	1	0	2	0	0	5
			%	0.0	10.0	4.8	5.3	0.0	7.4	0.0	0.0	**3.2**
		Female	*n*	12	20	22	31	31	39	44	36	235
			NTA	0	0	1	0	0	1	0	3	5
			%	0.0	0.0	4.5	0.0	0.0	2.6	0.0	8.3	**2.1**
		Indeterminate	*n*	5	4	4	7	4	8	2	0	34
			NTA	0	0	0	0	0	0	0	0	0
			%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
		Total	*n*	19	34	47	57	56	74	76	60	423
			NTA	0	1	2	1	0	3	0	3	10
			%	0.0	2.9	4.3	1.8	0.0	4.1	0.0	5.0	**2.4**
			χ^2	-	2.07	0.00	1.66	-	6.58	-	2.11	0.47
			p	-	0.1503	0.9731	0.1969	-	0.0103	-	0.1468	0.4952
Ashford	African	Male	*n*	0	0	0	1	2	8	5	6	22
			NTA	0	0	0	0	0	0	0	0	0
		Female	*n*	0	0	4	4	7	7	3	6	31
			NTA	0	0	0	0	0	0	0	0	0
		Total	*n*	0	0	4	5	9	15	8	12	53
			NTA	0	0	0	0	0	0	0	0	0
			%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
			χ^2	-	-	-	-	-	-	-	-	-
Dambarare	European	Male	*n*	28	27	32	34	33	28	34	30	246
			NTA	0	0	0	0	0	0	0	0	0
			%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
		Female	*n*	4	4	4	4	4	4	4	3	31
			NTA	0	0	0	0	1	1	0	0	2
			%	0.0	0.0	0.0	0.0	25.0	25.0	0.0	0.0	**6.5**
	African	Male	*n*	4	4	5	5	6	6	6	4	40
			NTA	0	0	0	0	0	0	0	0	0
			%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
		Female	*n*	6	8	10	12	15	18	17	10	96
			NTA	0	0	0	0	1	0	2	0	3
			%	0.0	0.0	0.0	0.0	6.7	0.0	11.8	0.0	**3.1**
	Total (Male)		*n*	32	31	37	39	39	34	40	34	286
			NTA	0	0	0	0	0	0	0	0	0
			%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Total (Female)		*n*	10	12	14	16	19	22	21	13	127
			NTA	0	0	0	0	2	1	2	0	5
			%	0.0	0.0	0.0	0.0	10.5	4.5	9.5	0.0	**3.9**
			χ^2	-	-	-	-	4.25	1.57	3.95	-	11.40
			p	-	-	-	-	0.0392	0.2097	0.0472	-	0.0007

n = Total number of teeth available per tooth type in the specific collection
NTA = Total number of teeth affected with dental caries per tooth type

$$\% = \frac{\text{Total number of teeth affected with dental caries per tooth type}}{\text{Number of teeth investigated per tooth type}} \times 100$$

χ^2 = Chi-squared value comparing the indices between the sexes regarding tooth type, excluding individuals with indeterminate sex
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 6.3: The prevalence of dental caries observed in adults in all the collections studied compared to dental caries observed in various comparative populations.

Collection	Ancestry	Sex	Individual caries frequency[1]			Carious teeth per mouth[2]			Caries intensity (tooth count)[3]		
			n	*NIA*	%	*n*	*NTA*	%	*NT*	*NTA*	%
Monk's Kop	African	Male	16	3	18.8	16	5	0.3	154	5	3.2
		Female	18	4	22.2	18	5	0.3	235	5	2.1
		Indeterminate	4	0	0.0	4	0	0.0	34	0	0.0
		Total	**38**	**7**	**18.4**	**38**	**10**	**0.3**	**423**	**10**	**2.4**
Ashford	African	Male	2	0	0.0	2	0	0.0	22	0	0
		Female	3	0	0.0	3	0	0.0	31	0	0
		Total	**5**	**0**	**0.0**	**7**	**0**	**0.0**	**53**	**0**	**0.0**
Dambarare	European	Male	12	0	0.0	12	0	0.0	246	0	0.0
		Female	1	1	100.0	1	2	2.0	31	2	6.5
		Sub-total	13	1	**7.7**	13	2	**0.2**	277	2	**0.7**
	African	Male	2	0	0.0	2	0	0.0	40	0	0.0
		Female	5	2	40.0	5	3	0.6	96	3	3.1
		Sub-total	7	2	**28.6**	7	3	**0.4**	136	3	**2.2**
	Indeterminate	Male	-	-	-	-	-	-	-	-	-
		Female	-	-	-	-	-	-	-	-	-
		Total	20	3	**15.0**	20	5	**0.3**	413	5	**1.2**
Hunter-Gatherer	**Source**	**NT**	**Individual caries frequency[1]**			**Carious teeth per mouth[2]**			**Caries intensity (tooth count)[3]**		
Riet River	(Sealy et al., 1992)	1061			**41.7**			**1.0**			**4.3**
Kakamas	(Morris, 1992)	989			**18.8**			**0.3**			**1.3**
Oakhurst	(Morris, 1992)	192			**84.6**			**2.6**			**17.7**
Agricultural	**Source**										
K2 Mapungubwe	(Steyn, 1994)	306			**54.5**			**1.4**			**18.3**
Venda	(L'Abbé, 2005)	2016			**60.8**			**1.6**			**7.8**
Toutswe	(Mosothwane, 2004)	587			**21.7**			**4.4**			**3.4**
Maroelabult	(Steyn et al., 2002)	582			**56.6**			**2.0**			**4.5**
Ingombede llede	(Gibbon and Grimoud, 2014)	482			**54.2**			**0.9**			**4.4**

1 = $\frac{\text{Total number of individuals affected by dental caries}}{\text{Total number of individuals investigated}} \times 100$

2 = $\frac{\text{Total number of carious teeth}}{\text{Total number of individuals investigated}} \times 100$

3 = $\frac{\text{Total number of carious teeth}}{\text{Total number of teeth investigated}} \times 100$

n = Total number of individuals investigated with observable teeth
NIA = Total number of individuals affected by dental caries
NTA = Total number of teeth affected by dental caries
NT = Total number of teeth investigated
%= Percentage as calculated at 1, 2 and 3 as applicable

Table 6.4: The caries intensity (tooth count) in adults in all the collections studied compared to that of applicable comparative populations of a hunter-gatherer subsistence economy.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare European	Dambarare African	Dambarare Total	Riet River	Kakamas	Oakhurst
Monk's Kop	This study 13th -15th Century Zimbabwe	African: *n* = 423 % (*Na* = 10) = 2.4	χ^2		1.28	2.68	0.01	1.58	3.24	2.04	46.81
			p		0.2579	0.1017	0.9152	0.2091	0.0720	0.1535	0.0001
Ashford	This study 14th - 15th Century Zimbabwe	African *n* = 53 % (*Na* = 0) = 0.0	χ^2			0.39	1.19	0.65	2.40	0.71	10.90
			p			0.5349	0.2757	0.4206	0.1216	0.4010	0.0010
Dambarare	This study 17th Century Zimbabwe	European *n* =277 % (*Na* = 2) = 0.7	χ^2				1.68		8.29	0.65	46.17
			p				0.1950		0.0040	0.4206	0.0001
		African *n* = 136 % (*Na* = 3) = 2.2	χ^2						1.39	0.68	19.11
			p						0.2380	0.4104	0.0001
		Total *n* = 413 % (*Na* = 5) = 1.2	χ^2						8.69	0.02	59.15
			p						0.0032	0.8749	0.0001
Riet River	(Morris, 1992) Later Stone Age South Africa(Steyn	African *n* = 1061 % (*Na* = 46) = 4.3	χ^2							16.71	48.64
			p							0.0001	0.0001
Kakamas	(Morris, 1992) 18th Century South Africa	African *n* = 989 % (*Na* = 13) = 1.3	χ^2								113.08
			p								0.0001
Oakhurst	(Sealy et al., 1992) 10 000 – 6 000 B.P. South Africa	African *n* = 192 % (*Na* = 34) = 17.7	χ^2								
			p								

n = Total number of teeth investigated
Na = Number of carious teeth
% = Percentage carious teeth observed
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 6.5: The caries intensity (tooth count) in adults in all the collections studied compared to that of applicable comparative populations of an agricultural (traditional) subsistence economy.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare			Mapung K2	Toutswe	Venda	Maroela bult	Ingombe llede
						Euro	African	Total					
Monk's Kop	This study 13th - 15th Century Zimbabwe	African: *n* = 423	χ^2		1.28	2.68	0.01	1.58	54.77	0.93	16.2	3.14	2.70
		% (*Na* = 10) = 2.4	*p*		0.2579	0.1017	0.9152	0.2091	0.0001	0.3354	0.0001	0.0765	0.1001
Ashford	This study 14th - 15th Century Zimbabwe	African *n* = 53	χ^2			0.39	1.19	0.65	11.49	1.86	4.47	2.47	2.40
		% (*Na* = 0) = 0.0	*p*			0.5349	0.2757	0.4206	0.0007	0.1722	0.0346	0.1161	0.1211
Dambarare	This study 17th Century Zimbabwe	European *n* =277	χ^2				1.68		50.15	5.47	18.84	8.35	7.91
		% (*Na* = 2) = 0.7	*p*				0.1950		0.0001	0.0194	0.0001	0.0039	0.0049
		African *n* = 136	χ^2						21.09	0.52	5.77	1.45	1.31
		% (*Na* = 3) = 2.2	*p*						0.0001	0.4720	0.0163	0.2278	0.2515
		Total *n* = 413	χ^2						66.12	4.80	23.82	8.49	7.81
		% (*Na* = 5) = 1.2	*p*						0.0001	0.0285	0.0001	0.0036	0.0052
Mapung K2	(Steyn, 1994) 11th - 14th Century South Africa	African *n* = 306	χ^2							57.30	35.24	45.79	41.28
		% (*Na* = 56) = 18.3	*p*							0.0001	0.0001	0.0001	0.0001
Toutswe	(Mosothwane, 2004) 8th - 13th Century Botswana	African *n* = 587	χ^2								13.77	0.87	0.65
		% (*Na* = 20) = 3.4	*p*								0.0002	0.3512	0.4211
Venda	(L'Abbé, 2005) 20th Century South Africa	African *n* = 2016	χ^2									7.60	6.92
		% (*Na* = 157) = 7.8	*p*									0.0058	0.0085
Maroela bult	(Steyn et al., 2002) 19th - 20th Century South Africa	African *n* = 582	χ^2										0.01
		% (*Na* = 26) = 4.5	*p*										0.9304
Ingombe llede	(Gibbon and Grimoud, 2014) 7th - 15th Century Zambia	African *n* = 482	χ^2										
		% (*Na* = 21) = 4.4	*p*										

n = Total number of teeth investigated
Na = Number of carious teeth
% = Percentage carious teeth observed

χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 6.6: The prevalence of antemortem tooth loss (AMTL) observed in adults in all the collections studied sorted by sex and tooth type (AMTL intensity per tooth type).

Collection	Ancestry	Sex		Tooth type: I1	I2	C	P1	P2	M1	M2	M3	Total
Monk's Kop	African	Male	*n*	12	12	21	19	24	34	34	29	185
			NTA	10	2	0	0	3	7	4	5	31
			%	**83.3**	**16.7**	**0.0**	**0.0**	**12.5**	**20.6**	**11.8**	**17.2**	**16.8**
		Female	*n*	26	25	26	35	36	44	45	38	275
			NTA	14	5	4	4	5	5	1	2	40
			%	**53.8**	**20.0**	**15.4**	**11.4**	**13.9**	**11.4**	**2.2**	**5.3**	**14.5**
		Indeterminate	*n*	5	4	4	7	4	8	2	0	34
			NTA	0	0	0	0	0	0	0	0	0
			%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Total	*n*	43	41	51	61	64	86	81	67	494
			NTA	24	7	4	4	8	12	5	7	71
			%	**55.8**	**17.1**	**7.8**	**6.6**	**12.5**	**14.0**	**6.2**	**10.4**	**14.4**
			χ^2	3.07	0.06	3.53	2.35	0.02	1.25	2.97	2.52	0.41
			p	0.0798	0.8058	0.0602	0.1257	0.8768	0.2628	0.0846	0.1122	0.5198
Ashford	African	Male	*n*	4	1	0	1	2	8	5	6	27
			NTA	4	1	0	0	0	0	0	0	5
			%	**100.0**	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**18.5**
		Female	*n*	4	0	4	4	7	7	4	6	36
			NTA	4	0	0	0	0	0	1	0	5
			%	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**25.0**	**0.0**	**13.9**
		Total	*n*	8	1	4	5	9	15	9	12	63
			NTA	8	1	0	0	0	0	1	0	10
			%	**100.0**	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**	**11.1**	**0.0**	**15.9**
			χ^2	-	-	-	-	-	-	1.41	-	0.25
			p	-	-	-	-	-	-	0.2357	-	0.6187
Dambarare	European	Male	*n*	33	33	38	38	37	44	46	39	308
			NTA	5	6	6	4	4	16	12	9	62
			%	**15.2**	**18.2**	**15.8**	**10.5**	**10.8**	**36.4**	**26.1**	**23.1**	**20.1**
		Female	*n*	4	4	4	4	4	4	4	3	31
			NTA	0	0	0	0	0	0	0	0	0
			%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	African	Male	*n*	4	4	5	5	6	6	6	4	40
			NTA	0	0	0	0	0	0	0	0	0
			%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		Female	*n*	6	8	12	12	16	20	19	12	105
			NTA	0	0	2	0	1	2	2	2	9
			%	**0.0**	**0.0**	**16.7**	**0.0**	**6.3**	**10.0**	**10.5**	**16.7**	**8.6**
		Total (Male)	*n*	37	37	43	43	43	50	52	43	348
			NTA	5	6	6	4	4	16	12	9	62
			%	13.5	16.2	14.0	9.3	9.3	32.0	23.1	20.9	**17.8**
		Total (Female)	*n*	10	12	16	16	19	24	23	15	136
			NTA	0	0	2	0	1	2	2	2	9
			%	0.0	0.0	12.5	0.0	5.3	8.3	8.7	13.3	**6.6**
			χ^2	1.51	2.22	0.02	1.60	0.29	4.93	2.17	0.42	9.80
			p	0.2188	0.1365	0.8847	0.2064	0.5902	0.0263	0.1405	0.5181	0.0017

n = Total number of teeth investigated per tooth type
NTA = Total number of teeth lost antemortem per tooth type
%= $\frac{\text{Number of teeth lost antemortem per tooth type}}{\text{Number of teeth investigated per tooth type}} \times 100$

χ^2 = Chi-squared value comparing the sex of a specific collection studied with that of the tooth type
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 6.7: The prevalence of antemortem tooth loss (AMTL) observed in all the collections studied compared to antemortem tooth loss observed in various comparative populations.

Collection	Ancestry	Sex	Individual AMTL frequency[1]			AMTL per mouth[2]			AMTL intensity (tooth count)[3]		
			n	*NIA*	%	*n*	*NTA*	%	*NT*	*NTA*	%
Monk's Kop	African	Male	16	6	37.5	16	31	1.9	185	31	16.8
		Female	18	9	50.0	18	40	2.2	275	40	14.6
		Indeterminate	4	0	0.0	4	0	0.0	34	0	0.0
		Total	38	15	**39.5**	38	71	**1.9**	494	71	**14.4**
Ashford	African	Male	2	1	50.0	2	5	2.5	27	5	18.5
		Female	3	2	66.7	3	5	1.7	36	5	13.9
		Total	5	3	**60.0**	5	10	**2.0**	63	10	**15.9**
Dambarare	European	Male	12	9	75.0	12	62	5.17	308	62	20.1
		Female	1	0	0	1	0	0	31	0	0
		Subtotal	13	9	**69.2**	13	62	**4.8**	339	62	**18.3**
	African	Male	2	0	0	2	0	0	40	0	0
		Female	5	2	40.0	5	9	1.80	105	9	8.6
		Subtotal	7	2	**28.6**	7	9	**1.3**	145	9	**6.2**
	Indeterminate	Male	-	-	-	-	-	-	-	-	-
		Female	-	-	-	-	-	-	-	-	-
		Total	20	11	**55.0**	20	71	**3.6**	484	71	**14.7**
Comparative	**Source**	**NT**									
K2 Mapungubwe	(Steyn, 1994)	306			**-**			**-**			**-**
Venda	(L'Abbé, 2005)	2016			**64.9**			**3.6**			**17.2**
Toutswe	(Mosothwane, 2004)	587			**-**			**-**			**-**
Ingombede llede	(Gibbon and Grimoud, 2014)	532			**37.5**			**2.1**			**9.4**

1 = $\frac{\text{Total number of individuals with one or more teeth lost antemortem}}{\text{Total number of individuals investigated}} \times 100$

2 = $\frac{\text{Total number of teeth lost antemortem}}{\text{Total number of individuals investigated}} \times 100$

3 = $\frac{\text{Total number of teeth lost antemortem}}{\text{Total number of teeth investigated}} \times 100$

n = Total number of individuals investigated
NIA = Total number of individuals with one or more teeth lost antemortem
NTA = Total number of teeth lost antemortem
NT = Total number of teeth investigated
%= Percentage as calculated at 1,2 and 3 as applicable

Table 6.8: The antemortem tooth loss (AMTL) intensity (tooth count) in adults in all the collections studied compared to that of applicable comparative populations.

Collection	Source Context	Ancestry: Prevalence		Monk's Kop	Ashford	Dambarare Euro	Dambarare African	Dambarare Total	Mapungubwe	Toutswe	Venda	Ingombe Llede
Monk's Kop	This study 13th-15th Century Zimbabwe	African: *n* = 494	χ^2		0.10	2.30	6.82	0.02	-	-	2.31	6.09
		% (*Na* = 71) = 14.4	*p*		0.7504	0.1295	0.0090	0.8951	-	-	0.1289	0.0136
Ashford	This study 14th - 15th Century Zimbabwe	African *n* = 63	χ^2			0.21	4.94	0.06	-	-	0.08	2.60
		% (*Na* = 10) = 15.9	*p*			0.6460	0.0262	0.8003	-	-	0.7813	0.1066
Dambarare	This study 17th Century Zimbabwe	European *n* =339	χ^2				11.84		-	-	0.23	14.61
		% (*Na* = 62) = 18.3	*p*				0.0006		-	-	0.6284	0.0001
		African *n* = 145	χ^2						-	-	11.91	1.46
		% (*Na* = 9) = 6.2	*p*						-	-	0.0006	0.2271
		Total *n* = 484	χ^2						-	-	1.81	6.71
		% (*Na* = 71) = 14.7	*p*						-	-	0.1782	0.0096
Mapungubwe	(Steyn, 1994) 11th-14th Century South Africa	African *No data available*	χ^2							-	-	-
			p							-	-	-
Toutswe	(Mosothwane, 2004) 8th-13th Century Botswana	*No data available*	χ^2								-	-
			p								-	-
Venda	(L'Abbé, 2005) 20th Century South Africa	African *n* = 2016	χ^2									19.4
		% (*Na* = 347) = 17.2	*p*									0.0001
Ingombe Llede	(Gibbon and Grimoud, 2014) 7th – 15th Century Zambia	African *n* = 532	χ^2									
		% (*Na* = 50) = 9.4	*p*									

n = Total number of teeth investigated
Na = Number of teeth lost antemortem
% = Percentage of teeth lost antemortem
χ^2 = Chi-squared value comparing the investigated sites with each other and with that of comparative populations for the condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

Table 6.9: The prevalence of abscesses, calculus and periodontitis in all collections studied.

Collection	Ancestry	Sex	Collection number	Age	Dental pathology: Abscesses	Calculus	Periodontitis
Monk's Kop	African	Male	M_37b	Adult			1
			M_200	40-60			1
			M_207	Adult			1
			M_230	Adult			1
			M_257	Adult	1		1
			M_296	35-50	1		1
			M_357	Adult			1
			M_400a	Adult			1
				Sub-total (*Na*)	2	0	8
				% (*n*=16)	12.5	0.0	50.0
		Female	M_199	55-70			1
			M_255	Adult	1		1
			M_282	45-65			1
			M_290	Adult			1
			M_367	30-50			1
			M_416	40-50			1
			M_432	Adult	1		
				Sub-total (*Na*)	2	0	6
				% (*n*=18)	11.1	0.0	33.3
		Indeterminate	M_420	Adult	-	1	-
				Sub-total (*Na*)	0	1	0
				% (*n*=4)	0.0	25.0	0.0
				Total (*Na*)	**4**	**1**	**14**
				% (*n* =38)	**10.5**	**2.6**	**36.8**
Ashford	African	Male	A_2	30-40			1
			A_4	50-60			1
				Sub-total (*Na*)	0	0	2
				% (*n*=2)	0.0	0.0	100.0
		Female	A_1	45-55			1
				Sub-total (*Na*)	0	0	1
				% (*n*=3)	0.0	0.0	33.3
				Total	**0**	**0**	**3**
				% (*n* =5)	**0.0**	**0.0**	**60.0**

Table 6.9 continued: The prevalence of abscesses, calculus and periodontitis in all collections studied.

