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HISTORICAL BACKGROUND AND ISOTOPIC ANALYSIS OF SKELETONS FOUND NEAR THE SITE OF FORT KNOKKE, CAPE TOWN FORESHORE

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By Glenda Cox

DISSERTATION

Submitted in Partial Fulfillment of the Requirements for the B.A. Honours Degree in Archaeology
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ABSTRACT

Isotopic analysis of skeletons excavated during the 1950's near the site of Fort Knokke has confirmed that they are the remains of shipwreck victims. Many of these individuals were slaves who were on board the Portuguese slaving brig the Pacquet Real when it sank on 18 May 1818. They were from Mozambique and were on their way to Brazil. Twenty-five slaves drowned and the remaining 133 became 'Prize Negroes' at the Cape. The isotope signatures are consistent with values expected for people living in an African village eating a terrestrially-based diet. The analysis of different skeletal elements i.e. teeth, long bone and rib are shown to be a valuable tool in tracing change or consistency in diet, during a person's life. This is because bone is laid down at different stages of life and even when growth has stopped, bone is constantly being remodelled. Turnover in compact long bone is slower than in cancellous bone. Long bone yields isotopic values that have accumulated over at least ten years, whereas rib will have values for a diet consumed in later life or for a shorter period prior to death.

These slaves have different patterns of decorated teeth, indicating that they are from different groups. The strontium isotopes confirm that they came from heterogeneous geographical origins.

Measurements were also taken of skeletons buried 50 yards from the slaves. These people were either soldiers or sailors. Their isotope values are consistent with a European diet, remarkably uniform through life. The strontium isotopes indicate that they came from areas of similar geology.

Never do the mere unassisted efforts of man appear feebler than amid those great convulsions of nature, to which the mariner is so especially exposed.

Mariners Chronicle, 1834.

The cost of the slave trade in human terms was many times the number landed in America.

(Curtin in Conrad 1986:35)

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ACKNOWLEDGEMENTS

This thesis is submitted in part fulfillment of the requirements for the degree of Honours in Archaeology at the University of Cape Town.

I would like to thank my supervisor Prof. Judy Sealy for her excellent guidance, support and encouragement. She suggested this particular project and it has proved to be a fascinating one, 'just up my street'.

The skeletons are housed at the South African Museum and I would like Dr.Graham Avery for giving me permission to sample them for isotope analysis. Mike Wilson was always available when needed and was very helpful.

Alan Morris provided me with a copy of Henrietta's report and brought the Gallows Hill specimen up to campus from Medical school for me to look at.

I am grateful to Prof. R.Singer who kindly sent me notes and sketches concerning the original excavation. Ute Seeman was inspirational when I first began the project and provided me with references, maps and help in the archives. Antonia Malan helped me on my first visit to the archives. Dr.Jane Klose took the majority of the photos of the decorated teeth and is always available for moral support when needed.

Tony Manhire helped me prepare my slides for my seminar. Bruno Werz provided me with some useful references.

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INTRODUCTION

During the early 1960's R.Singer and E.N. Keen excavated a shallow mass grave 100 yards from the site of Fort Knokke. Their initial excavation uncovered 19 individuals: juveniles and adults. A second excavation unearthed seven other individuals from coffins 50 yards from Fort Knokke. Subsequent analysis by Henrietta Rose-Innes shows that there are 31 individuals in total: 21 adults and 10 juveniles.

Many of the skeletons in the first group have teeth that were chipped or filed into decorative shapes. This practice is sometimes referred to as 'dental mutilation' but since this has some perjorative connotations the preferred term in this project is 'dental or tooth decoration'. Tooth decoration is not usual at the Cape but a characteristic of peoples from further North in Africa; Central, East and West. Most slaves at the Cape were from Madagascar, and not from mainland Africa. It has therefore been presumed that these were people of African origin, most likely slaves in transportation and their deaths were the result of a shipwreck.

Research in the archives will hopefully identify shipwrecks in the area of Fort Knokke. Discovering the origin of the coffin burial individuals is particularily difficult because of a lack of distinguishing morphological features on the skeletons. Singer(1955) has suggested that they are European. Very few artefacts were found with these skeletons and there are no archaeological clues as to whether they are from the same group or if they are locals or foreigners.