Collection	Ancestry	Sex	Collection number	Age	Dental pathology: Abscesses	Dental pathology: Calculus	Dental pathology: Periodontitis
Dambarare	European	Male	D_A2	40-55			1
			D_A3	45-55			1
			D_A5	20-30			1
			D_AA1	40-55			1
			D_AA2	25-35			1
			D_AA3	25-35			1
			D_C2	45-55		1	1
			D_C5	55-70			1
			D_C7	35-55			1
				Sub-total (*Na*)	0	1	9
				% (*n*=12)	0.0	8.3	75.0
		Female	D_A4	20-30			1
				Sub-total (*Na*)	0	0	1
				% (*n*=1)	0.0	0.0	100.0
				Total (European)	0	1	10
				% (*n*=13)	0.0	7.7	76.9
	African	Male	-	-	-	-	-
				Sub-total (*Na*)	0	0	0
				% (*n*=2)	0.0	0.0	0.0
		Female	D_B1	45-60			1
			D_B2	18-20			1
			D_B4	45-60			1
				Sub-total (*Na*)	0	0	3
				% (*n*=5)	0.0	0.0	60.0
				Total (African)	0	0	3
				% (*n*=7)	0.0	0.0	42.9
				Grand Total	**0**	**1**	**13**
				% (*n* =20)	**0.0**	**5.0**	**65.0**

n = Total number of individuals investigated with observable teeth
Na = Total number of individuals presenting with abscesses, calculus and periodontitis respectively in the specific collection
% = The prevalence of individuals presenting with abscesses, calculus and periodontitis respectively in relation to the total number of individuals investigated with teeth (*N*) in the specific collection

Table 6.10: The prevalence of supernumerary teeth, crowding of teeth and teeth modifications of all collections studied.

Collection	Ancestry	Sex	Collection number	Age	Dental pathology: Supernumerary teeth	Dental pathology: Crowding of teeth	Dental pathology: Modifications of teeth
Monk's Kop	African	Male			-	-	-
			Sub-total (*Na*)		0	0	0
			% (*n*=16)		0.0	0.0	0.0
		Female	M_201	30-50			1
			M_255	Adult			1
			M_290	Adult		1	
			M_295	35-55			1
			M_367	30-50	1		
			Sub-total (*Na*)		1	1	3
			% (*n*=18)		5.6	5.6	16.7
		Indeterminate	M_42	Adult			1
			M_142	Adult			1
			M_159	Adult			1
			M_166b	Adult			1
			M_450	8-12		1	
			Sub-total (*Na*)		0	1	4
			% (*n*=4)		0.0	16.7	100.0
			Total (*Na*)		**1**	**2**	**5***
			% (*n* =38)		**2.6**	**5.3**	**13.2**
Ashford	African	-	-	-	-	-	-
			Total (*Na*)		**0**	**0**	**0**
			% (*n* =5)		**0.0**	**0.0**	**0.0**
Dambarare	European	Male	D_A2	40-55		1	
		Female	-	-	-	-	-
	African	-	-	-	-	-	-
	Indeterminate	-	-	-	-	-	-
			Total (*Na*)		**0**	**1**	**0**
			% (*n* =20)		**0.0**	**5.0**	**0.0**

n = Total number of individuals investigated with observable teeth
Na = Total number of individuals presenting with supernumerary teeth, crowding of teeth and teeth modifications respectively in the specific collection
% = The prevalence of individuals presenting with supernumerary teeth, crowding of teeth and teeth modifications (*Na*) respectively in relation to the total number of individuals investigated with teeth (*n*) in the specific collection
*Number of individuals based on observing 5 mandibular I1's of the right side showing V-filing

Table 6.11: Description of dental miscellaneous findings in the collections studied.

Collection	Ancestry	Collection number	Sex	Age	Bone affected	Developmental anomaly
Monk's Kop	African	-	-	-	-	-
		-	-	-	-	-
Ashford	African	A_1	Female	45-55	Mandible	Mesioangular impaction of the right mandibular M3.
Dambarare	European	-	-	-	-	-
	African	D_B3	Female	15-20	Mandible	Peg-shaped incisor.
	Indeterminate	-	-	-	-	-

Table 6.12: Summary of the dental health observed in all the collections studied of African ancestry compared per contact period.

Contact period	Collection		Dental caries	Antemortem tooth loss	Abscesses	Calculus	Periodontitis	Supernumerary teeth*	Crowding of teeth*	Modifications of teeth*	No Dental pathology
			Dental Health								
Pre-European	Monk's Kop*	*n*	38	38	38	38	38	38	38	38	38
		Na	7	15	4	0	14	1	2	5	13
		%	18.4	39.5	10.5	0.0	36.8	2.6	5.3	13.2	34.2
	Ashford	*n*	5	5	5	5	5	5	5	5	5
		Na	0	3	0	0	3	0	0	0	1
		%	0.0	60.0	0.0	0.0	60.0	0.0	0.0	0.0	20.0
	Sub-total	*n*	43	43	43	43	43	43	43	43	43
		Na	7	18	4	0	17	1	2	6	14
		%	**16.3**	**41.9**	**9.3**	**0.0**	**39.5**	**2.3**	**4.7**	**14.0**	**32.6**
Post-European	Dambarare	*n*	7	7	7	7	7	7	7	7	7
		Na	2	2	0	0	3	0	0	0	2
		%	**28.6**	**28.6**	**0.0**	**0.0**	**42.9**	**0.0**	**0.0**	**0.0**	**28.6**
	Total	*n*	50	50	50	50	50	50	50	50	50
		Na	9	20	4	0	20	1	2	6	13
		%	18.0	40.0	8.0	0.0	40.0	2.0	4.0	12.0	26.0
		χ^2	0.62	0.44	0.71	-	0.03	0.17	0.34	1.11	0.04
		p	0.4324	0.5057	0.4002	-	0.8679	0.6836	0.5603	0.2921	0.8339

*Supernumerary teeth as well as crowding and modifications of teeth not classified as a dental pathology, thus not included in the total dental pathology calculations
n = Total number of individuals investigated with observable teeth
Na = Total number of individuals affected by the respective condition
$\% = \frac{\text{Total number of individuals affected by the respective conditions}}{\text{Total number of individuals investigated}} \times 100$

χ^2 = Chi-squared value comparing the contact period with that of the respective condition
p = p-value
Significant difference (df = 1; p-value < 0.05)

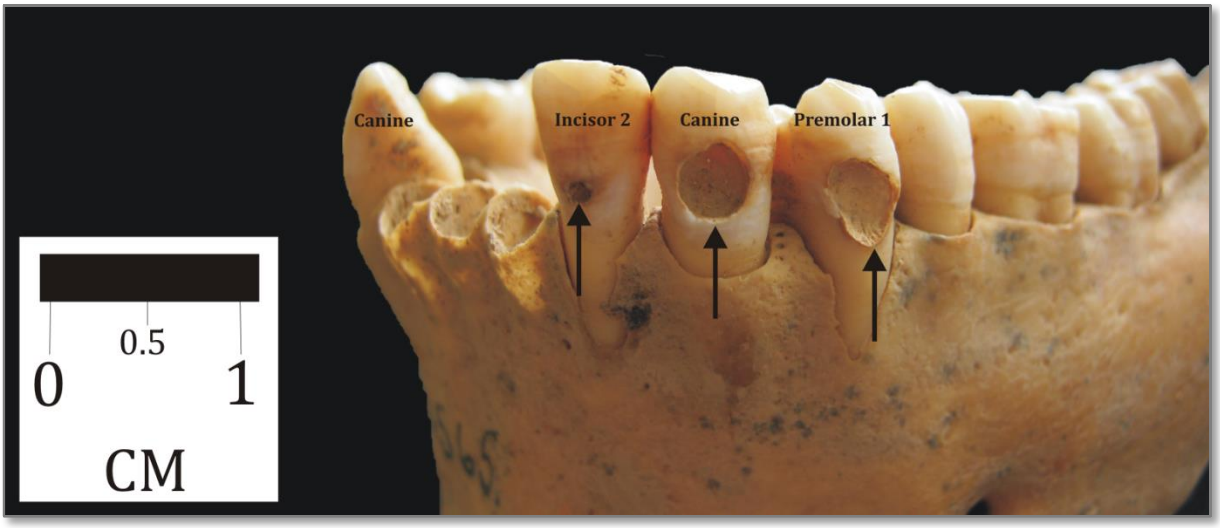


Figure 6.1: Individual M_401 (Lateral view of mandible): Dental (neck) caries observed on the buccal surfaces of the left mandibular I2, C and PM1.

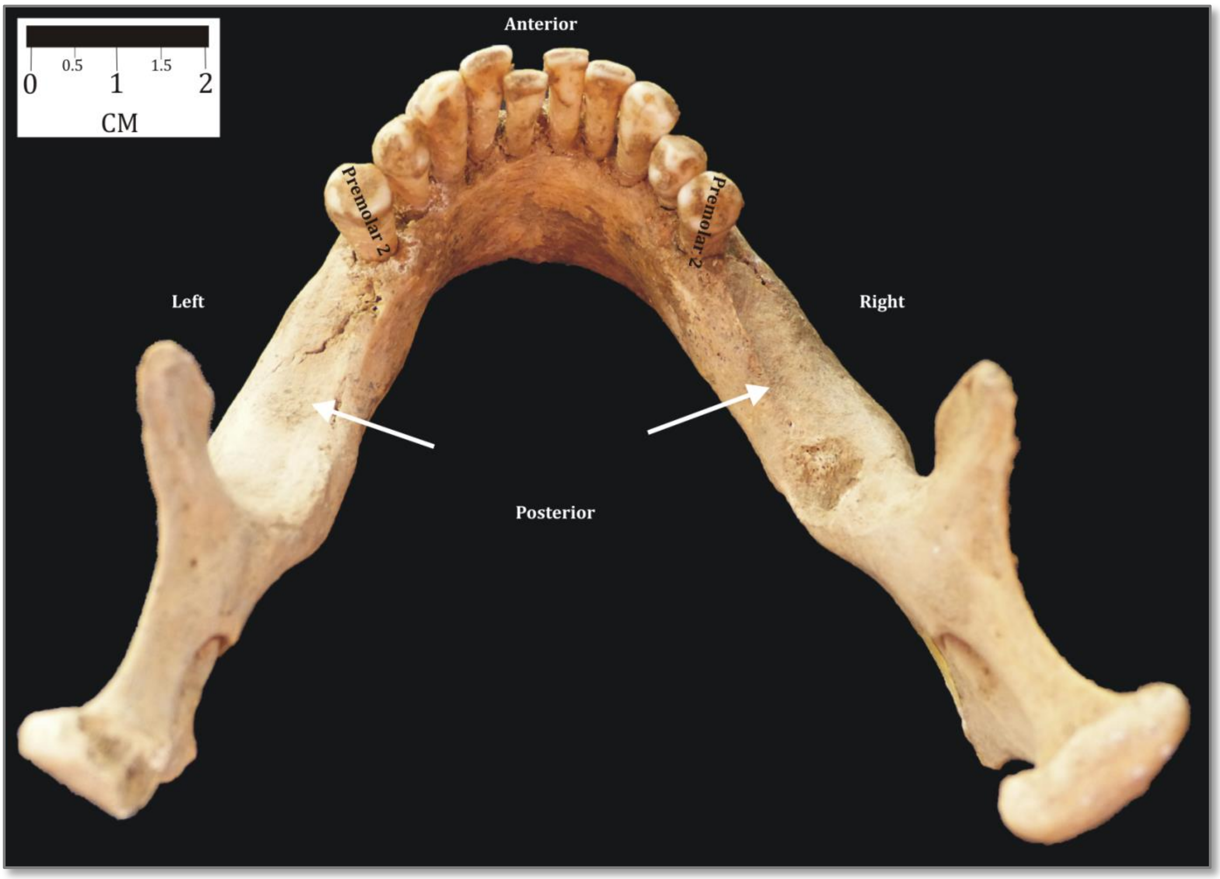


Figure 6.2: Individual D_AA3 (Superior view of mandible): Antemortem tooth loss of the right and left mandibular M1's, M2's and M3's.

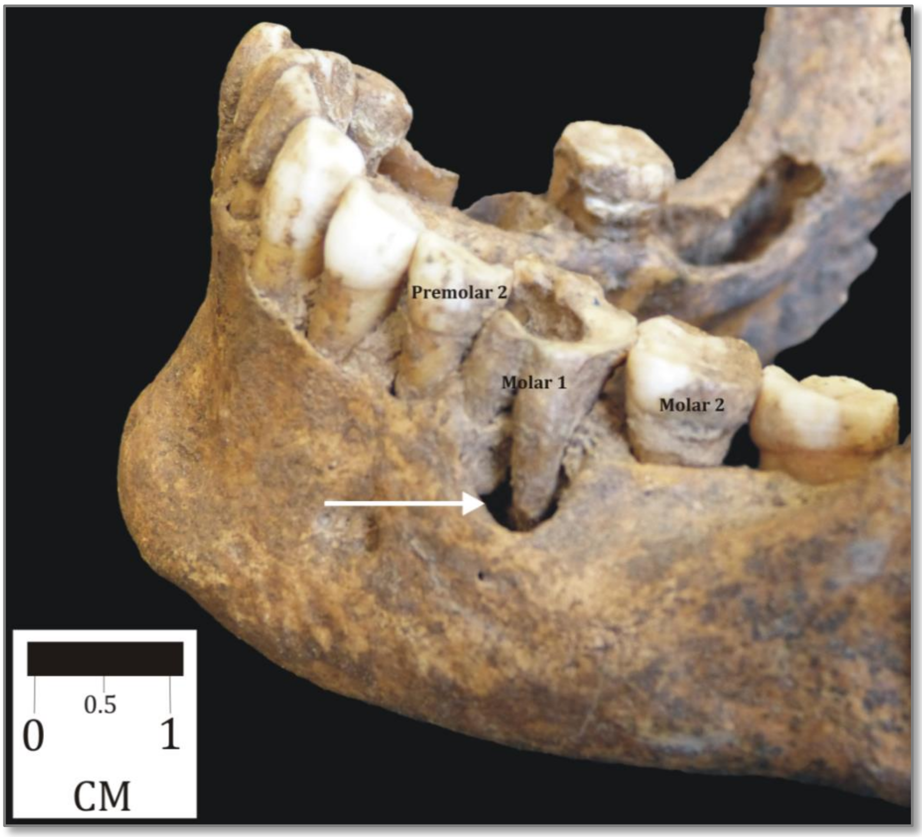


Figure 6.3: Individual M_255 (Lateral view of mandible): Signs of abscess formation below left mandibular M1 associated with caries of the same tooth.

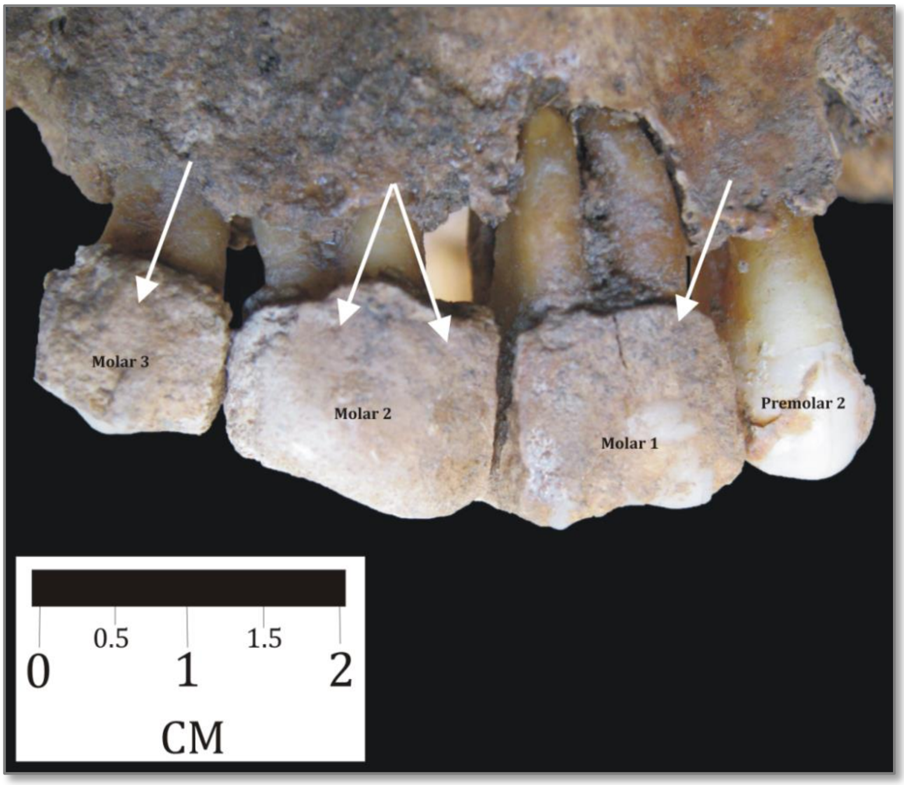


Figure 6.4: Individual D_C2 (Lateral view of maxilla): Severe calculus formation seen on the right maxillary M1, M2 and M3.

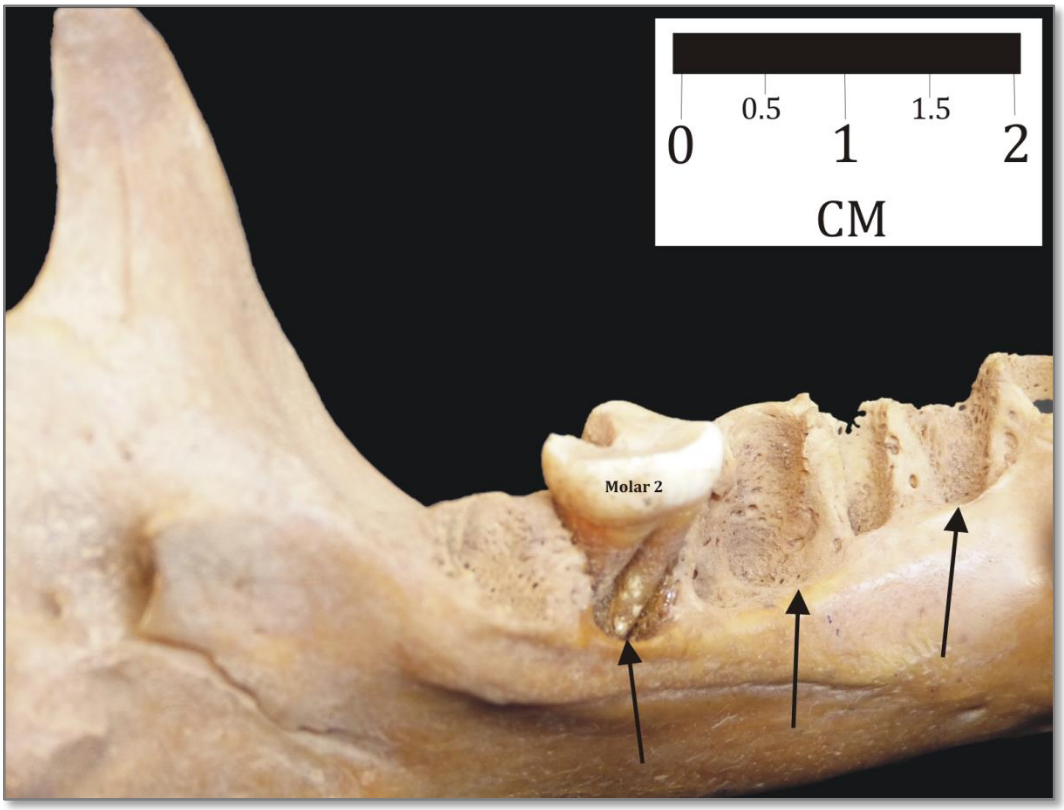


Figure 6.5: Individual M_400a (Internal view of mandible): Severe bone resorption indicative of periodontitis.

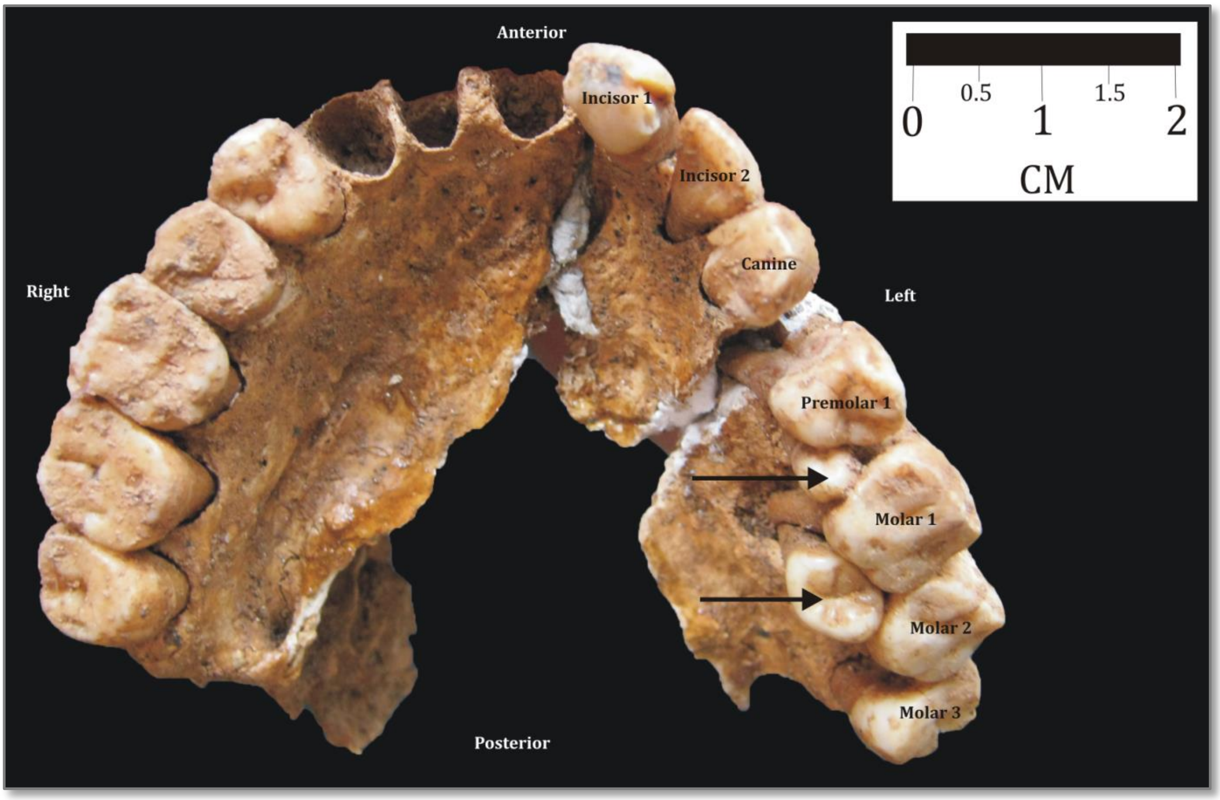


Figure 6.6: Individual M_367 (Inferior view of maxilla): Supernumerary/abnormal teeth on the left maxillary region indicative of a case of hyperdontia or retained deciduous dentition.

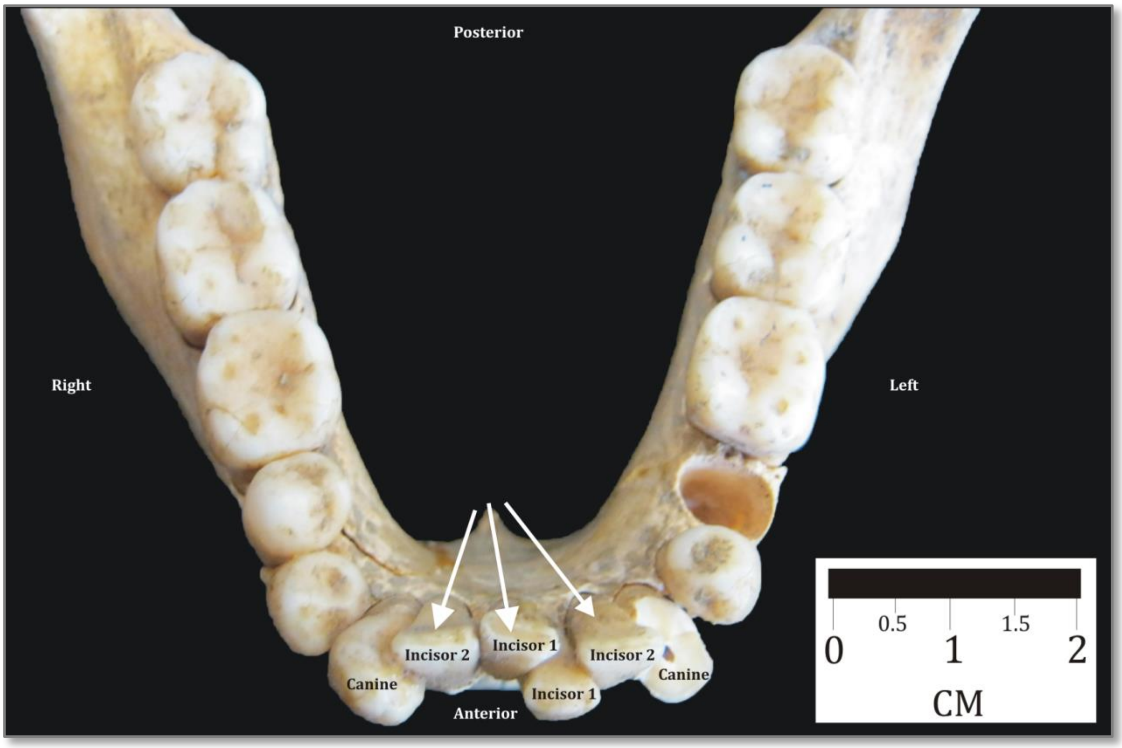


Figure 6.7: Individual D_A2 (Superior view of mandible): Misalignment of right I1, I2 and left I2 indicative of teeth crowding.

Figure 6.8: Individual M_295 (Anterior view of skull and mandible): Oblique filing of mandibular I1's both left and right side as a modification to teeth.

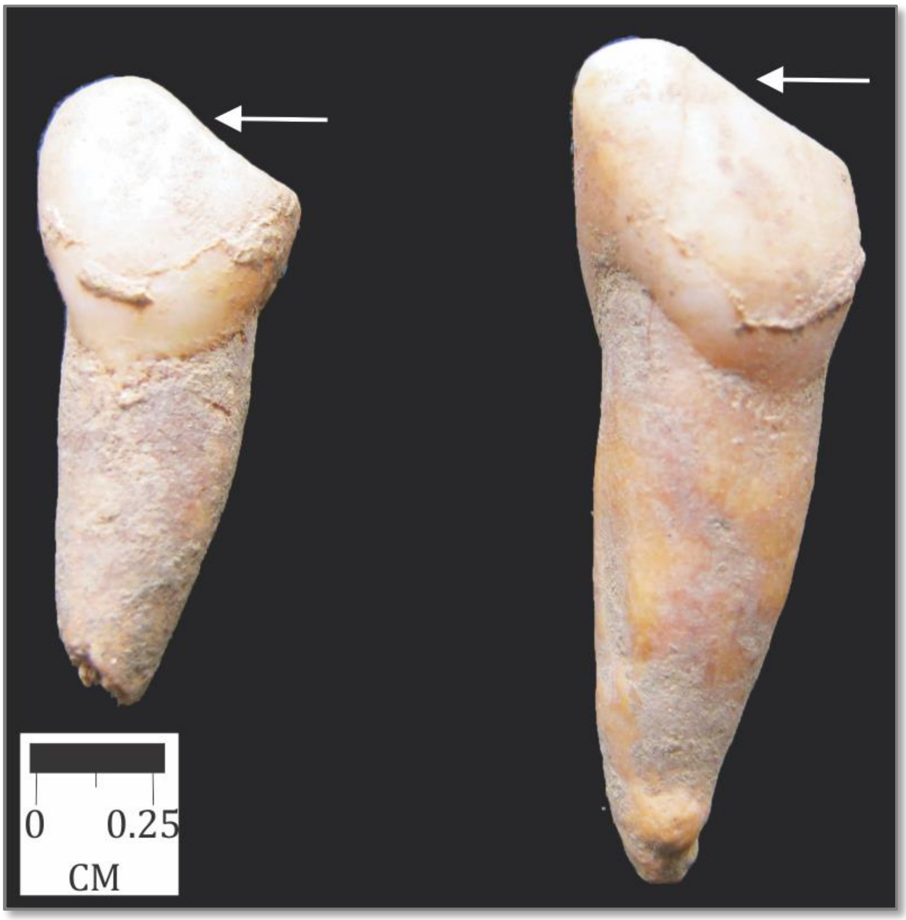


Figure 6.9: Sub-collection M_142 (Anterior view of right mandibular incisors of two different individuals): Oblique filing of mandibular I1's as a modification to teeth.

CHAPTER 7: DISCUSSION

7.1 Introduction

The populations investigated in this study are from various backgrounds and time periods of the northern Zimbabwe plateau; a fertile region agriculturally but also an important trade centre during the history of Zimbabwe. The three collections investigated were from Monk's Kop, Ashford Farms and Dambarare. They are currently housed in the National Museum of Human Sciences, Harare, Zimbabwe, but a few specimens of Monk's Kop and Ashford Farms remained in the Raymond A. Dart collection, University of the Witwatersrand, South Africa, after the initial assessment that took place during the 1960's. The skeletal collections from the Monk's Kop and Dambarare sites were the result of formal excavations, whereas the skeletal collection from Ashford Farms was the product of accidental surface finds. The archaeological finds and skeletal material of all three sites were recovered during the 1960's, however an in-depth skeletal analysis was never done. The skeletal remains of Monk's Kop (A.D. 1280 – 1400) and Ashford Farms (A.D 1330 – 1440) date back to the 13^{th} to 15^{th} centuries, a period in the history of Zimbabwe prior to European contact. Dambarare, an important trading market in the 17^{th} century in northern Zimbabwe, represents an indigenous population which came in contact with Europeans, and in this case, most probably Portuguese pioneers. This study attempted to provide some background on the people occupying the investigated sites and to assess whether European contact had any effect (positive or negative) on their health.

7.2 Northern Zimbabwe in the 13^{th} to 17^{th} centuries

The Monk's Kop site, which was excavated by Crawford in 1964, yielded 43 minimum number of individuals of African origin which consisted of 20 females, 17 males and six individuals of indeterminate sex. Only two sub-adult individuals were identified, whereas the remainder of the collection consisted of adults (mostly middle- and old-aged). The middle- and older-aged adults form the majority of individuals from this collection and suggest that they were in relative good health and that most of the population managed to reach adulthood. The almost equal number of males and females in the sample also suggests that the individuals represent a normal population. As the skeletal collection did, however, include very few sub-adults, the possibility that this burial place was reserved for a specific subset of the population should be considered.

The way in which the Monk's Kop individuals were interred as well as the excavation, inventory, curation and storage methods resulted in this collection being commingled. During skeletal analysis, skeletal remains were unpacked, cleaned and paired wherever possible. Successfully paired skull and mandible combinations as well as near-complete unpaired mandibles were identified as individuals, due to the fact that the mandible was the most represented skeletal element available in the collection. Sex, ancestry, age at death and pathological, traumatic or developmental lesions were identified and recorded. All other skeletal material not identified as belonging to one of these individuals were investigated, relabelled and repacked. The majority of the Monk's Kop collection therefore comprised of commingled remains, but all were documented according to state of preservation, side of the body it belonged to, and whether it was the remains of an adult or sub-adult. The pathological, traumatic or developmental lesions were also recorded. It is a well-known fact that the minimum number of individuals documented for commingled remains are often an underestimated value (Byrd and Adams, 2003), thus resulting in the probability that this collection consisted of more individuals than what is reported in this study.

The re-investigation of Monk's Kop resulted in the re-discovery of the exact location of this hill-top site, a detailed archaeological site map and a proposed location of Crawford's originally excavated trenches.

It is believed that the Monk's Kop ossuary was used to bury the royal elite, rather than ordinary members of society. This is evident from the burial practices associated with Shona tradition as well as the archaeological finds linked to the Monk's Kop individuals. In the recent past, it was customary for Shona chiefs to be buried together resulting in multiple burials, specifically on high ground. Monk's Kop is the largest example of a Musengezi site characterised by multiple burials in Zimbabwe. Other sites usually contain three or four individuals with only a limited number of pottery vessels, but the Monk's Kop ossuary yielded at least 43 individuals with an abundance of pottery vessels linked to the burials (Pwiti, 1996). Successive chiefs and their family members within a society were buried in a cave reserved for only royalty (Mahachi, 1986; Pwiti and Mahachi, 1991), which is supported by the almost equal distribution of male and female individuals identified in this collection. The conus shell discs found in close proximity to the buried individuals of Monk's Kop are also characteristic of chiefly regalia in historic Shona traditions, thus supporting the royal origin of this skeletal collection. As part of the Musengezi tradition, Monk's Kop is therefore seen as a burial site suggestive of the chiefdom level of social organisation, which is marked by the utilisation of a cave, situated on a hill-top used for burying the royal with their associated chiefly regalia (Nienaber et al., Submitted; Mahachi, 1986; Pwiti and Mahachi, 1991). Crawford (1967) suggested that the burial practices utilised during the era that the Monk's Kop ossuary was used, consisted of interring the dead in seated positions. This was evident from the pots found in close vicinity of the buried individuals containing skeletal elements such as hand and foot bones. As the soft tissue of the buried individual disintegrated through to skeletonisation, the skeletal elements most probably collapsed onto the pots, thereby resulting in the pots containing skeletal material.

The four Zambezian states of succession of this wider region include (in order) the Mapungubwe/K2, Great Zimbabwe, Mutapa and the Rozwi states (Pikirayi, 2001, 2009). The states and their associated traditions replaced each other as populations grew and economic power shifted more to the north of Zimbabwe. For example, the Mapungubwe/K2 tradition was replaced by the Great Zimbabwe tradition. The Musengezi tradition (to which Monk's Kop is assigned archaeologically), however, is believed to have not been part of this succession and Pwiti (1996) suggests that the Mutapa and Great Zimbabwe states most probably allowed the chiefdoms of the Musengezi tradition to maintain some form of authority. The Monk's Kop population was therefore allowed to co-exist with the overlapping Mapungubwe, Great Zimbabwe and Mutapa state societies. There is, however, not any clear archaeological evidence on how the Musengezi people eventually came under control of the Mutapa state (Pwiti, 1996). Craniometric analysis of the Monk's Kop male skeletal collection from the current study showed that the individuals of this society were more closely related to East Africans, whereas Mapungubwe/K2 is more associated with Central Africa. This lends some support to the theory that the Musengezi tradition was not replaced by the Great Zimbabwe tradition, but rather allowed to co-exist with the overlapping Zambezian states. The female craniometric analysis conversely showed associations with both East and Central Africans possibly suggesting that some links and alliances were formed through arranged marriages. The odontometric analysis of the maxillary teeth showed some association with the Mapungubwe/K2 as well as Venda populations. The mandibular odontometric analysis showed the closest alignment with Toutswe and the modern black South African population, but was also still close to the Mapungubwe/K2 populations. The similarities between the Monk's Kop and Mapungubwe/K2 skeletal collection related to the female craniometric analysis as well as the odontometric analysis could possibly suggest limited bidirectional gene flow between these societies as they co-existed. The pottery of the Monk's Kop site is similar to that of earlier Iron Age cultures, which supports the notion that the Monk's Kop population was not an intrusion from outside Zimbabwe (Crawford, 1967), but rather a late farming community that gradually replaced the indigenous early farming community (Sinamai, 2008).

The skeletal collection from Ashford Farms was the result of accidental surface finds by the public. The remains comprised of seven individuals of whom five were adults (three females and two males) and two were sub-adults (indeterminate sex). Curation and storage methods (incorrect labelling and commingling with other collections) resulted in the post-cranial remains of this collection not being utilised during skeletal analysis. The skeletal analysis therefore only included the assessment of skulls and mandibles, which limited the estimation of the general health of this population. The craniometric assessment performed on the skeletal remains indicated that the Ashford Farms individuals showed no clear association with Monk's Kop, Dambarare or the comparative collections used in this study. There was unfortunately no archaeological background available for this site, thus the manner of burial and the exact context in which the remains were found are unknown. It was determined that Ashford farms did indeed belong to the same pre-contact period (A.D. 1330 – A.D. 1440) as the Monk's Kop population, but the small sample size and lack of archaeological background made further interpretations such as ancestry, dynamics, gene flow and possible association with the studied sites or other comparative collections difficult.

The town of Dambarare was organized around a church which was served by a Dominican priest (Theal, 1898) and was associated with surrounding earthworks where gold was discovered (Abraham, 1962). Gold mining was endangered by conflict from A.D. 1684 onwards and Dambarare was attacked and destroyed in 1693 by Changamire Dombo who was the first leader of the last Zambezian state, the Rozwi Empire (1660–1866). Dambarare was occasionally visited by traders hereafter, but never regained its original standing (Schebesta, 1966; Garlake, 1969). A total of 40 individuals were identified from the Dambarare site excavated by Garlake in 1967. The population showed considerable diversity regarding sex, age at death and ancestry. The population yielded individuals from both African and European ancestry which supports the post-European contact date reports. The burials that were undisturbed contained skeletons lying stretched in full length with their arms folded across the chest or waist, that suggests a Christian type of burial practice which was different from indigenous customs (Garlake, 1969). The original excavation notes described the European individuals being interred inside the church whereas the African women and children were buried outside the church, but still in close proximity to the building. Garlake (1969) identified four different historical timelines associated with the site's burials: 1) prior to the construction of the first church, 2) those interred immediately beneath the floors of the first church, 3) after the demolition of the first church and lastly 4) during occupation of the second and last church.

The European individuals comprised of 17 males and 1 female. This high percentage of male European individuals can possibly be attributed to the fact that Portuguese settlers reportedly consisted of approximately 80% males (Solsten, 1993). The single European female was a young adult and could have either been one of the rare female settlers, a wife of a settler or possibly a nun in service of the church. The seven adult African individuals conversely comprised of mostly females (5). The presence of African females interred in close proximity to the church, might be a reflection of women in employment of the church or they may have been assistants to the priests. Alternatively, it could also reflect an indigenous population being indoctrinated to follow European customs of being buried in church cemeteries. One could also consider the possibility that the many African females could be attributed to Dominican priests or other Portuguese settlers reportedly taking African females as concubines. There is, however, no published literature to support this theory. The African female skeletal remains were associated with copper and bronze bracelets and anklets. One of the African women also wore a girdle of shell and glass beads from which a rosary of small carved ivory beads and a bronze medal was hanging (Garlake, 1969). The close proximity of the African burials to the church and their associated adornments is suggested by Garlake (1969) to be an indication of their possible high status within the class system of the indigenous society. The infants and juveniles present in the collection could be suggestive of assistance provided by the church to treat possible disease or illness which the indigenous population may have believed (or were made to believe) the Europeans had more experience or knowledge. The high incidence of African deaths in the 15-19 age group might also confirm the abovementioned interpretation. This, however, remains speculative, as this high incidence may also reflect a general low life expectancy possibly due to hard labour associated with the mining activities. Due to poor preservation and incompleteness of the remains, the ancestry of 19 of the individuals and sex of 16 individuals could not be determined.

The craniometric analysis of the male Dambarare individuals showed a clear mix of affinities, and although there were cases of similarity to East Africans, most individuals were related to groups outside of Africa. This supports the morphological assessment of the male Dambarare individuals who were found to be mostly from European descent. The female individuals showed to be closely related to the Bahutu, therefore again most probably descending from / related to East Africans. The odontometric analysis of the African Dambarare individuals displayed maxillary dimensions with a close association with K2 and Venda populations whereas the mandibular teeth were similar to Toutswe. Archaeological and ethnographic evidence clearly links Dambarare to the Mutapa state and therefore also to the previous state of Mapungubwe. Mapungubwe, however, is most similar craniometrically to Central Africa, while the African individuals of Dambarare showed association with East Africa in the craniometric analysis. It can therefore be suggested that the gene flow which impacted on the African Dambarare individuals was the result of both Eastern and Central African influence. Taking into account that the Musengezi tradition was allowed to continue through the succession of states as the Great Zimbabwe tradition became the ruling system, it is quite possible that the African individuals who lived at Dambarare during the church's history was the result of a mix between East and Central African genetic influence. The Dambarare African individuals also displayed mandibular dental dimensions similar to individuals of European descent. This may support the original analysis of de Villiers (1967), that some of the individuals seemed to have been hybrid in ancestry, therefore suggesting gene flow between the African and European individuals of Dambarare.

The African grouping showed correlation with the "medium" stature range of Tobias (1972) which both the South African and Rhodesian (Zimbabwean) samples were grouped under. Individuals D_B2 and D_B4, however, were substantially shorter than the medium range. Both were females and still fell within the 5-7% sexual dimorphism reported by Tobias (1972).

The general preservation of the individual skeletal elements of all three sites was in most cases good which allowed for the visualisation of any skeletal and dental lesions. A discussion of the pathological conditions encountered and the dental health of all three populations is described below.

7.3 Skeletal Health

The general preservation of the individual skeletal elements of all three sites was in most cases good, which allowed for the visualisation of any skeletal lesions. The presence of palaeopathological conditions included possible infectious disease, degenerative changes, lesions related to lack of nutrition and/or metabolic insults, developmental anomalies as well as non-specific indicators of disease such as sub-periosteal lesions.

The Monk's Kop, Ashford Farms and the Dambarare individuals of African descent did not present with any lesions indicative of specific infectious diseases. The possibility of treponemal disease was conversely found in two Dambarare individuals of European descent as indicated by possible gummatous lesions and sabre-shin tibiae. The presence of treponemal disease in southern African populations of African descent has been reported in only a few skeletal collections (Steyn, 1994; Steyn et al., 2002;

L'Abbé et al., 2007), and the case from K2 was most probably yaws (Steyn and Henneberg, 1995a). Nevertheless one should keep in mind that only approximately 20% of individuals who have suffered from treponemal disease in life, would present with skeletal lesions in death (Resnick and Niwayama, 1995; Aufderheide and Rodriguez-Martin, 1998), which impacts on the assessment of the prevalence of this condition in archaeological populations (Roberts and Manchester, 2010).