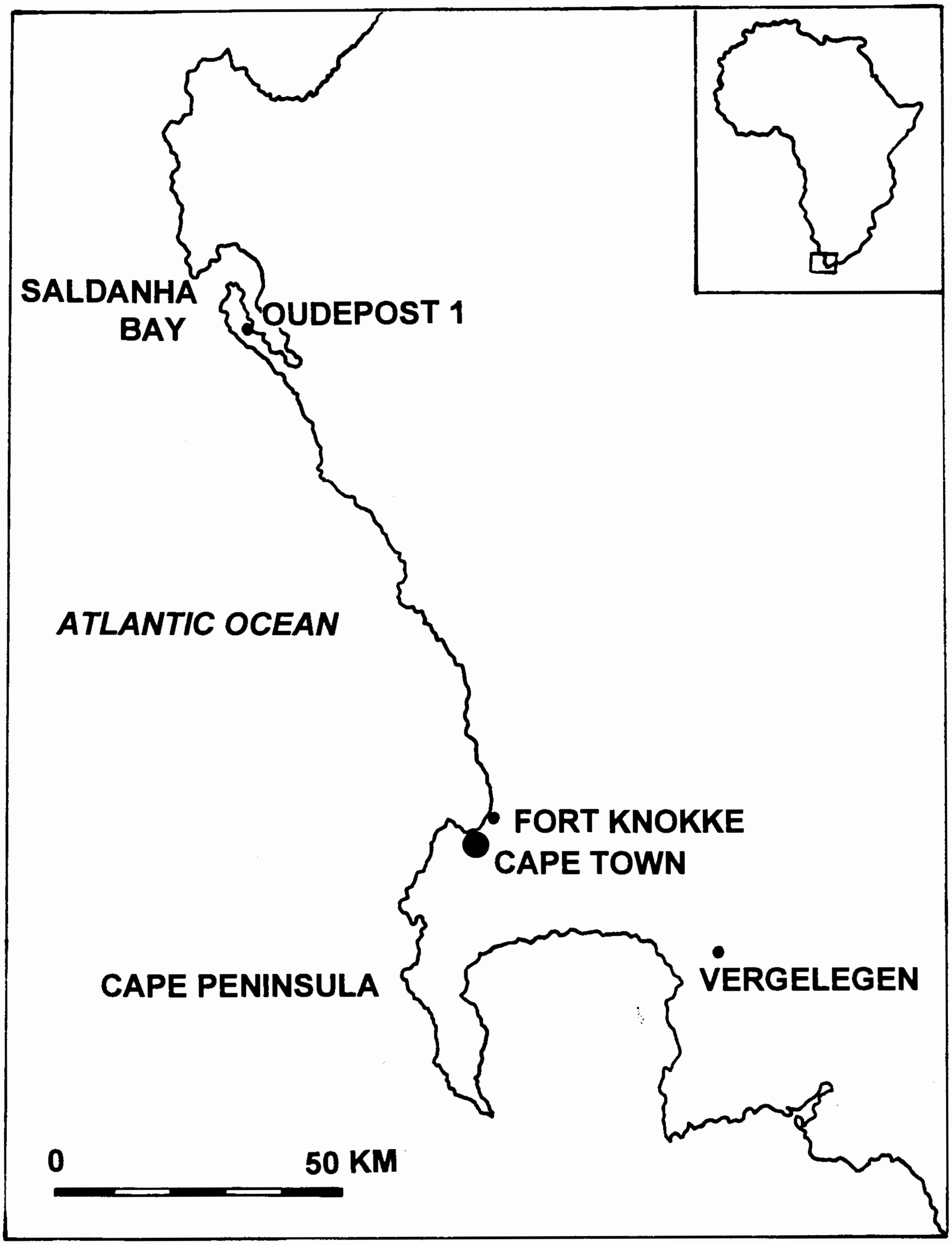


Figure 1: Sites referred to in the text

The main objective of this project is to combine historical research, including archival work, with the bone chemistry of stable isotope and trace element analysis. I hope to discover who these individuals were found near to Fort Knokke.

Isotopic analysis of different calcified tissues from the Vergelegen, Oudepost and Fort skeletons demonstrates the potential of these techniques as a means of tracing changes in diet and place of residence during an individuals life (See Figure 1). In this project, I plan to undertake similar analysis of teeth and bones from the Fort Knokke skeletons. The aims of the project will be:

1) To investigate the similarity (or otherwise) in isotopic signals in different individuals. I hope to be able to deduce from these results whether or not these individuals originated in a single area, or whether they came from heterogeneous geographical origins.

2) To compare the isotopic profiles of the Fort Knokke skeletons with those of the Vergelegen, Fort and Oudepost skeletons, thus expanding our database of isotopic results for historical skeletons from the Cape, especially skeletons likely to be the remains of slaves.

BACKGROUND TO SITE

FORT KNOKKE AND THE MILITARY LINES

During the 1950's Ronald Singer from the UCT anatomy department performed a rescue excavation near the site of the now demolished Fort Knokke. Workmen had found skeletal remains of a number of individuals which Singer proceeded to remove. Fort Knokke or Fort de Knokke was constructed between 24 October 1743 and October 1944, to the east of the Castle, originally on the recommendation of Commissioner Van Imhoff (Seeman 1993). Knokke is the name of a place on the coast of Flanders, near Ostende (Standard Encyclopaedia of SA).

Fort Knokke was built on the star model and was surrounded by a moat and armed with sixteen cannon (Brann n.a.)(See Figure 2). Its ramparts were built of earth and mortar and it was not highly regarded by later fortification engineers. As a result it was constantly modernised (Seeman 1993). The Castle was poorly situated to defend the settlement from attack both from the sea and land. A string of batteries and breastworks were built in the early and mid-eighteenth century. Fort Knokke was linked to the Castle by a sea wall and a series of batteries called the Elizabeth, the Helena, Charlotte and Tulbagh (See Figure 3 & 4). Powder magazines and the hospital were positioned behind these breastworks, known as the 'sea lines' (Seeman 1993). The Imhoff battery was built between the Castle and the sea. In 1781 French soldiers erected the Intermediate Battery to the east of Fort Knokke, between it and the Niewe battery (1755) at the mouth of the Salt River.