Three of the four types of treponemal disease (yaws, bejel and venereal treponematosis) can be observed as skeletal lesions; however, the fourth form of this infection (pinta) does not leave any skeletal signs (Hackett, 1967; Ortner, 2003; Waldron, 2007). The type of treponemal disease depends on the geographical location of the site as well as the location of the lesion on the skeleton. Bejel and yaws are found mostly in the tropical and sub-tropical regions with poor hygiene levels (Marples and Bacon, 1953; Jelliffe and Stanfield, 1988; Aufderheide and Rodriguez-Martin, 1998; Larsen, 1999), while venereal treponemal disease is not restricted to any geographical region and manifests mainly in urbanised populations (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010).The fact that no lesions indicative of treponemal infection were observed in the individuals of African descent suggests that this infectious disease was absent in Monk's Kop and Ashford Farms societies. The rural, dry geographical location of these two populations supports the absence of treponemal disease and could further imply that both populations had adequate levels of hygiene. The presence of the disease in only the Dambarare individuals of European descent showed that treponemal disease may have only been prevalent in the Portuguese inhabitants of this trade town and was most probably a disease that was brought from their country of origin; an urbanised Portugal which was at that stage a relatively poor country, with inadequate levels of hygiene which promoted the spread of treponemal disease. The venereal form of this disease is most commonly seen in the cranium as gummatous lesions and deformation of the tibia (Hackett, 1967; Powell, 1988; Ortner, 2003), which was the case in the European Dambarare individuals in this study identified with possible treponemal disease. The results of this study thus indicate that the individuals of African origin of all three studied populations were most probably free from this particular infectious disease. Other than for the presence of possible treponemal disease in the Dambarare

Europeans, there were no other clear signs of specific infectious disease. It is nevertheless possible that the individuals in these collections may have succumbed to diseases or other specific infections prior to developing a skeletal response, which may have resulted in an underestimation of the prevalence of specific infectious disease in the studied collections (Wood et al., 1992).

Degenerative changes were observed only in individuals of the Monk's Kop population and were completely absent in Ashford farms and Dambarare, but the different age distributions should be kept in mind. The Monk's Kop population most probably supplemented their agricultural existence with hunting and gathering when required. Both these subsistence economies require walking or running for long distances, often carrying water and wood and taking part in physical activities such as the herding of livestock and harvesting fresh produce (Bridges, 1991). The low prevalence of arthritic changes in the Monk's Kop population is comparable to that of Mapungubwe/K2 and substantially less than Toutswe. The 11.8% prevalence of osteophytic growth formation observed in the Monk's Kop population is less than Mapungubwe/K2 (44.4%) and Venda (16.8%). Both the low arthritic and osteophytosis prevalence in the Monk's Kop population are seen merely as a result of normal activity with advancing age as this population was mostly represented by older individuals. This observation may also support the fact that the Monk's Kop individuals were of royal descent and therefore most likely were not expected to perform any rigorous and prolonged physical labour.

Non-specific indicators of disease observed in the collections studied included periostitis, cribra orbitalia, enamel hypoplasia and Schmorl's nodes. Periostitis was observed in only the Dambarare collection. Both Europeans (21.4%) and Africans (14.3%) were affected. The Dambarare individuals of European descent however showed a significantly higher prevalence than the Mapungubwe/K2, Toutswe and Venda populations. The tibia and fibula were also mostly affected with a combined prevalence of 83.3%. Treponemal disease often result in periostitis of the tibia and fibula (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003), thus the high number of tibiae and fibulae affected in this population may suggest additional cases with treponemal involvement. Without additional signs such as gummatous lesions, it is however impossible to confirm. It is nonetheless clear that the high prevalence of non-specific periostitis in the European individuals of Dambarare suggests that this population most likely suffered significantly more from diseases than their African counterparts.

Cribra orbitalia was only encountered in 2 individuals in the Monk's Kop population of which the prevalence (12.5%) is comparable to Toutswe (17.1%), but substantially less than Mapungubwe/K2 (37.8%); though no statistical significant difference was noted. Cribra orbitalia can be the result of a variety of factors such as iron-deficiency anaemia, local periostitis, osteomyelitis as well as secondary effects of diseases such as Vitamin C deficiency, scurvy, haemangioma and osteopenia. Diet has also been suggested to play a role in the presentation of cribra orbitalia, thus an individual's socio-economic status could also possibly influence diet which in turn could be a factor in the formation of this porosity of the orbits (Ortner, 2003; Wapler et al., 2004; Walker et al., 2009; Brickley and Ives, 2010). The affected individual, M_430a (African male of 18-22 years), did not show any other signs of pathology, except for the cribra orbitalia and therefore the cause of the cribra orbitalia is unknown. Individual M_450 (African child of 9-11 years) showed signs of slight, healed cribra orbitalia in both orbits, but also presented with various other signs of pathology which included craniofacial asymmetry, abnormal head shape and enamel hypoplasia. Similar to a case study presented in Işcan and Steyn (2013), this individual could have suffered from foetal alcohol syndrome or a number of other congenital conditions. Unfortunately the postcranial remains of this individual were not available for investigation, thus an informed differential diagnosis was not possible. There is however no literature available on the presence or absence of alcohol abuse during this era. The multiple developmental anomalies and the evidence of possible prenatal insults do however suggest that individual M_450 could have suffered from any of a variety of diseases or syndromes that also continued throughout the childhood years, eventually leading to an early death. Individual M_450 was one of only two children identified in the Monk's Kop skeletal population. The early age at death and ill health of this individual is therefore in stark contrast with the relatively healthier adult population of this site. His relationship to the rest of the buried individuals also sparks special interest. This African child may indeed have been a descendant of royalty, as the child was buried with the elite, but shows signs of malnutrition or even periodic starvation evident from the cribra orbitalia and multiple linear enamel hypoplastic lesions observed on the anterior mandibular teeth. The consequences of the disease or developmental abnormality of individual M_450 could also have resulted in the possible nutritional deficiencies or metabolic insults evident from the lesions identified in the skull. It is therefore not clear what the exact relationship was between this diseased child and the seemingly much healthier adults buried alongside him/her.

Enamel hypoplasia is an indication of periods of disease or malnutrition which compromises an individual's health. The process of enamel formation that takes place during childhood tooth development is interrupted during these insults (Goodman and Rose, 1991; Hillson, 2000; Roberts and Manchester, 2010) and therefore has been shown to be more prevalent in societies of low socio-economic status; inferring that these societies have poor living conditions (such as unsanitary conditions and poor diet) which in turn leads to an increased exposure to pathogens (Roberts and Manchester, 2010). All skeletal populations studied were identified with enamel hypoplastic lesions. Multiple enamel hypoplastic lesions on the teeth were observed in 1 (2.6%) individual (M_450) of the Monk's Kop collection and in 2 (40%) individuals in the Ashford Farms collection. Although the African Dambarare individuals had a 28.6% prevalence of this lesion, it was again the European Dambarare individuals who showed the highest prevalence (53.8%). The fact that the enamel hypoplastic lesions form in the childhood years therefore suggests that these European individuals endured physiological hardships related to both lifestyle and disease in Portugal, rather than in Africa.

Schmorl's nodes were previously thought to be related to mainly trauma, manual labour and strenuous physical activities (Mann and Murphy, 1990; Roberts and Manchester, 2010), but have recently been shown to be attributable to a variety of additional factors such as disease, arthritis, scoliosis as well as the normal degradation of the vertebral bodies and intervertebral discs associated with old age (Kelley, 1982; Larsen, 1999; O'Neill et al., 1999; Dar et al., 2010). It has been suggested that Schmorl's nodes affect the lower thoracic spine most often due to the higher torsional stress caused by rotational movement as well as the thinner body cortex of thoracic vertebrae in comparison to lumbar vertebrae (Edwards et al., 2001; Kapandji, 2008). Studies have shown that men are more prone to develop these lesions and that centrally located

Schmorl's nodes are most often related to back pain (Faccia and Williams, 2008). Schmorl's nodes were only observed in the European population of Dambarare. These individuals were mostly males (92.9%) and the lesions were frequently situated in the centre of the lower thoracic and upper lumber vertebral bodies which correlates with other reports. European individuals were represented by both young and old adults, thus the cause of the Schmorl's nodes can be due to normal ageing processes, but also possibly disease or strenuous physical activities. Most of the affected individuals were however young, which may suggest that the individuals were involved in activities such as manual labour, and specifically gold mining activities which Dambarare was centred around (Theal, 1922; Abraham, 1961). Regardless of the cause, these lesions most probably had a negative impact on activity and productivity due to the associated back pain.

Traumatic injuries provide important information about a population's interpersonal relationships, how well they knew their terrain and environment, but also whether care was taken to assist healing and how successful they were in this process (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998; Steyn et al., 2010). Trauma is therefore specific to a population and can even fluctuate as economy, occupation, dietary status, cultural activities and availability of medical treatment changes within a society (Steinbock, 1976; Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Although activities such as gold-mining often result in increased interpersonal violence as individual mercantile participation increases, there were only 3 cases of fractures observed in the Dambarare skeletal collection. Individual D_C5, an adult European male of 55-70 years of age, showed healed fractures of the metacarpals of the right hand. This could have been due to interpersonal violence during his younger years, however any accident related to old age could have also resulted in this fractured hand. The misalignment subsequent to healing could have had a minor impact on productivity of this individual. Other fractures documented in Dambarare involved a fibula and humerus and although the healing was not optimal, the affected individuals' quality of life would have not been severely affected. The traumatic lesion on individual D_B4, an African Dambarare female of 45-60 year, could be a case of trephination. Although this lesion is healed, indicating that the individual survived the procedure, it could have had a temporary debilitating effect on this female. This earliest form of surgery involves the removal of a piece of the skull and was said to treat problems with raised intracranial pressure, such as headaches, vertigo, coma and convulsions (Lisowski, 1967; Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003). Trephination is said to be the earliest form of surgery and evidence of it being practiced in Africa as early as the pharaonic era is documented (Moodie, 1920; Bailey, 1994; El Khamlichi, 1998). Trephination has, however, been practiced in several geographical regions and at different times in history. Although the procedure was practiced by different societies for medicinal and/or magical purposes (Courville, 1967; Margetts, 1967; Majno, 1991), the main motivation for trephination in Africa is said to have been to treat headaches or wounds after head injuries. This was often the case in female individuals who were subjected to partner-abuse (El Khamlichi, 1998). Only a few trephination cases have been documented originating from Europe (Crubézy et al., 2001) and therefore the surgeon who performed the procedure on individual D_B4 was most probably from the indigenous population. The success of the procedure and therefore the survival rate of trephined patients depends on avoiding the brain, meninges and blood vessels (Aufderheide and Rodriguez-Martin, 1998; El Khamlichi, 1998). The experience of this indigenous surgeon could therefore be questioned, as the lesion of individual D_B4 is uncommonly situated on the sagittal suture, an area that is normally avoided due to its close proximity to the sagittal venous sinus. The affected female inhabitant of Dambarare therefore might have suffered from symptoms related to a head injury or any other cause and sought the assistance from an indigenous surgeon. The exact reason for the procedure and who performed it, could however not be confirmed. The female did survive the surgery, nonetheless, and lived to reach old age.

The Monk's Kop collection yielded one individual identified with a healed rib fracture (with associated osteophyte formation) and another possible case of chronic subluxation of the acromioclavicular joint which could have had an impact on this individual's activity and productivity levels. Ashford Farms showed no evidence of any traumatic events.

Only two cases of developmental anomalies were observed in the Monk's Kop population, of which only one individual (M_450) may have been affected by the abnormality to such an extent that it caused an early death. Neither the Dambarare nor the Ashford Farms individuals showed any developmental abnormalities.

A summary of all skeletal pathology identified in the three collections studied can be seen in Table 5.19. The limited number of skeletal lesions observed in the pre-contact populations of Monk's Kop and Ashford Farms (18%) suggests that the associated individuals were not diseased or severely affected by nutritional, metabolic, degenerative, traumatic or developmental pathology. The few cases of skeletal pathology documented at the Monk's Kop site could be a reflection of the wealth of this elite population as royalty were supported by agricultural production, livestock herding and an element of external trade. The higher prevalence (42.3%) of pathological skeletal manifestations encountered in the post-contact Dambarare individuals of African descent, may suggest a more diseased or less healthy population. However, these differences between the African individuals of the pre-contact versus the post-contact periods were not statistically significant.

This first European contact with Zimbabwe can be perceived as colonisation if seen from an indigenous view (Lightfoot, 1995; Cusick, 1998; Silliman, 2005). It is reported that European expansion to other continents, in general, had considerable social and political effects on the indigenous populations which the Europeans encountered (Gray and Birmingham, 1970; Kelly, 1997). Pikirayi (2009) refers to African-Portuguese settlements during the seventeenth century in Zimbabwe as chaotic and haphazard with a lack of trade regulations, increased industrial activity and where violence was commonplace. He also states that from the 1650s (corresponding with a trade in African slaves) health and life expectancy of indigenous groups declined as many African settlements changed their identities as a result of Portuguese influence. This argument is motivated by the fact that the investment of more time in gold mining inevitably would have removed the local population from agricultural activities, which often led to hunger and famine in areas less environmentally stable (Pikirayi, 2009). The huge external demand for gold also increased individual mercantile participation, which in turn decreased the wealth of the local ruling system and therefore also their authority (Pikirayi, 2009). Diseases and epidemics were also reportedly introduced to Africa by the Europeans which often led to depopulation in affected areas of Africa (Curtin, 1998). The skeletal evidence of the collections analysed in this study, however, suggests that there seems to have been little difference in the health status of pre-and post-European contact communities. This could be supported by the fact that

Portuguese accounts of history report that certain regions in the Mutapa state was still ruled by the indigenous population, even though Portuguese trade played an important role in the economy. The Portuguese immigrants of Zimbabwe were also often Dominican priests (Theal, 1898), which was most probably the case at the Dambarare church site. Although it is well-known that the Portuguese attempted to influence indigenous religion, it therefore seems that European contact had a limited effect on the health of the African individuals buried at Dambarare (Abraham, 1961, 1962; Beach, 1980). It should however be kept in mind that the results of this study is based on small sample sizes and skeletal material that were excavated at sites used for a very specific or restricted purpose. The effect of European contact will most probably be seen more clearly in skeletal collections representative of the populations who lived during the period of British colonisation as the indigenous population were forced to adopt European ways of living. Further investigations of other pre- and post-European contact sites may therefore shed more light on the matter.

The Dambarare individuals of European origin were, however, most certainly less healthy than their African counterparts, thus more diseased and affected by possible malnutrition. The diseases and conditions that affected these individuals were most likely a reflection of their possible poor living conditions in Portugal during the childhood years, rather than their experiences in Africa. Their long period of traveling to Africa, on both sea and land, with the possibility of suffering from scurvy while on the ships, should also be taken into account.

7.4 Dental Health

The dental pathology in all the populations studied included dental caries, antemortem tooth loss, abscesses, calculus formation and periodontitis. Non-clinical miscellaneous conditions affecting the teeth of these populations included supernumerary teeth, crowding and modifications of teeth.

A diet that contains much sugar and refined carbohydrates supports microbial activity (produced by fermentation of food sugars) on the tooth surface and initiates progressive destruction of the crown and root of a tooth which is both infectious and transmissible (Aufderheide and Rodriguez-Martin, 1998; Ortner, 2003; Roberts and Manchester, 2010). The risk of developing caries therefore decreases in substance economies such as hunter-gatherers (foragers), and will be increased in societies utilising agriculture due to their diets being rich in carbohydrates (Morris, 1992; Cohen and Armelagos, 2013). The individuals of both Monk's Kop and Dambarare populations showed evidence of caries, while the Ashford Farms population displayed no affected cases. The Monk's Kop individuals and the African individuals of Dambarare displayed a similar caries intensity of 2.4 and 2.2 respectively. This caries intensity is relatively low if compared to other studies (Turner, 1979) and may suggest that the diet of the African individuals was relatively non-cariogenic and did not significantly change after contact with the Europeans. The European individuals of Dambarare showed very low caries intensity (0.7) which is in contrast with previous investigations of Mesolithic Portugal showing a high caries prevalence attributed to the consumption of cariogenic non-agricultural foods such as honey and sticky fruits (Meiklejohn et al., 1992; Lubell et al., 1994).

All dental diseases, such as caries, periodontitis and abscesses, can ultimately result in antemortem tooth loss (AMTL). Dental attrition, trauma as well as cultural or ritual practices such as tooth modification, have also been documented as causes. Extraction of a tooth (often the result of caries), in the absence of dental treatment, is often the only means of alleviating pain (Turner, 1979; Hillson, 1998, 2000). It can then be suggested that if no other variable influences AMTL, there would be a direct correlation between the frequency of AMTL and dental caries (L'Abbé, 2005). The prevalence of posterior teeth lost antemortem in the Monk's Kop population was most probably related to the presence of dental caries or periodontitis as no cases of calculus was encountered and very few abscesses were observed. The AMTL in the anterior teeth was, however, abnormally high (55.8%). The caries intensity of this population was nonetheless low and caries most often affects the posterior teeth, therefore it is suggested that the AMTL of the anterior teeth in the Monk's Kop population was not related to dental caries. Although periodontitis could have played a role, the dental modification of specifically the anterior teeth which was observed in the adult population of Monk's Kop could have contributed to the high AMTL prevalence. In females, 53.8% of the first incisors were lost antemortem, while the males displayed a much higher prevalence of 83.3% of the same teeth. Dental alteration and mutilation modifies the shape and form of the tooth. It is evident in many ancient populations and can be the consequence of intentional or unintentional activities (Aufderheide and Rodriguez-Martin, 1998; Roberts and Manchester, 2010). Cultural modifications can serve as proof of social identity (van Reenen and Briedenhann, 1986), peer pressure (Friedling and Morris, 2005), enhancing appearance through decoration (Bachmayer, 1982; Jones, 1992; Roberts and Manchester, 2010), religious beliefs (Davies, 1963) and superstition (Halestrap, 1971). The incisors of either the maxillary or mandibular teeth are normally involved and modification is often performed during initiation ceremonies at the onset of puberty (Briedenhann and Van Reenen, 1985; van Reenen and Briedenhann, 1986). The intentional mutilation of teeth has been a common practice in Africa and although it differs from area and culture, it is evident from many studies (Halestrap, 1971; Briedenhann and Van Reenen, 1985; van Reenen and Briedenhann, 1986; Jones, 1992; Morris, 1998; Friedling and Morris, 2005). V-shape filing of the mandibular first incisors was observed in only the female population of Monk's Kop. This sex-specific observation could, however, be the result of poor preservation as many of the modified teeth were separated from the dental arcade and could therefore not be assigned to a specific sex. Due to the fact that Monk's Kop was most probably a representation of an elite section of the society, the tooth modification could also have been an indication of rank within the society as not all female individuals displayed this modification. Dental modification was reported in the Mapungubwe/K2 skeletal collection as V-shaped filing of the maxillary incisors (Steyn, 1994). A recent study on a Zambian Iron Age population showed that 29% of the sampled population also had modified maxillary incisors. The study did not report any significant difference in the sample related to sex or age, but most of the cases occurred in males (Gibbon and Grimoud, 2014). Dental mutilation is often traumatic and can lead to infection, inflammation and pulp mortification as was seen in the Zambian Iron Age population. AMTL can therefore often be associated with dental modification practices. The high AMTL prevalence of the Monk's Kop males could thus be the result of infection and pulp degradation due to unsuccessful tooth modifications. It can therefore be proposed that unsuccessful tooth modifications may have ultimately resulted in some of the female individuals losing the first incisors prior to death, while it may have been customary for males to have the mandibular first incisors removed. Extraction of teeth due to cultural practices, often involved the anterior, most visible teeth (L'Abbé, 2005). This theory is, however, only speculative at this stage.

The Ashford Farms population showed a similarly high prevalence of AMTL of the first incisors in both male and females. No tooth modification or dental caries were, however, observed in this population. Sixty percent of the sample had periodontitis which may have contributed to the AMTL of this population. It is nevertheless still unclear why this population showed such a high AMTL prevalence.

The Dambarare population showed the highest prevalence of AMTL in the posterior teeth which corresponds with the caries intensity of this population. No abscesses were observed in the Dambarare skeletal collection. Periodontitis seemed to have been common amongst the European individuals of Dambarare as 76.9% of these individuals were affected by this inflammatory disease. The African females of Dambarare also showed a 60% prevalence of periodontal disease. The AMTL in the Dambarare population could therefore have been due to both caries and periodontitis.

Calculus was uncommon in all three populations studied as only one Monk's Kop and one Dambarare individual were encountered displaying dental calculus. The process of calculus formation is normally enhanced by sucrose when the accumulation of plaque is mineralised (Roberts and Manchester, 2010). The absence or limited availability of sugar in the diets of all three populations (as was seen from the low caries intensity) therefore supports the low prevalence of calculus encountered in the studied collections.

Only one case of supernumerary teeth and two cases of dental crowding were encountered. Neither of the individuals affected seemed to have been negatively affected by these abnormalities.

Table 6.12 provides a summary of all dental pathology observed in the African populations studied. Dental caries were more prevalent in the post-European contact period, although not significantly so. AMTL in the African populations was, conversely, higher in the pre-contact period, and specifically involved the anterior teeth. This was most probably related to the repercussions of unsuccessful tooth modification practices rather than dental decay, and could also have been due to deliberate removal as part of cultural influence or tradition. The reason for the tooth modification or possible deliberate removal remains unclear. Periodontitis was equally prevalent in the pre- and post-European African populations and has therefore been a disease that this population has been affected by throughout at least the 13^{th} to 17^{th} centuries. As was the case with skeletal lesions, it seems that European contact had a limited effect on the dental health of the African individuals buried at Dambarare.