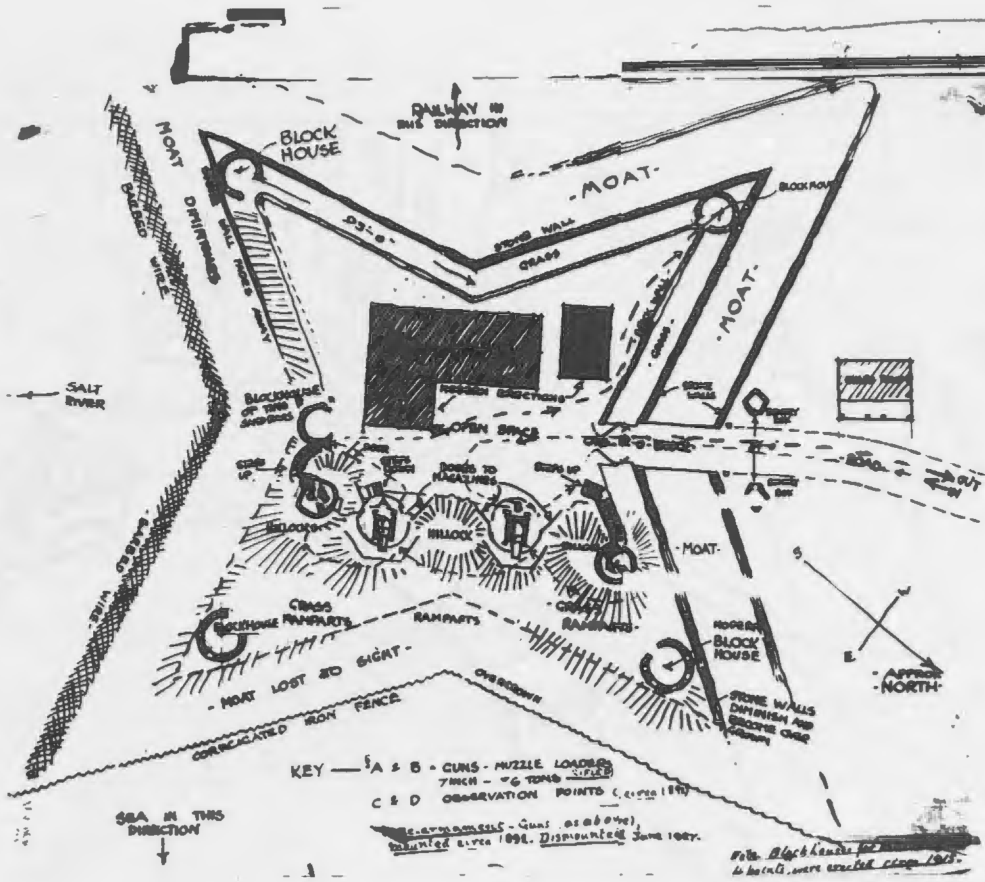
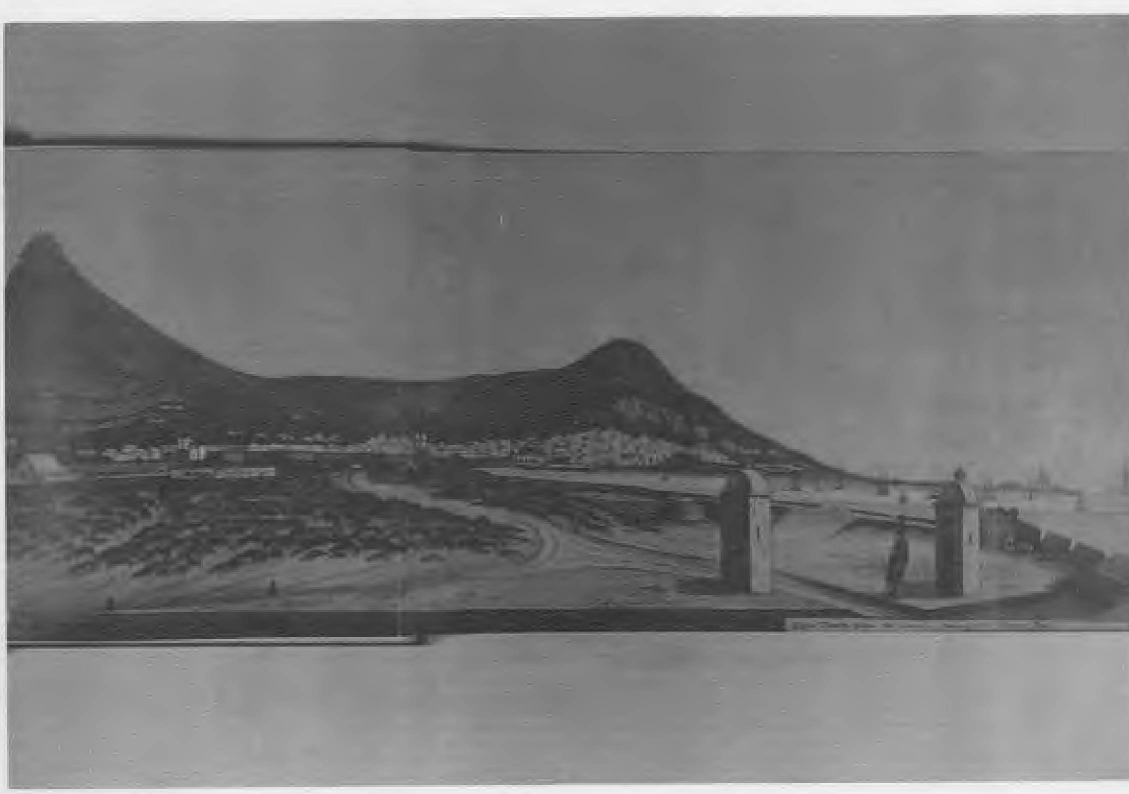


Figure 2: Plan of Fort Knokke, 1915 (de Smidt, no date)