7.5 Limitations and future investigations

One of the major challenges of this study was the commingled nature of the skeletal collections analysed which often resulted in a discrepancy between the reported excavated individuals and the current study's results. Crawford reported that the skeletal remains were mostly found scattered which resulted in the collection being a "confused mass" of skeletal elements upon excavation (Crawford, 1967). Crawford was a lawyer by profession, thus a more experienced archaeologist may have been able to separate specific elements identified as belonging to a single individual upon excavation, but the seated burial positions and limited space in the cave, might have proven to be difficult for any investigator. The Dambarare skeletal analysis posed fewer challenges due to the fact that Garlake was an archaeologist by trade and therefore his excavation notes and inventory methods were in most cases clear and logical. Due to the fact that the Ashford Farms collection was the result of accidental surface finds, there was no archaeological background or published data available for this collection to assist with interpretation of the results of this study. Furthermore, the postcranial remains of this collection were unlabelled or incorrectly labelled and placed with similar post-cranial remains of other skeletal collections (e.g. all femora of different sites were stored together). This limitation resulted in the Ashford Farms collection only being represented by cranial remains which could have led to unidentified pathological conditions present in this population. It is a well-known fact that the minimum number of individuals identified in commingled collections is often an underestimated figure, therefore the discrepancy between original numbers reportedly excavated, could not be as severe as it seems.

The skeletal collections consisted of a limited number of remains, resulting in relatively small sample sizes. The excavated skeletal material were also often a representation of a very specific community. Monk's Kop was most probably representative of only the elite section of the society, while the Dambarare skeletal collection represented a small and very specific community. Ashford Farms was also represented by seven individuals, of whom two were sub-adult, thereby possibly impacting negatively on comparative statistical analyses due to the small sample size available for investigation. Thus it is important to note and agree with the statement made by Garlake in his publication of 1969 that excavations such as Dambarare provides only a glimpse of one aspect of a community possibly fulfilling a restricted function and therefore it may not provide a complete overall picture of the life at the settlement. Various studies have been done worldwide to investigate the biological and cultural impact the encounters of societies that differ in overall population size, organisational complexity, economic subsistence, technological complexity and ecological setting had on each other. These type of encounters generally involved societies of the Old World, such as Europe, meeting previously isolated populations such as these from the northern Zimbabwean region. Most studies describe that the aftermath of contact between once-isolated groups often resulted in biological and cultural catastrophe, as can be seen in native America and the Pacific islands (Larsen and Milner, 1993). Studies on pre- and post-contact impact often involve skeletal collections that were excavated since the 1970's as skeletal remains were found to offer special insight into the study of how the world that we know today came about. Pre-contact samples, required for these studies, have however, been proven to be poorly represented, thus small sample sizes is a limiting factor in these investigations (Larsen and Milner, 1993). The results of this study may therefore not be an exact reflection of the general population of the once-living civilisations.

In this study, the time-lapse since excavation and the fact that skeletal elements were sent to the University of the Witwatersrand for preliminary identification, could have resulted in skeletal remains being stored in locations unknown to the investigator. Although every attempt was made to ensure that this was not the case, one has to consider that some of the initially excavated skeletal remains may have been omitted or have since been lost. This is evident from Table 4.15 where the Dambarare individuals reported on by de Villiers in the 1960's are compared to the current study's results. It therefore seems that there were initially more remains which was not represented in the collection that was analysed during this study.

Upon re-investigation of the Monk's Kop site during this study, a number of additional possible ossuaries were identified in close proximity to the originally excavated Monk's Kop cave. Crawford (1969) also refers to the possibility of additional archaeological and skeletal finds still interred at Monk's Kop. Great Zimbabwe is the largest and best known archaeological site in Zimbabwe and formed part of the four kingdoms of succession in Zimbabwe. The excavations at Zimbabwe unfortunately did not yield any skeletal material which could have shed more light on the relationship between Monk's Kop and the four states of Zimbabwe. As Monk's Kop is referred to as the largest example of Musengezi tradition found within Zimbabwe (Pwiti, 1996) it would be of great value to continue excavations at this site. This would not only enhance further interpretation of the population who lived at Monk's Kop throughout its occupation but also add to the already-gained knowledge of the interaction this society had with the four Zambezian kingdoms of succession. Unfortunately no further archaeological investigations were possible at the time of the study. Garlake (1969) excavated the Dambarare site prior to it being flooded by the construction of a dam associated with the Jumbo mine. According to Garlake, only 2% of the site was excavated prior to the flooding. Today, the only remnants of Dambarare are some of the surrounding earthworks where gold was unearthed during this trading market's existence (Garlake, 1969). Further excavation at the surrounding earthworks may, however, prove successful in providing additional information.

Additional excavations and skeletal analysis will not only increase the small sample sizes, but can also be accompanied by the use of modern techniques. Isotope analysis can shed more light on the population's diet as well as the source of the archaeological finds associated with the skeletal collection. Even though small samples are needed for this purpose, the analyses are destructive and would require additional permissions from regulating authorities. The same can be said for aDNA analyses, which have not been done in any depth on southern African skeletal remains but are now starting to emerge.

CHAPTER 8: CONCLUSIONS

1. The Monk's Kop population occupying this hill-top location during the 13th-15th centuries was most probably of royal descent or represented an elite section of society. The skeletal remains included only 2 children, which could suggest that the ossuary was mainly reserved for adult burials. These African individuals were interred in a seated position and were equally represented by both males and females. Due to burial practice, excavation and curation methods, the skeletal remains were of a commingled nature upon analysis. The inhabitants of Monk's Kop was of the Musengezi tradition and seem to have not been directly related to the civilisations who represented the four Zimbabwean kingdoms of succession, but craniometric and ethnographic evidence do suggest that there was interaction with the indigenous people of Mapungubwe and possibly the Mutapa state. Whether the interaction resulted in gene flow and when the Musengezi tradition seized to exist entirely, is still unclear.

2. Ashford Farms is represented by only a small number of individuals consisting of African adults and sub-adults as well as individuals of both sexes. Due to the lack of archaeological background available, little is known of the inhabitants who occupied this area in the 14th to 15th centuries. Craniometric analysis did not result in Ashford Farms being clearly identified as related to any of the comparative collections, therefore the population dynamics, culture and relationship to either Monk's Kop or Dambarare remains unknown.

3. The Dambarare site is an example of a population which occupied a trade-market town during the era when Zimbabwe came into contact with Europeans, and in this case most probably the Portuguese. Individuals were represented by both Africans and Europeans of both sexes of all age groups. All individuals were buried according to Christian practices, with the Europeans interred inside the church and the African outside the church. Individuals of European descent were mainly males, which may have been representatives of the church (Dominican friars) or were possibly directly involved with the gold-mining activities of the area. Craniometric analysis confirmed that the female individuals mostly came from the

local population and were buried in close proximity to the church which could suggest a high social status within the native society.

4. Palaeopathological conditions in African individuals of all the populations studied included degenerative changes, lesions related to inadequate nutrition and/or metabolic insults, developmental anomalies as well as non-specific indicators of disease. The relatively low prevalence of the above conditions in the African individuals suggests that the African populations were not subjected to a high level of pathogens and that the inhabitants most likely received proper nutrition most of the time. This could however be related to their possible elite status in society and is therefore not necessarily a true reflection of the entire society of that era. The European population did, however, reflect a population which were more diseased as evident from both specific and non-specific skeletal lesions. These individuals were also less healthy in general and suffered from malnutrition and disease during childhood which is related to the living conditions experienced in Portugal, rather than in Africa.

5. The limited presence of traumatic injuries in all populations studied reflects a low level of violence in the society. Even though literature often link gold-mining activities with increased violence, Dambarare also showed no indication of increased aggression levels due to the possible change to individual mercantile participation amongst the indigenous people. An interesting case of possible trephination suggests that the indigenous population practiced this ancient neurosurgery and although the procedure was a success as the individual lived to reach old age, the motivation remains uncertain.

6. Dental pathology in all the populations studied included dental caries, antemortem tooth loss, abscesses, calculus formation and periodontitis. The relatively low prevalence of dental caries in all the populations studied reflects a non-cariogenic diet, which changed little between pre-and post-contact periods. The high antemortem tooth loss of incisors observed in the Monk's Kop population could be related to V-filing tooth modification practices observed in this population. Alternatively, these teeth may have been removed on purpose as part

of the modification. Dambarare showed antemortem tooth loss within reported parameters which could be related to either dental caries or their high prevalence of periodontitis. Non-clinical miscellaneous conditions affecting the teeth of these populations included supernumerary teeth and crowding of teeth.

7. Although most pre- versus post-contact investigations report that the biological and cultural effects on the native population are catastrophic to their health and prosperity, it seems that the initial Europeans that came into contact with the previously isolated indigenous northern Zimbabwean population had a minor effect on the health of the people that they interacted with. This is most probably in contrast to the British colonisation which would follow only a few centuries later. It should be kept in mind though that the sample sizes were small throughout and may not have represented all of the once living populations.

Through this project, the locality of the Monk's Kop archaeological site and specifically the ossuary was re-established and a preliminary surface survey was done. This clearly indicated that the complexity and elite status of the site was vastly underestimated by the initial excavators. This site holds much promise for future investigation which would considerably enhance our knowledge of the archaeology of the region.

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APPENDICES

Skeletal reports will be described as Appendix A (Monk's Kop), Appendix B (Dambarare) and Appendix C (Ashford Farm).

- Each site will utilise particular abbreviations and terms specific to each site, but the following abbreviations will be used throughout:

I1 = Central/First Incisor

I2 = Lateral/Second Incisor

C = Canine

P1 = First Premolar

P2 = Second Premolar

M1 = First Molar

M2 = Second Molar

M3 = Third Molar

R = Right

L = Left

Maxillary = Upper jaw

Mandibular = Lower jaw

Upper limb elements = Scapula, Clavicle, Humerus, Radius, Ulna, Carpals, Metacarpals and phalanges associated with the hand

Lower limb elements = Hip bone, Femur, Tibia, Fibula, Patella, Tarsals, Metatarsals and phalanges associated with the foot

Axial elements = Vertebrae, Sacrum, Sternum and Ribs

- There were many cases within these skeletal collections that the remains of a single individual were stored in two different locations at the time of data collection. For this reason, the storage location of the different skeletal elements was indicated under *Preservation and storage location at time of analysis* in all skeletal reports. The catalogue reference numbers are therefore also provided.

Appendix A: Monk's Kop Skeletal Reports

The skeletal reports of Monk's Kop will be represented according to one of the following:

- Individual skeletal reports: Accession numbers of the Monk's Kop collection of those who could be confirmed as an individual
  OR
- Summary: Accession numbers of the Monk's Kop collection of those who could NOT be confirmed as an individual

  - The collection of bones (whether it was represented by one or more individuals) within an accession number were named according to the following example:

M_319a

If applicable

Monk's Kop
(Added by author)

Sub-collection of bones 319
(Original accession number)

Age-related separation
(Unfused epiphyes)

  - The brown paper tear-offs displaying the accession number originally indicated by the excavator was often accompanied by abbreviations such as "IMB". These abbreviations were unfortunately not described in the excavation reports. To avoid incorrect assumptions of the meaning of these abbreviations, they were not used in any context in this study. For reasons of comprehensiveness the abbreviations were however noted under *Burial information* of all Monk's Kop skeletal reports.

Confirmed individuals

M_37b:

Burial information: Quoted as per excavator's note: "IMB/5/1; Burial II; The heap of bones shown on diagram 2; The main heap."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible, vertebrae, clavicle and scapula fragments present. Dart catalogue reference: A2569 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_37b: Osteophytosis

Age: Indeterminate. (Incomplete remains)

Sex: Male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular C ; L-mandibular P1, I2. The following teeth were lost antemortem: R-mandibular I1 ; L-mandibular I1. All teeth showed extensive tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Osteophytosis of L1. No signs of trauma were observed.

Conclusion: 25 – 35 year old African male of indeterminate sex and height.

M_91:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible present. Dart catalogue reference: A2579 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular P2, P1, C, I2 ; L-mandibular P2, P1, C. The following teeth were lost postmortemR-mandibular M3, M2, M1, I1 ; L-mandibular M3, M2, M1, I2, I1. All teeth showed extensive tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology observed. No signs of trauma were observed.

Conclusion: African male of indeterminate sex and height.

M_117a:

Burial information: Quoted as per excavator's note: "IMB/5/2; 2 jaws and long bones at point 'R'. Teeth in mandible: Right - M3, M2, M1."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Mandible present. Dart catalogue reference: A2581 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Female. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost antemortem: L-mandibular P2. The following teeth were lost postmortem: R-mandibular M1, P2, P1, C, I2, I1 ; L-mandibular P1, C, I2, I1. All teeth showed extensive tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African female of indeterminate sex and height.

M_117b:

Burial information: Quoted as per excavator's note: "IMB/5/2; 2 jaws and long bones at point 'R'. Teeth in mandible: Right - M3, M2, M1."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Mandible, tarsal and long bone fragments present. Dart catalogue reference: A2577 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Female. (Based on mandible)

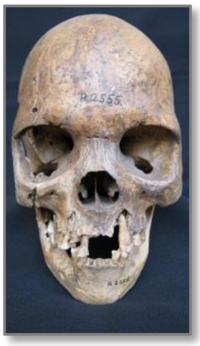
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost antemortem: L-mandibular P2. The following teeth were lost postmortem: R-mandibular M1, P2, P1, C, I1 ; L-mandibular P1, C, I2, I1 . All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African female of indeterminate sex and height.



M_199:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2555 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Tooth, vertebra and bone fragments present.

M_199: Caries

Age: 55-70 years. (Based on skull)

Sex: Female. (Based on skull and mandible)

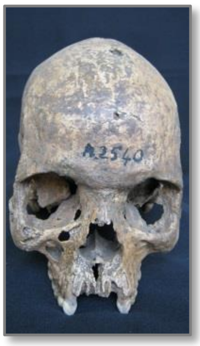
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P1, C ; L-maxillary M3, M2 ; R-mandibular M3, C, I2, I1 ; L-mandibular I1. The following teeth were lost antemortem: R-maxillary I2, I1 ; L-maxillary I1 ; R-mandibular P2 ; L-mandibular M3, M2, M1, P2. All teeth showed severe tooth wear. Carious lesions were observed on L-maxillary P1 and R-maxillary M1, C. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 55 – 70 year old African female of indeterminate height.



M_200:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Skull present. Dart catalogue reference: A2540 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 40-60 years. (Based on skull)

Sex: Female. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary I2, I1 ; L-maxillary I2, I1No teeth were lost antemortem. All teeth showed extensive tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No pathology observed. No signs of trauma were observed.

Conclusion: 40 – 60 year old African female of indeterminate height.

M_201:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Skull present. Dart catalogue reference: A2530 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Teeth, skull fragments present.

M_201: Tooth modification

Age: 30-50 years. (Based on skull)

Sex: Female. (Based on skull)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary I2 ; L-maxillary I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed. Dental modification of R-mandibular I1 was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 30 – 50 year old African female of indeterminate height.

M_207:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Mandible present. Dart catalogue reference: A2583 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular C, I2, I1 ; L-mandibular M3, P2, P1, I2, I1. No teeth were lost antemortem. All teeth showed extensive tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African male of indeterminate height.

M_226a:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Vertebrae, ribs, hip bone fragments, sternum, clavicles, scapulae, long bone fragments, hand and foot bones present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Teeth and mandible fragments present.

Age: Indeterminate. (Incomplete remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: Teeth could not be identified as belonging to mandible. All teeth present were permanent dentition. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Sub-adult African individual of indeterminate sex and height.

M_230:

Burial information: Quoted as per excavator's note: "IMB/6/2; 3rd Batch of bones."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, vertebrae, ribs, sacra, hip bone, clavicle, hand and foot bones present. Dart catalogue reference: A2566 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. No teeth were lost postmortem. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult year old African male of indeterminate height.

M_233:

Burial information: Quoted as per excavator's note: "IMB/6/2; 6th Batch of bones"

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, vertebrae, ribs, sacra, hip bone, clavicle, hand and foot bones present. Dart catalogue reference: A2570 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Female. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. No teeth were lost postmortem. The following teeth were lost antemortem: R-mandibular M3, M1. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African female of indeterminate height.

M_255:

Burial information: Quoted as per excavator's note: "IMB/5/2."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible, long bone fragments present. Dart catalogue reference: A2576 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_255: Tooth modification

Age: Indeterminate. (Incomplete remains)

Sex: Possible female. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. No teeth were lost postmortem. The following teeth were lost antemortem: R-mandibular M3, M1. All teeth showed moderate tooth wear. Carious lesion was observed on L-mandibular M1. Slight periodontal disease observed. No linear enamel hypoplasia was observed. Abscess on inferior L-mandibular M1 observed. Tooth modification observed on mandibular I1's.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_257:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible present. Dart catalogue reference: A2572 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_257: Possible arthritic change

Age: Indeterminate. (Incomplete remains)

Sex: Possible Male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular C, I2, I1 ; L-mandibular I2, I1. The following teeth were lost antemortem: L-mandibular M3, M1, P2. All teeth showed severe tooth wear. Carious lesions were observed on R-mandibular M1, P2. No periodontal disease observed. No linear enamel hypoplasia was observed. Abscess observed inferior to R-mandibular M1.

Pathology and trauma: Possible TMJ osteoarthritis observed on left side. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height who possibly suffered from TMJ osteoarthritis.

M_263:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandile, skull fragments present. Dart catalogue reference: A2573 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Possible female. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular M3, P2, P1, C, I2, I1 ; L-mandibular MP2, P1, C, I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_266:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Mandible present. Dart catalogue reference: A2580 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Possible Male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains).

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present All teeth showed extensive tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_282:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2549 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_282: Caries

Age: 45-65 years. (Based on skull and mandible)

Sex: Female. (Based on skull and mandible)

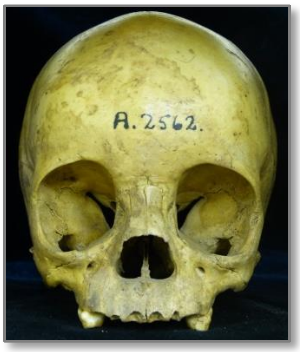
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular I2 ; L-mandibular C, I2. The following teeth were lost antemortem: R-mandibular I1 ; L-mandibular I1. All teeth showed moderate tooth wear. Carious lesion was observed on R-mandibular M3. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 45 – 65 year old African female of indeterminate height.



M_285:

M_285: Open fontanelle

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- None.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Well-preserved, but incomplete. Skull present. Dart catalogue reference: A2562 (Skull).

Age: 3-5 years. (Dentition)

Sex: Indeterminate. (Sub-adult)

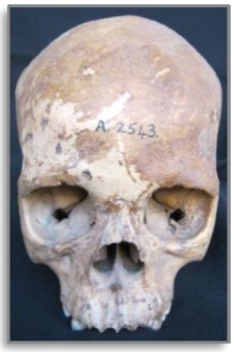
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were decidous dentition. The following teeth were lost postmortem: R-maxillary C, I2, I1 ; L-maxillary C, I2, I1. No teeth were lost antemortem. All teeth showed slight tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Open anterior fontanelle was obesrved. No signs of trauma were observed.

Conclusion: 3 – 5 year old African individual of indeterminate sex and height with a non-clinical associated developmenta anomaly.



M_286:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull present. Dart catalogue reference: A2543 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_286: Unusual foramen formation

Age: 35-45 years. (Based on skull)

Sex: Female. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P2, C, I2, I1 ; L-maxillary M2, C, I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed, however the foramen magnum rim showed abnormal bone browth or develeopment. No signs of trauma were observed.

Conclusion: 35 – 45 year old African female of height.

M_290:

Burial information: Quoted as per excavator's note: "IMB/6/2; 10th Batch of bones."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, vertebrae, ribs, sacrum, hip bones, clavicles, scapulae, hand and foot bones, bone fragments present. Dart catalogue reference: A2574 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_290: Tooth crowding

Age: Indeterminate. (Incomplete remains)

Sex: Possible female. (Based on mandible)

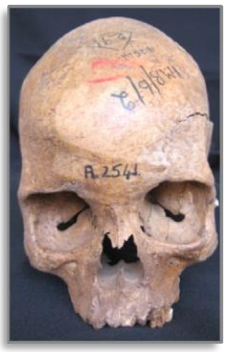
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular P1 ; L-mandibular M3. No teeth were lost antemortem. All teeth showed severe tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed. Crowding of R-mandibular I1 present. Non-clinical mandibular torus on left side of mandible observed.

Pathology and trauma: Noskeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African male of indeterminate sex and height.



M_291:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Skull present. Dart catalogue reference: A2541 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 50-70 years. (Based on skull)

Sex: Female. (Based on skull)

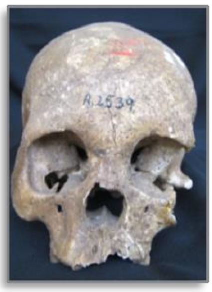
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, M1, P2, P1, C, I2 ; L-maxillary M1, C, P2. The following teeth were lost antemortem: R-maxillary I1 ; L-maxillary I1. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Noskeletal pathology was observed. No signs of trauma were observed.

Conclusion: 50 – 70 year old African female of indeterminate height.