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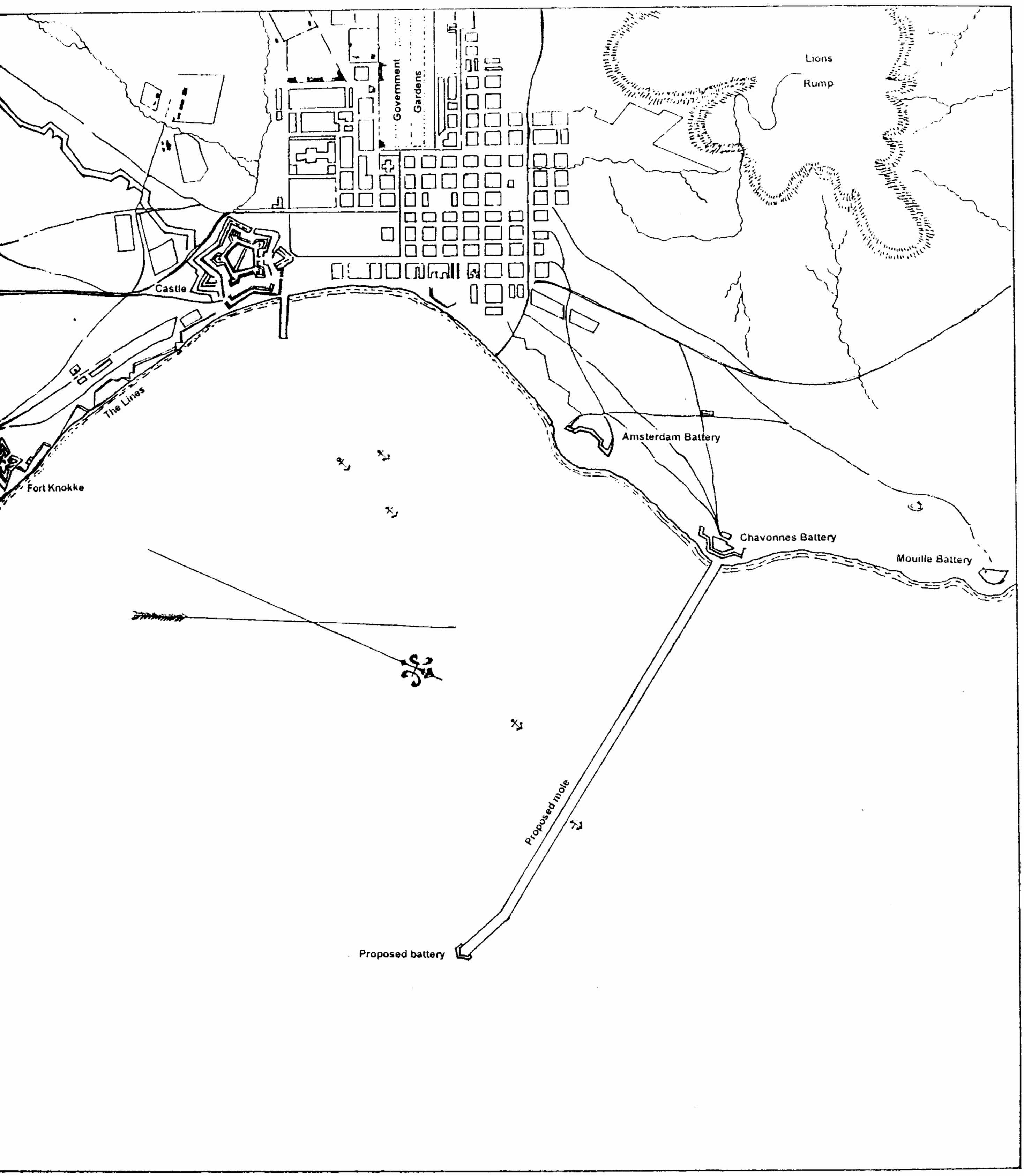
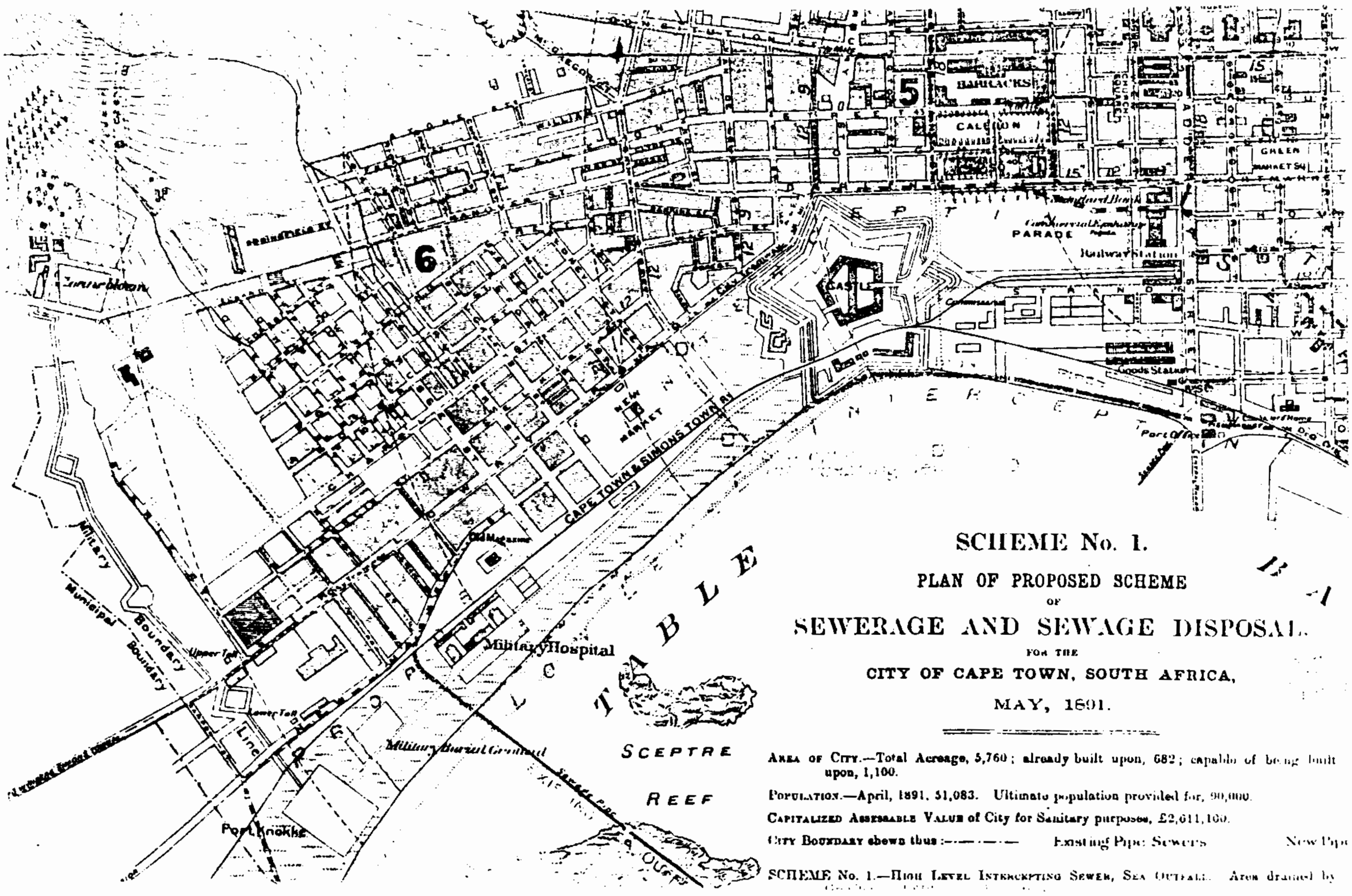


igure 4: State of the Cape of Good Hope, 1822. (From W.Bird, 1823)

The fortifications were extended in 1782 with the construction of the French Lines. The French Lines consisted of three Redoubts: the Hollands, Centre and the Burgher Redoubt. The remains of the Centre Redoubt still exist in Trafalgar Park in Woodstock (See Figure 5 &6).

When the British took over the Cape in 1795, certain changes were made to the defences. General Craig was in charge of strengthening the defences of Cape Town. He left a memorandum to his successor in 1796, saying amongst other things that "...Fort Knock is defective in shape with acute angles...without flank and with a bad ditch..." (Craig Papers 1796:41). He ordered the building of Craig's Tower and battery in place of the ruined Niewe Battery. This tower was erected to protect Fort Knokke but also to attack it if it were taken. The magazine was self-sufficient, even if cut off from Fort Knokke. Alterations to Fort Knokke were recommended, such as palisading and completion of the ditch. A quantity of 'abbates' wood had been collected to lie in the space between the left face of Fort Knokke and the sea. A covered way was also suggested between Fort Knokke and Craig's Tower in 1797 (Seeman 1993).

Two other military structures were known to exist by the late 18th century - the military hospital constructed by the British in 1795 and the military cemetery (See Figure 7). There is very little information available about the military hospital, Percival (1804) says "...The British erected the hospital on the road to Fort Knokke..."p.113 (See Figure 10). More information on this institution and the cemetery must surely be available but it is beyond the scope of this project to continue



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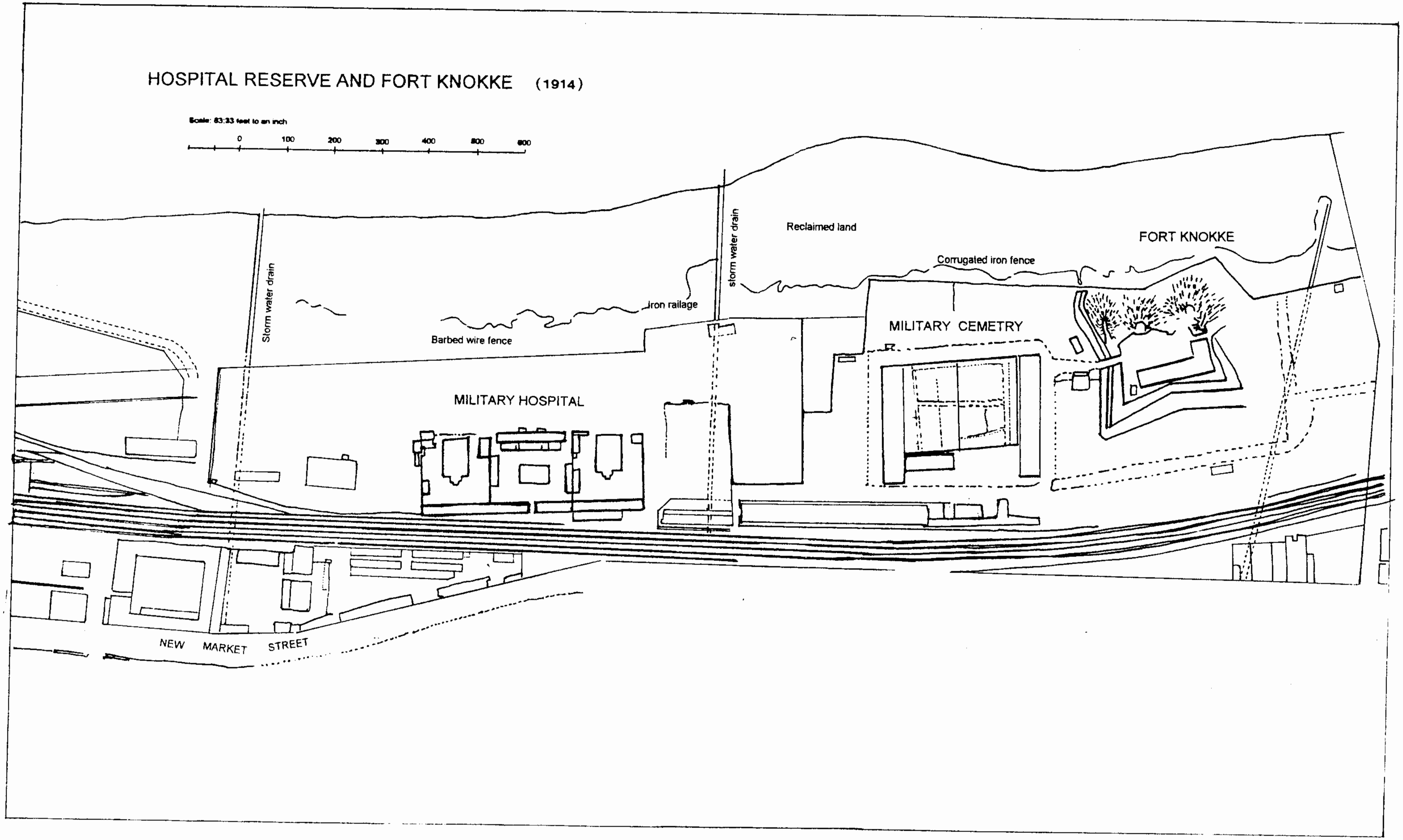


Figure 7: Cape Town- Hospital Reserve and Fort Knokke, 1914 (Cape Archives)

the search further. There was also a military road behind the sea lines between Fort Knokke and the Imhoff Battery. I visited the National Monuments Council to find out if they had any records of when bodies were exhumed (if at all) from the cemetery but they were unable to help me. The aerial photograph taken in1926 still shows the hospital and the burial ground so they could still have been in place then (See Figure 8). Staff at the Fort Wynard museum at Green Point were also unable to tell me more.