M_292:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2539 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 40-60 year. (Based on skull)

Sex: Male. (Based on skull and mandible)

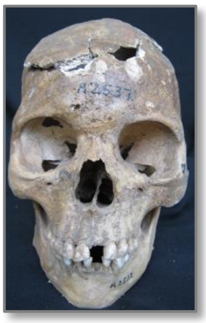
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, M2, P2, P1, C, I2, I1 ; L-maxillary M3, M2, P2, P1, C, I2, I1 ; R-mandibular I1 ; L-mandibular I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 40 – 60 year old African male of indeterminate height.



M_293:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2537 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Atlas, hand and foot bones present.

Age: 40-60 years. (Based on skull)

Sex: Female. (Based on skull and mandible)

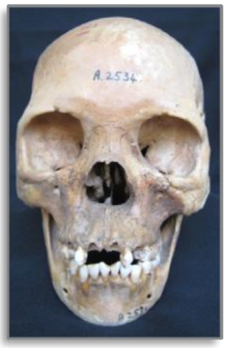
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: L-mandibular I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 40 – 60 year old African female of indeterminate height.



M_295:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2534 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_295: Tooth modification

Age: 35-55 years. (Based on skull)

Sex: Female. (Based on skull and mandible)

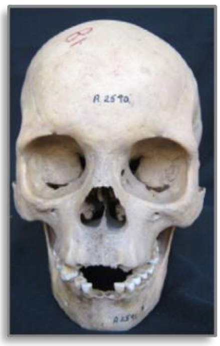
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary C, I1 ; L-maxillary C, I1 ; L-mandibular P2. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed. Tooth modification was observed on the mandibular inscisors.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 35 – 55 year old African female of indeterminate height.



M_296:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2590 (Skull) and A2591 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_296: Abscess and caries

Age: 35-50 years. (Based on skull)

Sex: Male. (Based on skull and mandible)

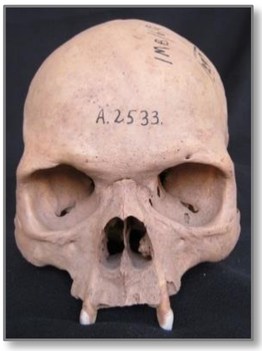
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P1, C, I2 ; L-maxillary P2, P1, C, I2 ; R-mandibular I1 ; L-mandibular I1. The following teeth were lost antemortem: R-maxillary M1, I1 ; L-maxillary M1, I1. All teeth showed severe tooth wear. Carious lesions were observed on the R-mandibular M1 and L-mandibular M1. Slight periodontal disease observed. No linear enamel hypoplasia was observed. An abscess was present below the R-mandibular M1 and M2.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 35 – 50 year old African male of indeterminate height.



M_297:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull present. Dart catalogue reference: A2533 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Hand bones present.

M_297: Abscess and caries

Age: 55-70 years. (Based on skull)

Sex: Male. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P1, I2 ; L-maxillary P1. The following teeth were lost antemortem: R-maxillary M3, M2, M1, P2, I1 ; L-maxillary M3, M2, M1, P2, I2, I1. All teeth showed slight tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. Trauma of unknown origin was observed as a cut surface at the posterior edge of the foramen magnum – it is unclear whether the trauma is ante-, peri- or post-mortem.

Conclusion: 55 – 70 year old African male of indeterminate height.

M_328:

Burial information: Quoted as per excavator's note: "IMB/5/4; Jaw A, Figure 15."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Mandible present. Dart catalogue reference: A2573 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular M1, P2, P1 ; L-mandibular P2. No teeth were lost antemortem. All teeth showed slight tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_348:

Burial information: Quoted as per excavator's note: "IMB/5/6 ; Under the granite slab."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Teeth, long bone fragments, hand and foot bones present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Mandibular body fragment, skull fragments present.

Age: Indeterminate. (Incomplete remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: Only one tooth was present for analysis. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: African individual of indeterminate sex age and height.

M_357:

Burial information: Quoted as per excavator's note: "IMB/5/4 ; Burial XII including four ? ; Figure 18."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Teeth, mandible, vertebrae, ribs, manubrium, clavicles, hip bones, radius, ulna, hand and foot bones and bone fragments present. Dart catalogue reference: A2572 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Possible male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular C, I2, I1 ; L-mandibular P1, I2, I1. No teeth were lost antemortem. All teeth showed severe tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_361:

Burial information: Quoted as per excavator's note: "IMB/5/4."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Teeth, mandible, vertebrae, hip bone, long bone fragments, hand and foot bones, bone fragments present. Dart catalogue reference: A2578 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular M3, M2, P2, P1, C, I2, I1 ; L-mandibular M3, P2, P1, C, I2, I1. No teeth were lost antemortem. All teeth showed modderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_365:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Mandible present. Dart catalogue reference: A2586 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Possible male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular P2, P1, C, I2, I1 ; L-mandibular P2, P1, I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: African individual of indeterminate sex, age and height.

M_367:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2532 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Tooth, vertebra and skull fragments.

M_367: Supernumerary teeth

Age: 30-50. (Based on skull)

Sex: Female. (Based on skull and mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary C, I2, I1 ; R-mandibular I1 ; L-mandibular P2. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed. Supernumerary teeth were observed on the left maxillary dental arcade.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 30 – 50 year old African female of indeterminate height.

M_369:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, but incomplete. Skull present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Vertebra, rib and bone fragments present.

Age: 18-25 years. (Skull and postcranial remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition with M3's erupting. The following teeth were lost postmortem: R-maxillary M2 ; L-maxillary I2. No teeth were lost antemortem. All teeth showed slight tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 18 – 25 year old African individual of indeterminate sex and height.

M_377:

Burial information: Quoted as per excavator's note: "IMB/5/5."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Vertebrae, ribs, clavicle, long bone fragments, scapula, hand and foot bones present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Mandible and skull fragments present.

Age: Indeterminate. (Incomplete remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were available. No periodontal disease observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: African individual of indeterminate sex, age and height.

M_400a:

Burial information: Quoted as per excavator's note: "IMB/6/2."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, vertebrae, ribs, hip bones, sacrum, clavicles, scapulae, patellae, hand and foot bones present. Dart catalogue reference: A2564 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_400a: Severe periodontitis

Age: Indeterminate. (Incomplete remains)

Sex: Male. (Based on mandible and hip bones)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular M1, P1, C, I2, I1 ; L-mandibular M3, M1, P2, P1, C, I1, I2. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African male of indeterminate height.

M_401:

Burial information: Quoted as per excavator's note: "IMB/6/2 ; Bones batch 2."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, vertebrae, stenum, sacrum, ribs, scapulae, clavicles, radii, humeri, hand and foot bones present. Dart catalogue reference: A2565 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_401: Abscesses

Age: Indeterminate. (Incomplete remains)

Sex: Male. (Based on mandible)

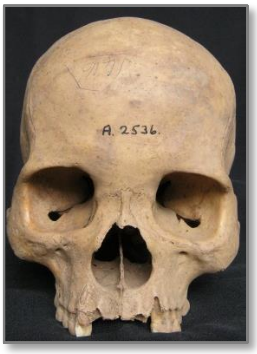
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular P1, I2, I1 ; L-mandibular I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. Carious lesions were observed on L-mandibular I2, C, P1. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Osteophyte formation observed on radius and sacrum. No signs of trauma were observed.

Conclusion: Adult African male of indeterminate height.



M_416:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull present. Dart catalogue reference: A2536 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 40-50 years. (Based on skull)

Sex: Female. (Based on mandible)

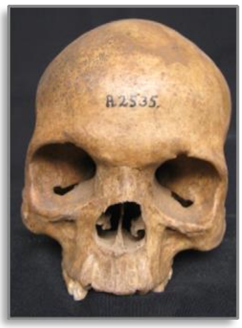
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, I2 ; L-maxillary M3, C, I2. The following teeth were lost antemortem: R-maxillary I1 ; L-maxillary I1. All teeth showed severe tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 40 – 50 year old African female of indeterminate height.



M_421:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull present. Dart catalogue reference: A2535 (Skull).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 55-75 years. (Based on skull)

Sex: Possible female. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary I2 ; L-maxillary P1, C, I2. The following teeth were lost antemortem: R-maxillary I1 ; L-maxillary I1. All teeth showed severe tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology wasobserved. No signs of trauma were observed.

Conclusion: 55 – 75 year old African male of indeterminate sex and height.

M_422:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Skull and mandible present. Dart catalogue reference:

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Female. (Based on mandible)

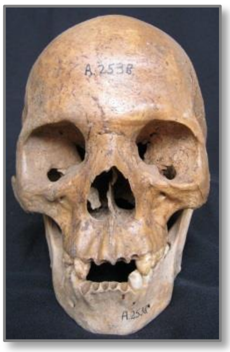
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, I2, I1 ; L-maxillary M3, P1, C, I2, I1 ; R-mandibular P2, P1, C, I2, I1 ; L-mandibular M3, P2, C, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African female of indeterminate height.



M_430a:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull and mandible present. Dart catalogue reference: A2538 (Skull) and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 18-25 years. (Based on skull)

Sex: Male. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition, M3's erupting. The following teeth were lost postmortem: R-maxillary I2, I1 ; L-maxillary MP2, P1, I2, I1 ; R-mandibular P2, C, I2, I1 ; L-mandibular I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Cribra orbitalia was observed bilaterally. No signs of trauma were observed.

Conclusion: 18 – 25 year old African male of indeterminate height who most probably suffered from a physiological insult of unknown cause (malnutrition, disease, metabolic stress etc.).

M_432:

Burial information: Quoted as per excavator's note: "IMB/9/1 ; Burial I."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, vertebrae, ribs, sternum, clavicle, scapula, hip bone, fibula, hand and foot bones present. Dart catalogue reference: A2567 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

M_432: Caries

Age: Indeterminate. (Incomplete remains)

Sex: Possible female. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition with M3's erupting. The following teeth were lost antemortem: R-mandibular P1 ; L-mandibular P2. The following teeth were lost postmortem: R-mandibular I2, I1 ; L-mandibular I2, I1. All teeth showed severe tooth wear. Carious lesions were observed on R-mandibular M3, C and L-mandibular M3. No periodontal disease observed. No linear enamel hypoplasia was observed. An abcess was observed bewlo R-mandibular C.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.

M_446:

Burial information: Quoted as per excavator's note: "IMB/6/4."

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Mandible, teeth, vertebrae, clavicle, hand and foot bones present. Dart catalogue reference: A2575 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Possible male. (Based on mandible)

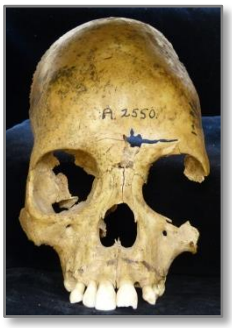
Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost antemortem: R-mandibular I1 ; L-mandibular I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African individual of indeterminate sex and height.



M_450:

M_450: Enamel hypoplasia and teeth crowding

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- None.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Poorly preserved, and incomplete. Skull and mandible present. Dart catalogue reference: A2550 (Skull and Mandible).

Age: 9-11 years. (Based on dentition)

Sex: Indeterminate. (Sub-adult)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: Permanent and decidious dentition were present. The following teeth were lost postmortem: L-maxillary I2 ; R-mandibular P1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. Multiple linear enamel hypoplasia were observed on the mandibular and maxillary dental arcade. Crowding of the anterior mandibulare teeth were on=bserved

Pathology and trauma: Assymetric skull was observed with bilateral cribra orbitalia. No signs of trauma were observed.

Conclusion: 9-11 year old African individual of indeterminate sex and height who possibly suffered from multiple physiological and metabolic insults accompanied by developmental difficulties.

M_471:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, but incomplete. Teeth, mandible, vertebrae, hand and foot bones and bone fragments present. Dart catalogue reference: A2587 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Skull fragments present.

Age: Indeterminate. (Incomplete remains)

Sex: Indeterminate. (Incomplete remains)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were available for analysis.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: African individual of indeterminate sex, age and height.

M_473:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible, vertebrae, clavicle ans scapula fragments present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 25-35 years. (Based on skull)

Sex: Male. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary C, I2 ; L-maxillary C, I2. The following teeth were lost antemortem: R-maxillary I1 ; L-maxillary I1. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 25 – 35 year old African male of indeterminate height.

M_480:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Possible male. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular P2, P1, C, I2, I1 ; L-mandibular M3, P2, P1, I2, I1. No teeth were lost antemortem. All teeth showed slight tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African Individual of indeterminate sex and height.

M_486:

Burial information: None available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Mandible present. Dart catalogue reference: A2592 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Indeterminate. (Incomplete remains)

Sex: Female. (Based on mandible)

Ancestry: African (Based on site location, site date and relationship to other identified remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortemR-mandibular I1. The following teeth were lost sntemortem: R-mandibular M1, P2. All teeth showed severe tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Adult African female of indeterminate height.

Accession numbers *not* confirmed as a representation of a single individual

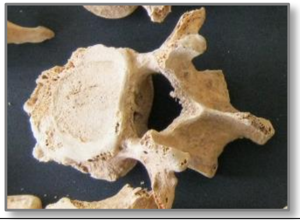
Accession Number	Age range	Preservation	Storage location		Pathology observed		
			Zimbabwe Museum of Human Sciences, Harare	Dart collection, University of the Witwatersrand	Bone affected	Type	Description
M_29	Sub-adult	Fairly well	Skull fragments, long bone fragments, foot bones	Skull fragments	Tibia	Animal activity	Gnawing 
M_36	Adult and Sub-adult	Fairly well	Teeth, vertebrae, rib fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_37a	Adult and Sub-adult	Good	Skull fragments, vertebrae, sacrum, rib fragments, scapula, hip bone fragments, long bone fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_38	Adult	Poor	Rib fragments, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_42	Adult	Fairly well	Teeth, vertebrae, rib fragments, patella, long bone fragments, hand and foot bones, bone fragments	Rib fragment	Left mandibular I1	Tooth modification	V-filing 
M_54a	Sub-adult	Poor	Rib fragments, vertebrae, hip bone fragments, long bones	None	None	Not applicable	Not applicable
M_54b	Sub-adult	Good	Vertebra	None	None	Not applicable	Not applicable
M_54c	Adult	Good	Skull fragments, tooth, vertebrae	None	None	Not applicable	Not applicable

Accession Number	Age range	Preservation	Storage location		Pathology observed		
			Zimbabwe Museum of Human Sciences, Harare	Dart collection, University of the Witwatersrand	Bone affected	Type	Description
M_58	Sub-adult	Fairly well	Tooth, vertebrae, rib fragments, hand bones, bone fragments	None	None	Not applicable	Not applicable
M_63	Adult	Fairly well	Vertebrae, rib fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_64	Adult	Poor	Patella, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_66	Adult	Fairly well	Skull fragments, tooth, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_68a	Sub-adult	Poor	Long bone fragments	None	None	Not applicable	Not applicable
M_68b	Adult	Fairly well	Vertebra, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_70	Adult	Poor	None	Skull fragments, teeth	None	Not applicable	Not applicable
M_77	Adult	Good	Teeth, hand bones	None	None	Not applicable	Not applicable
M_79	Adult	Good	Teeth, hand bones	None	None	Not applicable	Not applicable
M_80	Adult	Fairly well	Tooth, vertebrae, ribs, clavicles, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_81	Adult	Good	Teeth, vertebrae, ribs, clavicle, hand and foot bones	None	None	Not applicable	Not applicable
M_84a	Sub-adult	Poor	Tooth, femur condyles	ne	None	Not applicable	Not applicable
M_84b	Adult	Fairly well	Skull fragments, teeth, vertebra, rib fragments, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_93	Adult	Poor	Hip bone fragments, femur fragments, patella	None	None	Not applicable	Not applicable
M_100	Adult	Poor	Tooth fragment, long bone fragments, bone fragments	None	None	Not applicable	Not applicable

			Storage location		Pathology observed		
Accession Number	**Age range**	**Preservation**	**Zimbabwe Museum of Human Sciences, Harare**	**Dart collection, University of the Witwatersrand**	**Bone affected**	**Type**	**Description**
M_104	Adult	Poor	Skull fragments, teeth, long bone fragments, bone fragments	None	None	Not applicable	Not applicable
M_107	Adult	Poor	Skull fragments, teeth, foot bone	None	None	Not applicable	Not applicable
M_113a	Adult	Good	Clavicles, hand and foot bones	None	None	Not applicable	Not applicable
M_113b	Adult	Good	Teeth, vertebrae, ribs, clavicles, scapula, patella, hand and foot bones, bone fragments	None	Patella	Arthritis	Eburnation; severe osteophyte formation 
					Phalanx	Arthritis	Rheumatoid arthritis 
M_118a	Sub-adult	Fairly well	Hand and foot bones	None	None	Not applicable	Not applicable
M_118b	Adult	Good	Teeth, hand and foot bones	None	None	Not applicable	Not applicable
M_119	Adult	Poor	Rib fragments, clavicle fragment, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_125	Adult	Poor	Skull fragments, rib fragments, hip bone fragment, tarsal	None	None	Not applicable	Not applicable

Accession Number	Age range	Preservation	Storage location		Pathology observed		
			Zimbabwe Museum of Human Sciences, Harare	Dart collection, University of the Witwatersrand	Bone affected	Type	Description
M_128a	Sub-adult	Poor	Scapula rag, long bone fragment	None	None	Not applicable	Not applicable
M_128b	Sub-adult	Fairly well	Vertebra, long bone fragment, hand and foot bones	None	None	Not applicable	Not applicable
M_128c	Adult	Fairly well	Tooth, vertebrae, long bone fragments, hand and foot bones, bone fragments	Skull fragments	None	Not applicable	Not applicable
M_132	Adult	Fairly well	Teeth, vertebra	None	None	Not applicable	Not applicable
M_134	Adult	Good	Tooth, vertebrae, rib, phalanges	None	None	Not applicable	Not applicable
M_140	Adult	Poor	Tooth, hip bone fragment, long bone fragments, phalanges, bone fragments	None	None	Not applicable	Not applicable
M_142	Adult	Fairly well	Teeth, hand and foot bones	None	Teeth	Tooth modification	V-filing 
M_144	Adult	Fairly well	Vertebrae, ribs, manubrium fragment, long bone fragment, tarsal	None	None	Not applicable	Not applicable
M_146	Adult	Excellent	Hand and foot bones	None	None	Not applicable	Not applicable
M_147	Adult	Excellent	Rib	None	None	Not applicable	Not applicable
M_153	Adult	Fairly well	Phalanges and bone fragments	None	None	Not applicable	Not applicable

Accession Number	Age range	Preservation	Storage location: Zimbabwe Museum of Human Sciences, Harare	Storage location: Dart collection, University of the Witwatersrand	Pathology observed: Bone affected	Pathology observed: Type	Pathology observed: Description
M_154	Adult	Poor	Long bone fragments, hand and foot bones, bone fragments	None	Right Ulna	Trauma or osteomyelitis	Stab wound or Cloakae 
M_157a	Sub-adult	Poor	Vertebra fragments, hi bone fragment, long bone fragments	None	None	Not applicable	Not applicable
M_157b	Adult	Poor	Tooth, vertebra, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_158a	Sub-adult	Good	Teeth, vertebrae, long bone fragments, carpals	None	None	Not applicable	Not applicable
M_158b	Adult	Poor	Teeth, scapula, patellae, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_159	Adult	Fairly well	Teeth, vertebra, phalanges, bone fragments	None	Left mandibular I1	Tooth modification	V-filing 

M_160	Adult	Fairly well	Vertebrae, ribs, clavicle, scapula fragment, hand bones	None	Clavicle	Luxation	Chronic dislocation of acromio-clavicular joint 
					L1	Osteophytosis	Slight osteophyte formation 
M_166a	Sub-adult	Poor	Sternum fragment, long bone fragment	None	None	Not applicable	Not applicable
M_166b	Adult and Sub-adult	Good	Teeth, vertebrae, rib fragments, clavicle fragment, patellae, hip bone fragment, long bone fragments, bone fragments	None	Left mandibular I1	Tooth modification	V-filing 
M_167	Adult	Fairly well	Teeth, vertebrae, hand and foot bones, bone fragments	None	L vertebra	Osteophytosis	Slight osteophyte formation
M_170	Adult	Fairly well	Hand and foot bones	Mandibular condylar process	None	Not applicable	Not applicable
M_174	Adult	Poor	Long bone fragments	None	None	Not applicable	Not applicable
M_175	Adult	Poor	Long bone fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_179	Adult	Fairly well	Tooth, vertebrae, rib fragments, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable

M_202	Adult	Poor	Long bone fragments, hand and foot bone fragments, bone fragments	None	None	Not applicable	Not applicable
M_203	Adult	Poor	Long bone fragments, phalanges, bone fragments	None	None	Not applicable	Not applicable
M_204	Adult	Poor	Clavicle fragments, scapula fragments, long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_206	Adult and Sub-adult	Poor	Vertebrae, rib fragments, sacral fragment, clavicle, long bone fragments, bone fragments	None	None	Not applicable	Not applicable
M_208	Adult	Good	Patella, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_209	Adult	Poor	Long bone fragments, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_210a	Sub-adult	Poor	Long bone fragment	None	None	Not applicable	Not applicable
M_210b	Adult	Poor	Tooth, vertebra fragment, clavicle fragment, long bone fragment, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_211	Adult	Poor	Skull fragments, long bone fragments, metacarpal fragment	None	None	Not applicable	Not applicable
M_212	Adult and Sub-adult	Fairly well	Vertebrae fragments, rib fragments, sacral fragment, clavicle fragment, scapulae fragments, long bone fragments, hand and foot bones, bone fragments	None	Ulna	Articulating defect	Abnormally shaped articulation surface 
M_217	Adult	Poor	Tooth, hand and foot bones	None	None	Not applicable	Not applicable
M_226b	Adult	Excellent	Vertebrae, ribs, hand and foot bones	None	None	Not applicable	Not applicable
M_227	Adult	Excellent	Vertebrae, sternums, scapula, hip bones, hand and foot bones	None	None	Not applicable	Not applicable