The first railway line at the Cape from Cape Town to Wellington began "...near Fort de Knokke at Papendorp (now Woodstock)..." (Burman 1984:17). A 'turning of the sod' ceremony was held on the 31 March 1859 (CO 738 No320). The railway line breached the French Lines between Fort Knokke and the Hollands Redoubt. The boundary of the city had changed and what is now 'Lower Main Road' was cut off from the shoreline and the beach (Aberman 1993).

The shoreline has changed dramatically during the twentieth century (See Figure 16). The first reclamation began in the 1920's and extended from the Cape town harbour across the Cape Town station site to the old Salt River Mouth. The Duncan Dock reclamation project was completed in 1945. The formerly fashionable Woodstock Beach no longer existed. The original shoreline would have contained the wrecks of many ships that went aground on Woodstock Beach (Aberman 1993).

Fort Knokke was demolished in 1926 to make way for the railway lines (Seeman 1993) (See Figure 8 & 9). J.H.R.Smidt (1928) writes of his visit to Fort Knokke in

Figure 8: Aerial Photograph, 1926 (Trigonometry Survey Department)

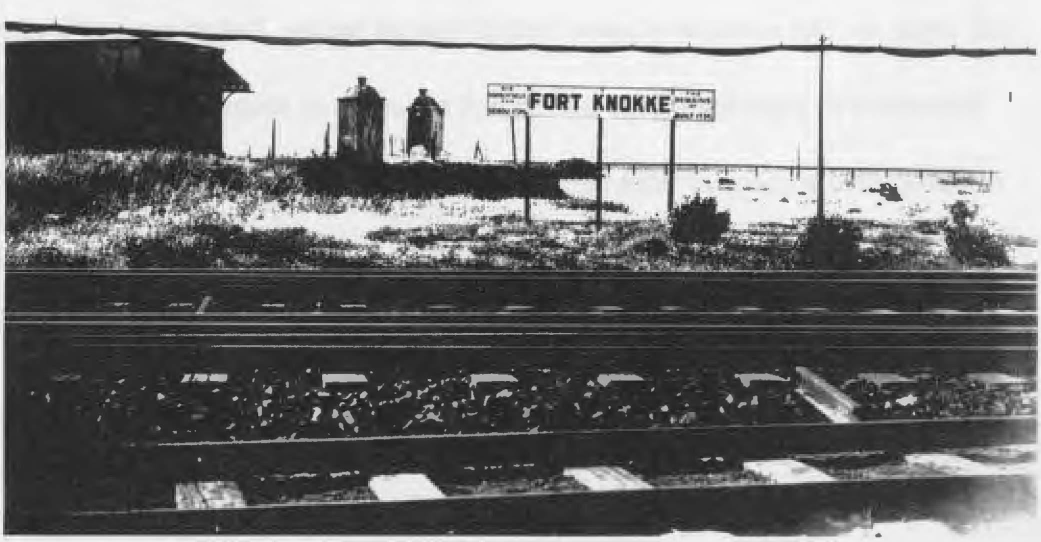
Figure 9: Fort Knokke, ca. 1910-1920 (De Smidt, no date)

Figure 10: Military Hospital, no date (Cape Archives, AGG 3420)

1925, "...The most cursory examination sufficed to show that this 180 year old fort had long outlived its day..."(p.2). The last renovations to Fort Knokke were done in 1885 when the ramparts facing the sea were strengthened, and two new guns were introduced. The magazines were modernised and two strongly fortified observation towers constructed. The reason for these changes was that Britain found the international situation threatening. The old Craig's Tower had already been demolished, but the battery was still in use and it was given two new guns. Smidt (ibid.) notes that a large factory now occupies the site of Craigs Tower. The new heavy guns remained in place until 1926 when they were dismounted during the course of demolition. Apparently the two old masonry sentry boxes remained in place until around 1949 (See Figures 11 & 12). One eventually crumbled but the other was moved to the front of the South African Museum (SAM) (Ewart 1970, SA National Yearbook 1942-45). The Smidt fort plan shows the location of the sentry boxes on the right side of Fort Knokke where the road enters the fort (See Figure 2). When Fort Knokke was razed a queer discovery was made: a quantity of old rusty muskets was found buried in the ramparts. No one knows why these weapons were concealed (Speight 1934). No traces of Fort Knokke remain today, although the elevated position of the railway tracks is said to be possibly the remains of the sealine embankments. In a report of inspection of remaining fortifications around the Cape Peninsula (Brann,1989) by the National Monuments Council, it is noted that there is a stone wall that borders the bus depot in Woodstock that could be the remains of a wall that connected the French Lines to Fort Knokke. It has been recommended that if this wall can be shown to be connected to Fort Knokke it should be declared a National Monument.

Figure 11: `Sentry Box, Fort Knokke'1946? (SA Library)

Figure 12: `Fort Knokke' (SA Library, GNG 2343)



SITE LOCATION

Unfortunately it has not been possible to pinpoint the exact location of the two excavations because no accurate drawings are available. In Singer's 'preliminary report' (1953) in which he concentrates on the decorated teeth he describes where and what he excavated as follows "... During excavations on the Cape Town Foreshore, workmen came across some skeletal material. Dr E. N. Keen and I have subsequently removed approximately 19 complete and incomplete skeletons from some shallow common graves, situated about 100 yards from the site where Fort Knokke once stood. It seems that the bodies had been haphazardly thrown together in these graves over which, in the middle of the last century, a road and railway was constructed..... (He suggests that they have Negro features and) ... that many exhibited dentitions undoubtedly mutilated... (and continues) .We subsequently excavated seven skeletons lying in the remains of wooden coffins about 50 yards nearer the Fort.....A complete story with detailed descriptions of the skeletal material will follow later...."(1953:116).