M_228a	Sub-adult	Excellent	Vertebrae, ribs, clavicles, scapulae, hip bone	None	None	Not applicable	Not applicable
M_228b	Adult	Excellent	Vertebrae, ribs, clavicle, hand bones	None	None	Not applicable	Not applicable
M_229	Adult	Excellent	Vertebrae, ribs, scapulae, ulna, fibula	None	Right Ulna	Osteomyelitis (possible)	Abnormal foramen at articulating surface: possible cloacae 
M_231	Adult	Excellent	Vertebrae, sacrum, ribs, sternum, hip bone, ulna, hip bone, calcaneus	None	None	Not applicable	Not applicable
M_232	Adult	Excellent	Vertebrae, ribs, clavicles, hip bone, fibula, metacarpals	None	Rib	Fracture accompanied by osteophyte formation	Osteophyte formation 
M_237	Adult and Sub-adult	Good	Tooth, vertebrae, rib fragments, sternum fragment, patella, long bone fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_241	Adult	Poor	Long bone fragments	None	None	Not applicable	Not applicable
M_244	Adult	Poor	Long bone fragments, metacarpal	None	None	Not applicable	Not applicable
M_245	Sub-adult	Poor	Vertebrae fragments, hip bone fragments, long bone fragments, metacarpals, bone fragments	None	None	Not applicable	Not applicable
M_250	Adult	Fairly well	Hand and foot bones	None	None	Not applicable	Not applicable
M_252	Adult	Poor	Sternal fragment	None	None	Not applicable	Not applicable

M_253	Adult	Fairly well	Teeth, vertebrae, rib fragments, sterna fragment, clavicle, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_254	Adult	Poor	Scapulae, clavicle	None	None	Not applicable	Not applicable
M_256	Adult	Poor	Scapula, long bone fragments	None	None	Not applicable	Not applicable
M_258	Adult	Fairly well	Metacarpals, long bone fragment	None	None	Not applicable	Not applicable
M_260	Adult	Poor	Teeth, rib fragment, clavicle, hand and foot bones, long bone fragments and bone fragments	None	None	Not applicable	Not applicable
M_261	Adult	Poor	Clavicle, hand bones, long bone fragments	None	None	Not applicable	Not applicable
M_262	Adult	Poor	Teeth, hip bone, rib frag, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_264	Adult	Poor	Tooth, bone fragments	None	None	Not applicable	Not applicable
M_265	Adult	Fairly well	Vertebrae, ribs, hip bone, radius, hand bones, bone fragments	None	None	Not applicable	Not applicable
M_267	Adult	Poor	Long bone fragments	None	None	Not applicable	Not applicable
M_268	Adult	Fairly well	Tibia, hand and foot bones	None	None	Not applicable	Not applicable
M_269	Adult	Excellent	Hand and foot bones	None	None	Not applicable	Not applicable
M_271	Adult	Poor	Tibia, fibula, long bone fragments	None	None	Not applicable	Not applicable
M_272	Adult	Poor	Skull fragments	None	None	Not applicable	Not applicable
M_287a	Sub-adult	Good	Hip bone fragment, clavicles, ribs and vertebra	None	None	Not applicable	Not applicable
M_287b	Adult	Good	Vertebrae, ribs, clavicle, humerus, hand and foot bones and bone fragments	None	None	Not applicable	Not applicable
M_287c	Sub-adult	Excellent	Clavicle and humerus	None	None	Not applicable	Not applicable

M_288	Adult	Fairly well	Vertebra, sternum, ribs, clavicle, scapula, hand bones and bone fragments	None	Sternum	Developmental anomaly	Sternal foramen 
M_289a	Sub-adult	Fairly well	Vertebra, hip bone fragment, clavicle fragment	None	None	Not applicable	Not applicable
M_289b	Adult	Fairly well	Vertebrae, sacrum, ribs, manubrium, hip bone fragment, hand and foot bones	None	None	Not applicable	Not applicable
M_298a	Adult	Fairly well	Vertebra, patella, hand and foot bones	None	None	Not applicable	Not applicable
M_298b	Adult	Poor	Rib, hip bone fragment, clavicles, scapulae fragments, long bone fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_300	Adult	Fairly well	Vertebra, ribs, hand and foot bones	None	Calcaneus	Osteophytosis	Additional bone formation on calcaneal tuberosity 
					Rib	Osteophytosis	Additional bone formation on head of rib 
M_302	Adult	Fairly well	Vertebra, sacral fragments, clavicles, hand and foot bones	None	None	Not applicable	Not applicable

M_304	Adult	Excellent	Vertebrae, ribs, sternum, patellae, hand and foot bones	None	None	Not applicable	Not applicable
M_309	Adult	Fairly well	Teeth, vertebrae, ribs fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_311	Adult	Excellent	Teeth, vertebra, ribs, sacral fragments, patellae, hand and foot bones	None	None	Not applicable	Not applicable
M_316	Adult	Fairly well	Talus	None	None	Not applicable	Not applicable
M_319a	Sub-adult	Fairly well	Vertebrae, femur fragments	None	None	Not applicable	Not applicable
M_319b	Adult and Sub-adult	Good	Vertebrae, ribs, sternum, sacrum, hip bones, clavicles, ulnae, radii, tibiae, hand and foot bones, and bone fragments	None	None	Not applicable	Not applicable
M_324	Adult and Sub-adult	Poor	Teeth, patellae, ulna, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_329	Adult	Poor	Clavicle fragment, Hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_353	Adult	Poor	Vertebrea, patella, fibula frag, humerus frag, hnd and foot bones, bone frags	Teeth, skull frags	None	Not applicable	Not applicable
M_354	Adult	Poor	Teeth, long bone fragments	None	None	Not applicable	Not applicable
M_359	Adult	Poor	Teeth, vertebrae, ribs, patella, scapula, long bone fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_368	Adult	Poor	None	Skull fragment	None	Not applicable	Not applicable
M_382	Adult	Poor	Long bone fragments	None	None	Not applicable	Not applicable
M_384	Adult and Sub-adult	Fairly well	Teeth, vertebrae, sternum, clavicles, long bone fragments, hand and foot bones, bone fragments	Skull fragments	None	Not applicable	Not applicable

					Vertebrae	Osteophytosis	Severe osteophyte formation 
M_400b	Adult	Excellent	Vertebrae, sacrum, hip bones, scapula, patella, humeri, hand and foot bones	None	Sacrum	Osteophytosis	Severe osteophyte formation 
					Hip bones	Osteophytosis	Severe osteophyte formation 
M_402	Adult	Excellent	Hand and foot bones	None	None	None	None
M_420	Adult	Poor	Skull fragments	Skull frags, tooth, long bone fragments	None	None	None
M_430b	Adult and Sub-adult	Good	Vertebrae, ribs, scapulae, humerus, radii, ulnae, fibulae, tibia, femurs, hand and foot bones	Bone fragment	None	None	Bangles associated with right radius and ulna
M_431	Sub-adult	Good	Ribs, vertebrae fragments, clavicles, radii, ulnae, humeri, tibiae, fibulae, femora	None	None	Not applicable	Not applicable
M_438a	Sub-adult	Fairly well	Vertebrae, femur, hand and foot bones	None	None	Not applicable	Not applicable

M_438b	Adult	Fairly well	Teeth, vertebrae, ribs, scapulae, hip bones, patellae, long bone fragments, hand and foot bones	None	Ulna	Animal activity	Gnawing 
M_439	Adult	Excellent	Hand and foot bones	None	None	Not applicable	Not applicable
M_451	Adult	Poor	Tooth, patella, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_453	Adult	Fairly well	Vertebra, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_464	Adult	Good	Vertebrae, ribs, sternum, clavicles, scapula, hand and foot bones	None	None	Not applicable	Not applicable
M_472	Adult	Fairly well	Teeth, vertebrae, manubrium, rib fragments, hand and foot bones	None	None	Not applicable	Not applicable
M_475	Adult	Fairly well	Teeth, vertebrae, clavicle, hand and foot bones, bone fragments	None	None	Not applicable	Not applicable
M_483	Adult	Good	Teeth, patella, hand and foot bones	None	None	Not applicable	Not applicable
M_485	Adult and Sub-adult	Fairly well	Vertebrae, patella, femur, hand and foot bones	Tooth, skull fragment	None	Not applicable	Not applicable
M_487	Adult	Poor	Hip bone fragment	None	None	Not applicable	Not applicable

Appendix C: Ashford Farm Skeletal Reports

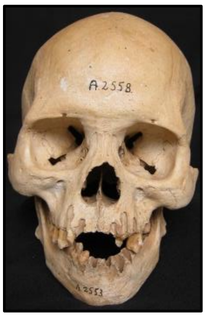
Individual skeletal reports of the Ashford Farm site will be described in this section.

- An individual within an accession number was named according to the following- example:

A_7

Ashford farm
(Added by author)

Individual 7
(Original accession number)



A_1:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible were present but a large number of teeth were lost post-mortem. Dart catalogue reference: A2558 (Skull) and A2553 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 45-55 years. (Based on skull)

Sex: Female. (Based on skull)

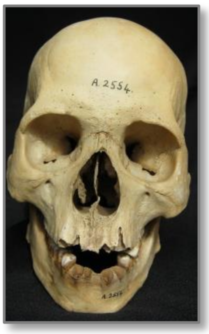
Ancestry: African. (Based on skull)

Antemortem stature: Unknown. (Incomplete)

Dentition: All teeth present were permanent dentition.The following teeth were lost post-mortem: R-maxillary M3, M2, I2; L-maxillary M3, M2, M1, P1, I2; R-mandibular I2, I1; L-mandibular M2, P2, P1, C, I2, I1. All teeth present showed moderate to extensive wear. The L-mandibular M3 erupted at an angle, possibly due to space restriction. No carious lesions or enamel hypoplasia were observed.

Pathology and trauma: No signs of pathology or trauma were observed.

Conclusion: 45 – 55 year old adult African female of undetermined height.



A_2:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull and mandible were present. Dart catalogue reference: A2554 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 30-40 years. (Based on skull)

Sex: Male. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, M2, P2, P1, C, I2 ; L-maxillary M3, M2, P2, P1, C, I2 ; R-mandibular C, I2 ; L-mandibular P1, C. The following teeth were lost antemortem: R-maxillary I1 ; L-maxillary I1 ; R-mandibular I1 ; L-mandibular I2, I1. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. Enamel hypoplasia were observed on R-mandibular M1, P2, P1 ; L-mandibular M1, P2.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 30 – 40 year old adult African Male of undetermined height.

A_3:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible were present. A2557 (Skull) and A2559 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 15-18 years. (Based on skull)

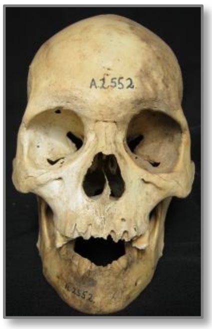
Sex: Female. (Based on skull)

Ancestry: African. (Based on skull)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, M2, M1, P1, C, I2, I1 ; L-maxillary M3, M2, M1, P2, C, I2, I1 ; R-mandibular M2, P2, P1, C, I2, I1 ; L-mandibular M3, M2, M1, P2, P1, C, I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 15 – 18 year old adult African female of undetermined height.



A_4:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible were present. Dart catalogue reference: A2552 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 50-60 years. (Based on skull)

Sex: Male. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P2, P1, C, I2, I1 ; L-maxillary M1 ; R-mandibular P2, P1, C, I2, I1 ; L-mandibular M2, P2, P1, C, I2, I1. No teeth were lost antemortem. All teeth showed severe tooth wear. No carious lesions were observed. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 50 – 60 year old adult African Male of undetermined height.

A_5:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fairly well-preserved, but incomplete. Skull and mandible were present. Dart catalogue reference: A2560 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 5-7 years. (Based on skull and mandible)

Sex: Indeterminate. (Sub-adult)

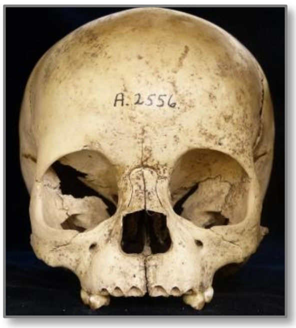
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete)

Dentition: Permanent and deciduous dentition present. The following teeth were lost postmortem: R-maxillary M2, P2, P1, C, I2, I1 ; L-maxillary M2, M1, P2, P1, C, I2, I1 ; R-mandibular M2, M1, P2, P1, I2, I1 ; L-mandibular M2, P2, P1, C, I2, I1. No teeth were lost antemortem: All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 5 – 7 year old adult African of indeterminate sex and height.



A_6:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- None.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- Fairly well-preserved, but incomplete. Skull present. Dart catalogue reference: A2556 (Skull).

Age: 3-5 years. (Based on skull)

Sex: Indeterminate. (Sub-adult)

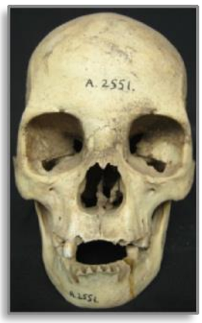
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete)

Dentition: Permanent and deciduous dentition present. The following teeth were lost postmortem: R-maxillary P1, C, I2, I1 ; L-maxillary P1, C, I2, I1. No teeth were lost antemortem. All teeth showed slight tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology observed. No signs of trauma were observed.

Conclusion: 3 – 5 year old adult African of indeterminate sex and height.



A_7:

Burial information: Unknown.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Well-preserved, but incomplete. Skull and mandible were. Dart catalogue reference: A2551 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 45-55 years. (Based on skull)

Sex: Female. (Based on skull)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate. (Incomplete)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P1, I2 ; L-maxillary P2, P1, C, I2 ; R-mandibular C, I2, I1 ; L-mandibular M2, M1, P1, P2, I2, I1. The following teeth were lost antemortem: R-maxillary M2, I1 ; L-maxillary I1. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. Linear enamel hypoplasia was observed on R-mandibular P2.

Pathology and trauma: No pathology observed. No signs of trauma were observed.

Conclusion: 45 – 55 year old adult African female of indeterminate height.

Appendix B: Dambarare Skeletal Reports

Individual skeletal reports of the Dambarare site will be described in this section.

- An individual within an accession number was named according to the following example:

D_AA4

Dambarare	Trench AA	Individual 4
(Added by author)	(Original trench number)	(Original accession number)

- In case skeletal elements could be paired and confirmed as an additional individual, the particular sub-collection of bones were named according to the following example:

D_AAMisc2

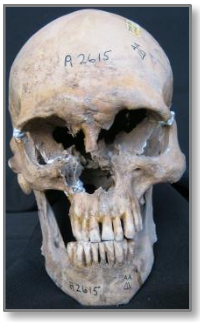
Dambarare	Trench AA	Miscellaneous Individual 2
(Added by author)	(Original trench number)	(Added by author)

- In case the elements could not be paired or confirmed as an additional individual, the particular sub-collection of bones were retained as originally accessioned and named according to the following example:

D_AAMiscElem6

Dambarare	Trench AA	Miscellaneous Sub-collection 6
(Added by author)	(Original trench number)	(Added by author)

- Burial information of the Dambarare skeletal reports include the position of the skeleton upon excavation as well as the grave goods associated with the individual as described in Garlake (1969). All figures and photographs of grave goods are also included, courtesy of Garlake (1969).



D_AA1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, partially reconstructed skull, complete mandible and partial post-cranial elements present. All elements preserved relatively well. Dart catalogue reference: A2615 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 40 – 55 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: European. (Based on skull)

Antemortem stature: 171.01cm ±6.90. (Femur: De Mendonça (2000))

D_AA1: Antemortem tooth loss

Dentition: All teeth present were permanent dentition. The following teeth were lost antemortem: L-maxillary M3, M2, M1; R-mandibular M3, M2, M1; L-mandibular M3, M2, M1. The R-mandibular M3 and L-mandibular M1 alveoli were still partly observable, but the rest of the alveoli were fully resorbed. The section of the maxilla associated with R-maxillary M3, M2 and M1 were absent. Crowding in the mandible resulted in crown of left mandibular I2 protruding slightly more anterior. The anterior teeth showed moderate wear. No carious lesions were observed. Signs of severe periodontal disease observed. Linear enamel hypoplasia was observed on the following teeth: R-maxillary C; L-maxillary C, I2; R-mandibular C.

Pathology and trauma: The humerus and ulna showed signs of slight subperiosteal bone growth of non-specific cause. No signs of trauma were observed.

Conclusion: 40 – 55 year old adult male of European descent who had been approximately 171 cm tall and suffered from periodontal disease.

D_AA2:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete skull, complete mandible and most post-cranial elements present. All elements preserved relatively well. Dart catalogue reference: A2616 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_AA2: Schmorl's node

Age: 25 – 35 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: European. (Based on skull)

Antemortem stature: 166.75cm ±6.90. (Femur: De Mendonça (2000))

Dentition: All teeth were present and permanent dentition. Slight crowding in the mandible resulted in the incisors being misaligned. All teeth showed minimal wear, except the maxillary I1's which showed moderate wear. No carious lesions were observed. Signs of severe periodontal disease observed. Linear enamel hypoplasia was observed on the following teeth: R-maxillary C; L-maxillary C.

Pathology and trauma: Schmorl's nodes were identified on T7 and L3 which could have been caused by a variety of factors, but the individual most probably suffered from back pain. The right 2nd rib showed signs of possible trauma evident by a healed fracture.

Conclusion: 25 – 35 year old adult male of European descent who had been approximately 166 cm tall and suffered from periodontal disease and possibly back pain. Individual also underwent possible trauma, evident by a healed rib.

D_AA3:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete skull, complete mandible and most post-cranial elements present. All elements preserved relatively well. Dart catalogue reference: A2617 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_AA3: Fused rib 1 and 2

Age: 25 – 35 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: European. (Based on skull)

Antemortem stature: 161.69cm ±6.90. (Femur: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. No teeth were lost anemortem. The following teeth were lost postmortem: R-maxillary M3, P2. All teeth showed extensive tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: The tibia and fibula showed signs of streaking and the skull exhibited healed depressed lesions, which could possibly be gumatous. Possible treponemal disease. Ribs 1 and 2, of unknown side, were fused, exhibiting a developmental anomaly. No signs of trauma were observed.

Conclusion: 25 – 35 year old adult male of European descent who had been approximately 162 cm tall who could possibly have suffered from treponemal disease.

D_AA4:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete hip bones, vertebrae and lower limb bones present. Many elements in poor state of preservation, specifically vertebrae which are still impregnated with solidified granitic sand.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_AA4: Schmorl's node

Age: 30 – 50 years. (Based on post-cranial remains)

Sex: Male. (Based on pelvis and postcranial measurements remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: A single lumbar vertebrae exhibited a Schmorl's node. No signs of trauma were observed.

Conclusion: 30 – 50 year old adult male of unknown descent who possibly suffered from back pain.

D_AAMisc1:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Only right femur identified and renamed as a miscellaneous additional individual of trench AA. Partially reconstructed and preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Middle-aged adult. (Based on complete fusion of epiphyses and presence of slight lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No pathology or trauma was observed. (Incomplete remains)

Conclusion: Middle-aged individual of indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc2:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Only left incomplete femur and right incomplete tibia. Most epiphyses not fused, but available remains fairly-well preserved.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 14-18 years. (Based on epiphyseal elements)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No pathology or trauma was observed. (Incomplete remains)

Conclusion: 14- 18 year old individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc3:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Relatively-well preserved. Complete right and left femora present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Middle-aged adult. (Based on complete fusion of epiphyses and presence of slight lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No pathology or trauma was observed. (Incomplete remains)

Conclusion: Middle-aged individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc4:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured left and right femora. Both femora in relatively poor state of preservation.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult. (Based on complete fusion of epiphyses and absence of any lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No pathology or trauma was observed. (Incomplete remains)

Conclusion: Young adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc5:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Poorly preserved, and incomplete. Only left incomplete femur present.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult. (Based on complete fusion of epiphyses and absence of any lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No pathology or trauma was observed. (Incomplete remains)

Conclusion: Young adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc6:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete left femur present. Preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_AAMisc6: Unknown pathology

Age: Young adult. (Based on complete fusion of epiphyses and absence of any lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: A healed lesion of Indeterminate pathological or traumatic origin was identified on the posterior aspect of the shaft of the femur which resulted additional bone growth.

Conclusion: Young adult individual of Indeterminate sex, descent and stature with possible traumatic or pathological . These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc7:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete right and incomplete left femora present. All elements preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult. (Based on complete fusion of epiphyses)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No skeletal pathology observed. No signs of trauma present.