No additional material was published. Judy Sealy wrote to Professor Singer (in America now) on my behalf, asking for any further notes, references and /or maps. He supplied one helpful reference to an article that he had used on railway development on the Cape Town Fore shore. He sent some notes that refer to specific individuals in the second excavation and rough sketches with X's (indicating site location), a railway line, the sea, a sewer and a 'hokkie', all of which I imagine are ubiquitous along this entire area of the coast (See Figure 13). There were, however, some clues: a

SKETCH 1

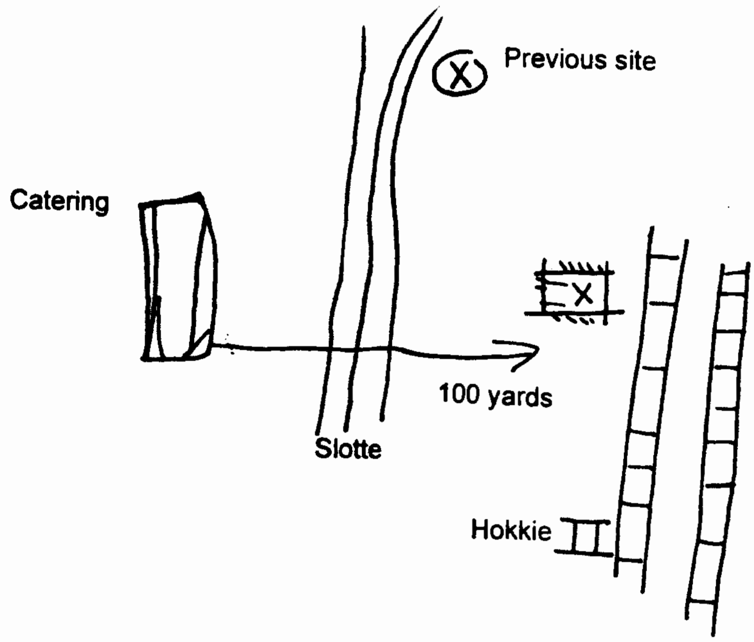
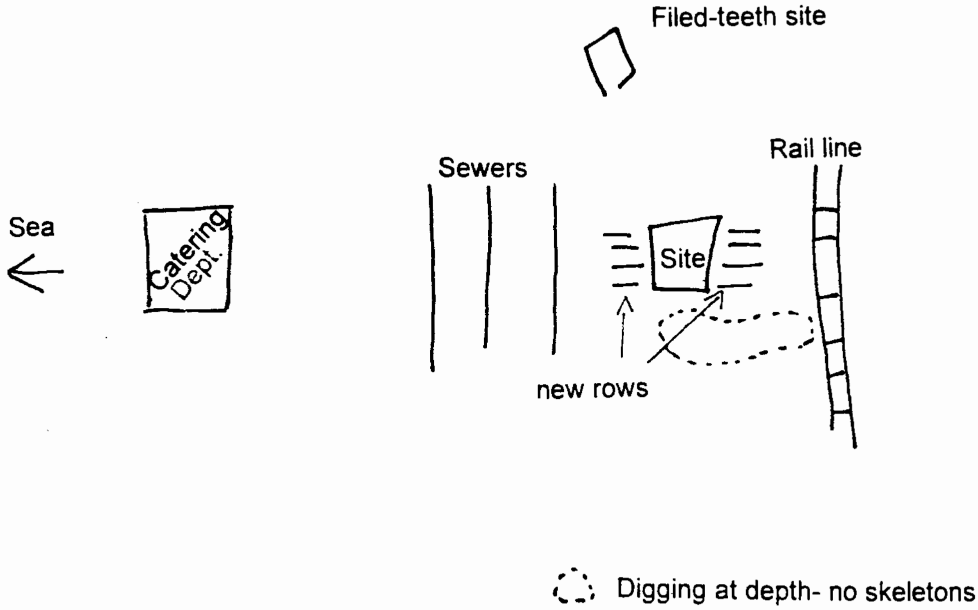


Figure 13: Singer's two sketches, 1953.

SKETCH 2



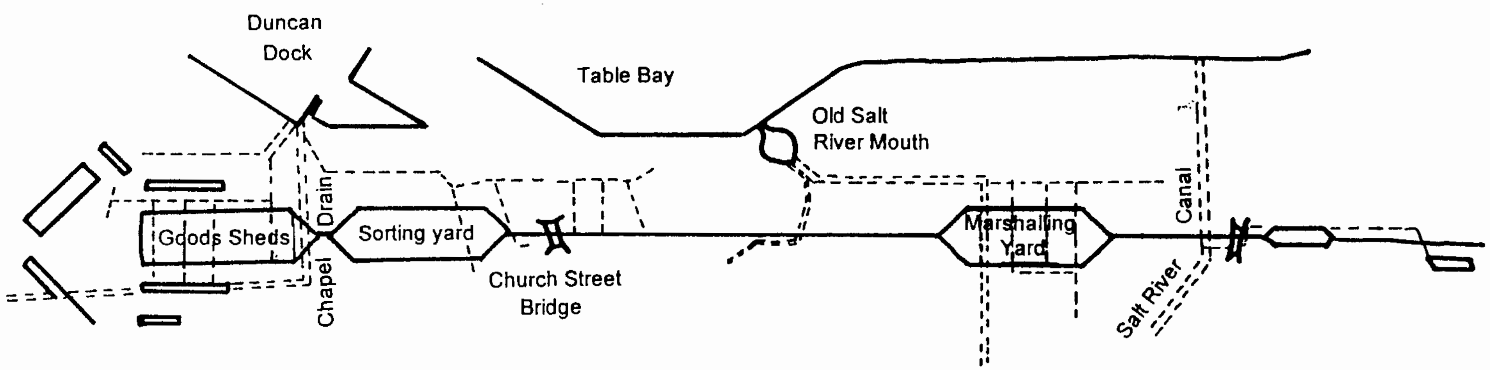


Figure 14: Sewerage for the Foreshore Railway Development (Zoutendyk 1956)