Conclusion: Young adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc8:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete right and incomplete left femora present. All elements preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young Adult. (Based on incomplete fusion of epiphyses and absence of any lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No skeletal pathology observed. No signs of trauma present.

Conclusion: Young adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc9:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete right and left femora present. All elements preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult. (Based on complete fusion of epiphyses and absence of lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No skeletal pathology observed. No signs of trauma present.

Conclusion: Young adult individual of Indeterminate sex, descnt and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc10:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Almost complete right and incomplete left femora present. All elements preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult. (Based on complete fusion of epiphyses and absence of lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No skeletal pathology observed. No signs of trauma present.

Conclusion: Young adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc11:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Almost complete right and incomplete left femora present. All elements preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult. (Based on complete fusion of epiphyses and absence of lipping)

Sex: Indeterminate. (Incomplete remains)

Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No skeletal pathology observed. No signs of trauma present.

Conclusion: Young adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_AAMisc12:

Burial information: Skeletal remains marked as belonging to trench AA, but could not be paired with any numbered individuals of trench AA. Author therefore renamed the remains as belonging to an additional individual. No burial information therefore available.

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete right and left femora present. All elements preserved relatively well.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Middle-aged adult. (Based on complete fusion of epiphyses and slight lipping present)

Sex: Indeterminate. (Incomplete remains)

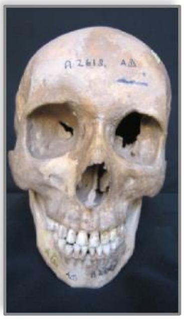
Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were present.

Pathology and trauma: No skeletal pathology observed. No signs of trauma present.

Conclusion: Middle-aged adult individual of Indeterminate sex, descent and stature. These remains could not be paired with any of the numbered individuals of trench AA and was renamed by the author as an additional miscellaneous individual.

D_A1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete, distorted skull, complete mandible and most post-cranial elements present. All elements preserved relatively well. Dart catalogue reference: A2618 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A1: Schmorl's node

Age: 16 – 20 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

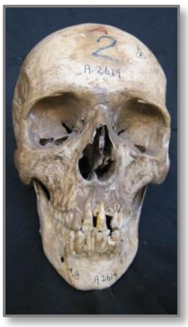
Ancestry: European. (Based on skull)

Antemortem stature: 159.29cm ±6.90. (Femur: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. No teeth were lost postmortem. The following teeth were lost antemortem: L-maxillary M1 ; R-mandibular M1. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Schmorl's node observed on T11. No signs of trauma were observed.

Conclusion: 16 – 20 year old adult male of European descent who had been approximately 159 cm tall and possibly suffered from back pain.



D_A2:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete, skull, complete mandible and most post-cranial elements present. All elements preserved relatively well. Dart catalogue reference: A2619 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A2: Periostitis

Age: 40 – 55 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: European. (Based on skull)

Antemortem stature: 165.28cm ±6.90. (Femur: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: L-maxillary C, I2 ; L-mandibular P2. No teeth were lost antemortem. All teeth showed extensive tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed. Tooth crowding of mandibular incisors were observed.

Pathology and trauma: Periostitis was observed in the left humerus. No signs of trauma were observed.

Conclusion: 40 – 55 year old adult male of European descent who had been approximately 165 cm tall and showed signs of non-specific disease.

D_A3:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fractured skull, partially reconstructed mandible and few post-cranial elements present. Post-cranial elements mostly fractured or incomplete. All elements preserved relatively well. Dart catalogue reference: A2620 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A3: Periostitis

Age: 45 – 55 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: European. (Based on skull)

Antemortem stature: 165.65cm ±6.90. (Humerus: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary C, I2, I1 ; L-maxillary P1, I2, I1. The following teeth were lost antemortem: R-maxillary M3. All teeth showed extensive tooth wear. No carious lesions were observed. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Periostitis of the left fibula was observed. Schmorl's nodes were present on L2, L3 and L4. No signs of trauma were observed.

Conclusion: 45 – 55 year old adult male of European descent who had been approximately 166 cm tall who showed signs of a non-specific disease and possibly suffered from back pain.

D_A4:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fractured, incomplete, distorted skull, incomplete mandible and partial post-cranial elements present. All elements in poor state of preservation, specifically vertebrae which are still impregnated with solidified granitic sand. Dart catalogue reference: A2621 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A4: Caries

Age: 20 – 30 years. (Based on skull and post-cranial remains)

Sex: Female. (Based on skull and postcranial remains)

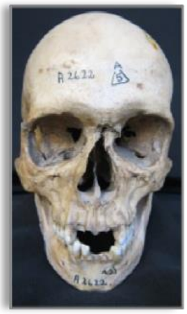
Ancestry: European. (Based on skull)

Antemortem stature: 154.52cm ±8.44. (Humerus: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular M3. No teeth were lost antemortem. All teeth showed extensive tooth wear. Carious lesions were observed on the R-maxillary P2 ; L-mandibular M1. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 20 – 30 year old adult female of European descent who had been approximately 155 cm tall.



D_A5:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete, partially reconstructed skull and complete mandible present. Only post-cranial elements present are rib fragments. Most elements relatively well preserved. Dart catalogue reference: A2622 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 20 – 30 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

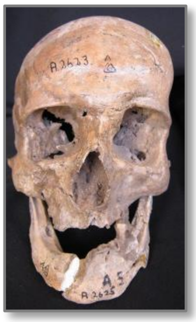
Ancestry: European. (Based on skull)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary I2, I1 ; L-maxillary I2, I1 ; R-mandibular I1 ; L-mandibular I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 20 – 30 year old adult male of European descent of indeterminate stature.



D_A6:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Fractured, distorted skull, fractured, incomplete mandible, upper limb bones, ribs, sternum, vertebrae and some tarsal bones present. Post-cranial elements relatively well preserved. Dart catalogue reference: A2623 (Skull) and A2625 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A6: Antemortem tooth loss

Age: 40 – 50 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull, pelvis and postcranial measurements of humerus)

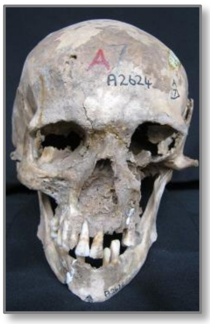
Ancestry: European. (Based on skull)

Antemortem stature: 162.22cm ±8.44. (Humerus: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M1, P1, I2, I1 ; L-maxillary P1 ; R-mandibular M3, I1 ; L-mandibular C, I1. The following teeth were lost antemortem: R-maxillary P2, C ; L-maxillary M3, M2, M1, P2, C, I2, I1 ; R-mandibular M3, M2, M1, P2, P1, C, I2 ; L-mandibular M3, M2, M1, P1, I2. All teeth showed extensive tooth wear. No carious lesions were observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 40 – 50 year old adult male of European descent who had been approximately 162 cm tall and suffered from severe antemortem tooth loss due to unknown cause.

D_A7:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured, partially reconstructed skull and mandible present. Most post-cranial elements present and relatively well preserved. Skull and mandible in poor state of preservation and impregnated with solidified granitic sand. Dart catalogue reference: A2624 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A7: Healed fracture

Age: 40 – 55 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: European. (Based on skull)

Antemortem stature: 167.12cm ±8.44. (Humerus: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P2 ; L-maxillary M3, C, I2 ; R-mandibular C, I1 ; L-mandibular M3, P2, P1, I1. The following teeth were lost antemortem: R-maxillary M1 ; L-maxillary P2, P1 ; R-mandibular M2, M1 ; L-mandibular M2, M1 . All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: The manubrium showed a non-clinical developmental anomaly. Signs of a healed fracture on the left fibula were observed with additional bone growth and periostitis.

Conclusion: 40 – 55 year old adult male of European descent who had been approximately 167 cm tall who experienced a traumatic incident of unknown cause.

D_A8:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Only some vertebrae and lower limb bones present. All elements relatively well preserved.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_A8: Periostitis

Age: 45 – 60 years. (Based on post-cranial remains)

Sex: Male. (Based on pelvis)

Ancestry: Indeterminate (Incomplete remains)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: No teeth were available for analysis.

Pathology and trauma: Sub-periosteal bone growth was observed on both fibulae. No signs of trauma were observed.

Conclusion: 45 – 60 year old adult male of European descent with indeterminate stature who suffered from a non-specific disease.

D_A9:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Skull and mandible absent. Most post-cranial elements present but most are in poor state of preservation. Vertebrae are impregnated with solidified granitic sand.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 20 – 35 years. (Based on post-cranial remains)

Sex: Male. (Based postcranial measurements of humerus)

Ancestry: Indeterminate (Incomplete remains)

Antemortem stature: 157.83cm ±6.90. (Femur: De Mendonça (2000))

Dentition: No teeth were available for analysis.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 20 – 35 year old adult male of indeterminate descent who had been approximately 158 cm tall.

D_AMisc1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual represented by complete left humerus and ulna only, with partially fused epiphyses.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 14 – 19 years. (Based on post-cranial remains)

Sex: Female. (Based on postcranial measurements of humerus)

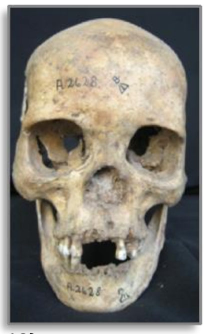
Ancestry: Indeterminate. (Incomplete remains)

Antemortem stature: Indeterminate. (Incomplete remains)

Dentition: No teeth were available for analysis.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 14 – 19 year old female of indeterminate descent and stature.

D_B1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured, distorted skull and incomplete mandible. All upper limb bones, incomplete sternum, ribs, incomplete vertebrae and foot bones present. Most elements preserved relatively well, except ribs and vertebrae which are impregnated with solidified granitic sand. Dart catalogue reference: A2628 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_B1: Caries

Age: 45 – 60 years. (Based on skull and post-cranial remains)

Sex: Female. (Based on skull and postcranial remains)

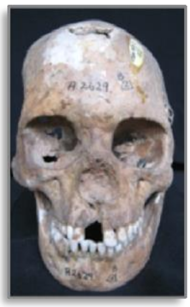
Ancestry: African. (Based on skull)

Antemortem stature: 165.43cm ±3.72. (Lundy & Feldsman (1987) formula for humerus only with Raxter *et al.* (2006) soft tissue correction factors)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, M2, I2, I1 ; L-maxillary M3, C, I1 ; R-mandibular I2, I1 ; L-mandibular P1, C, I2, I1. The following teeth were lost antemortem: R-mandibular M3, M2, M1 ; L-mandibular M3, M2, M1, P2. All teeth showed extensive tooth wear. Carious lesions were observed on the R-maxillary P2. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed. Postmortem animal activity observed on the ulna.

Conclusion: 45 – 60 year old adult female of African descent who had been approximately 165 cm tall.



D_B2:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured, distorted and partially reconstructed skull with incomplete mandible present. Most upper limb bones, incomplete sternum and ribs as well as incomplete vertebrae and hip bones present. All lower limb bones, except right incomplete femur absent. All elements poorly preserved and impregnated with solidified granitic sand. Dart catalogue reference: A2629 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 18 – 20 years. (Based on skull and post-cranial remains)

Sex: Female. (Based on skull and postcranial remains)

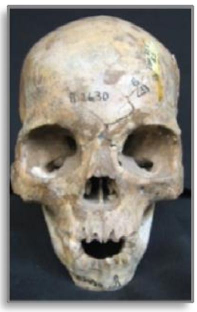
Ancestry: African. (Based on skull)

Antemortem stature: 146.50cm ±3.72. (Lundy & Feldsman (1987) formula for humerus only with Raxter *et al.* (2006) soft tissue correction factors)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3 ; L-maxillary M3 ; R-mandibular P1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. Slight periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 18 – 20 year old adult female of African descent who had been approximately 147 cm tall.



D_B3:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured, distorted and partially reconstructed skull and mandible present. Incomplete post-cranial elements present in various stages of epiphyseal fusion. All elements relatively well preserved. Postcranial remains numbered incorrectly (swopped with D_B4). Dart catalogue reference: A2630 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_B3: Peg-shaped incisor

Age: 15 – 20 years. (Based on skull and post-cranial remains)

Sex: Female. (Based on skull and postcranial remains)

Ancestry: African. (Based on skull)

Antemortem stature: 147.03cm ±3.06. (Lundy & Feldsman (1987) formula for tibia only with Raxter *et al.* (2006) soft tissue correction factors)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary I2, I1 ; L-maxillary C, I2, I1 ; R-mandibular M3, P1, C, I2, I1 ; L-mandibular P2, P1, I2, I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. Linear enamel hypoplasia was observed on R-maxillary C. Peg-shaped incisor observed in mandible.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed. Animal activity observed on radius.

Conclusion: 15 – 20 year old female of African descent who had been approximately 147 cm tall.

D_B4:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured, distorted skull and complete mandible present. Incomplete upper limb bones, sternum, ribs vertebrae and hip bones present. All lower limb bones absent. Post-cranial elements in poor state of preservation. Postcranial remains numbered incorrectly (swopped with D_B3) Dart catalogue reference: A2631 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_B4: Possible trephination

Age: 45 – 60 years. (Based on skull and post-cranial remains)

Sex: Female. (Based on skull and postcranial remains)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M1 ; L-maxillary M1 ; R-mandibular M1 ; L-mandibular M1. The following teeth were lost antemortem: R-maxillary M1 ; L-maxillary M1 ; R-mandibular M1 ; L-mandibular M1 . All teeth showed extensive tooth wear. No carious lesions were observed. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. Possible trephination observed.

Conclusion: 45 – 60 year old adult female of African descent of indeterminate stature who have undergone trephination.


D_B5:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Only skull and post-cranial fragments present in poor state of preservation.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 1 – 2 years. (Based on skull and post-cranial remains)

Sex: Indeterminate (Sub-adult)

Ancestry: Indeterminate (Sub-adult)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: Deciduous teeth present.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 1 – 2 year old individual of indeterminate sex, descent and stature.

D_BMisc1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual only represented by right incomplete clavicle which is relatively well preserved. Incorrectly labelled as belonging to D_B1.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Young adult (Based on epiphyseal closure)

Sex: Indeterminate (Incomplete remains)

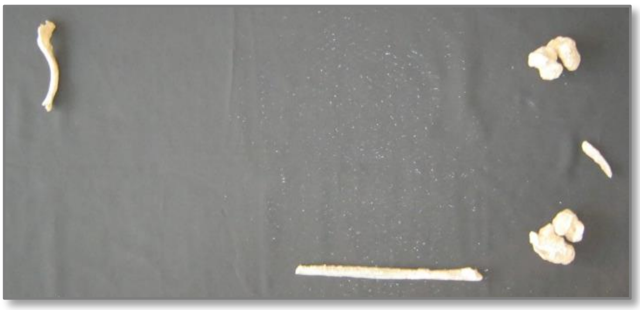
Ancestry: Indeterminate (Incomplete remains)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: No teeth were available for analysis.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Young adult individual of indeterminate sex, descent and stature.



D_C1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual only represented by incomplete clavicle, fibula and some tarsal bones. Elements poorly preserved.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: Middle-aged (Based on post-cranial remains)

Sex: Indeterminate (Incomplete remains)

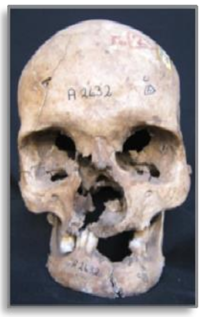
Ancestry: Indeterminate (Incomplete remains)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: No teeth were available for analysis.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: Middle-aged adult individual of indeterminate sex, descent and stature.



D_C2:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Complete, distorted skull, complete mandible and most post-cranial elements present. All elements preserved relatively well. Dart catalogue reference: A2632 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_C2: Calculus

Age: 45 – 55 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial measurements of humerus)

Ancestry: European. (Based on skull)

Antemortem stature: 169.24cm ±8.44. (Humerus: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary P1; L-maxillary M1, P2 ; R-mandibular I2 ; L-mandibular P1, C. The following teeth were lost antemortem: R-maxillary C, I2, I1 ; L-maxillary P1, C, I2, I1 ; R-mandibular M2, M1, I1 ; L-mandibular M1, I2, I1 . All teeth showed severe tooth wear. No carious lesions were observed. Severe periodontal disease observed. Linear enamel hypoplasia was observed on R-mandibular P2, P1. Calculus formation on maxillary molars present.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 45 – 55 year old adult male of European descent who had been approximately 169 cm tall.

D_C3:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual only represented by fractured, distorted and compressed skull and mandible. Poorly preserved, impregnated with solidified granitic sand with most structures almost unidentifiable.

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 1 – 2 years. (Based on dentition)

Sex: Indeterminate (Incomplete remains)

Ancestry: Indeterminate (Incomplete remains)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: All teeth present were deciduous dentition.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 1 – 2 year old individual of indeterminate sex, descent and stature.

D_C4:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual only represented by incomplete, fractured and partially reconstructed skull and mandible, poorly preserved. Dart catalogue reference: A2633 (Skull) and A2638 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_C4: Caries

Age: 30 – 40 years. (Based on skull)

Sex: Female. (Based on skull)

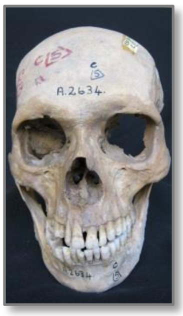
Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary MP2, P1, C, I2, I1; L-maxillary P2, P1, C, I1 ; R-mandibular P2, P1, C, I2, I1 ; L-mandibular I1. No teeth were lost antemortem. All teeth showed moderate tooth wear. Carious lesions were observed on R-mandibular M2 ; L-mandibular M2. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 30 – 40 year old adult female of African descent of indeterminate stature.



D_C5:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured skull, incomplete mandible and most post-cranial elements present. Only some cervical vertebrae present. Most elements relatively well preserved, with green discolouration on anterior surfaces of tibiae and fibulae. Dart catalogue reference: A2634 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_C5: Healed fracture

Age: 55 – 70 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

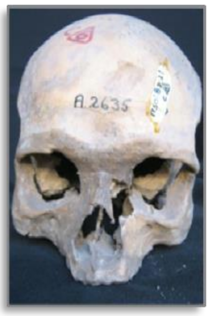
Ancestry: European. (Based on skull)

Antemortem stature: 167.61cm ±8.44. (Humerus: De Mendonça (2000))

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-mandibular P2. The following teeth were lost antemortem: R-maxillary C. All teeth showed extensive tooth wear. Carious lesions were observed on R-mandibular M2 ; L-mandibular M2. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Signs of possible treponemal infection observed. Periostitis observed in tibiae and fibulae. Healed fractures of metacarpals present.

Conclusion: 55 – 70 year old adult male of European descent who had been approximately 168 cm tall and suffered from possible treponemal disease. Individual also experienced traumatic incident of unknown cause.



D_C6:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual only represented by incomplete, fractured and partially reconstructed skull and mandible, poorly preserved. Dart catalogue reference: A2635 (Skull) and A2637 (Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_C6: Antemortem tooth loss

Age: 25 – 40 years. (Based on skull)

Sex: Male. (Based on skull)

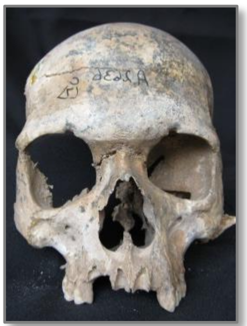
Ancestry: European. (Based on skull)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: No teeth were available for analysis due to post- ante-mortem tooth loss.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 25 – 40 year old adult male of European descent of indeterminate stature.



D_C7:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Individual only represented by incomplete, fractured and partially reconstructed skull, poorly preserved. Dart catalogue reference: A2636 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

D_C7: Bone resorption

Age: 35 – 55 years. (Based on skull)

Sex: Male. (Based on skull)

Ancestry: European. (Based on skull)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: All teeth present were permanent dentition. The following teeth were lost postmortem: R-maxillary M3, I2, I1 ; L-maxillary M3, P1, C, I2, I1. No teeth were lost antemortem. All teeth showed extensive tooth wear. No carious lesions were observed. Severe periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: No skeletal pathology was observed. No signs of trauma were observed.

Conclusion: 35 – 55 year old adult male of European descent of indeterminate stature.

D_E1:

Burial information: Refer to inventory of burials in Garlake (1969).

Preservation and storage location at time of analysis:

Iron Age Lab, National Museum of Human Sciences, Harare, Zimbabwe

- Incomplete, fractured, partially reconstructed skull, incomplete mandible and most post-cranial elements present. Only some rib fragments present. Elements poorly preserved. Dart catalogue reference: A2639 (Skull and Mandible).

Dart Collection, University of the Witwatersrand, Johannesburg, South Africa

- None.

Age: 30 – 45 years. (Based on skull and post-cranial remains)

Sex: Male. (Based on skull and postcranial remains)

Ancestry: African. (Based on skull)

Antemortem stature: Indeterminate (Incomplete remains)

Dentition: All teeth present were permanent dentition. No teeth were lost postmortem. No teeth were lost antemortem. All teeth showed moderate tooth wear. No carious lesions were observed. No periodontal disease observed. No linear enamel hypoplasia was observed.

Pathology and trauma: Periostitis of the tibia observed. No signs of trauma were observed.

Conclusion: 30 – 45 year old adult male of African descent of indeterminate stature who suffered from possible non-infectious disease.