catering department was marked on both the sketches. Singer's notes indicate that the second excavation revealed rows of coffins on the sea and land side of the excavation. These were not retrieved by Singer, perhaps because of the time constraints involved in a rescue excavation. Thus it can be deduced that whatever burial occasion this was, it involved the burial of more than ten people. Other rough sketches not reproduced here show uniform rows of oblong coffins.

I also contacted Dr.Ted Keen but because this excavation took place such a long time ago he was unable to remember any details that could help me. I phoned the railways to enquire about old records but it seems that details of the day-to-day works have not been kept. Visits to the archives and Town Planning yielded no further information on the location of these two sites.

Singer (1953) did not indicate whether the excavations were to the east or west of Fort Knokke. It can be deduced that they could not have been on the seaward side because that land has only recently been reclaimed. The site was most probably not inland because the skeletons were found "...on the beaches of early Cape Town..."(ibid.:116). The rough sketches appear to indicate that the site was on the east side of Fort Knokke towards Craig's Battery and not on the military burial ground and hospital side (See Figure 13). Figure 15 was drawn at about the time Singer excavated. In the overlay on this map Fort Knokke has been drawn as accurately as possible and Singer's estimated 100 and fifty yards have been converted to feet according to the scale of the map. The arcs represent possible site locations.

2.)

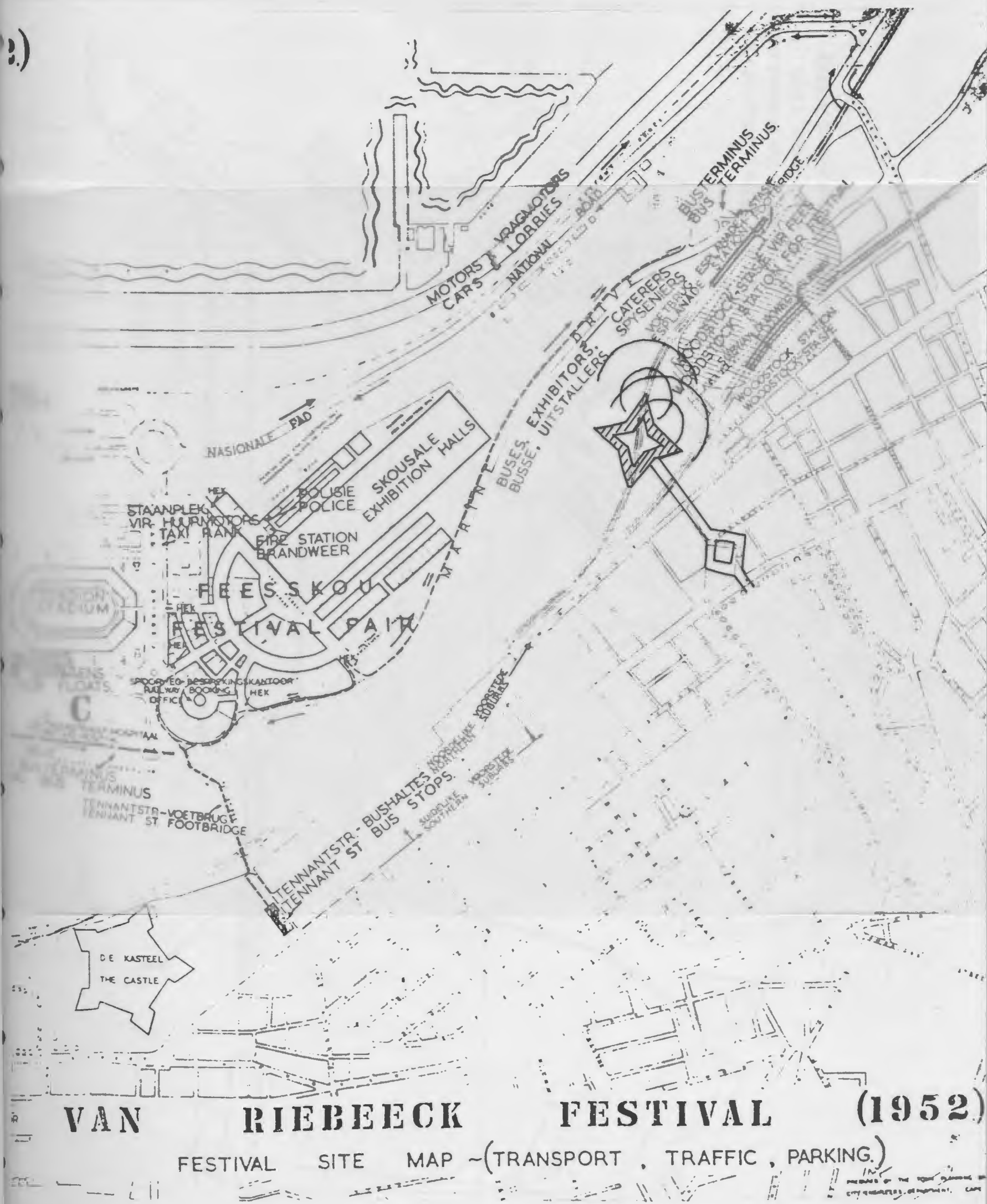


Figure 15: Van Riebeeck Festival, 1952 (SA Library)
Overlay: Fort Knokke and possible site locations at 50 yards and 100 yards

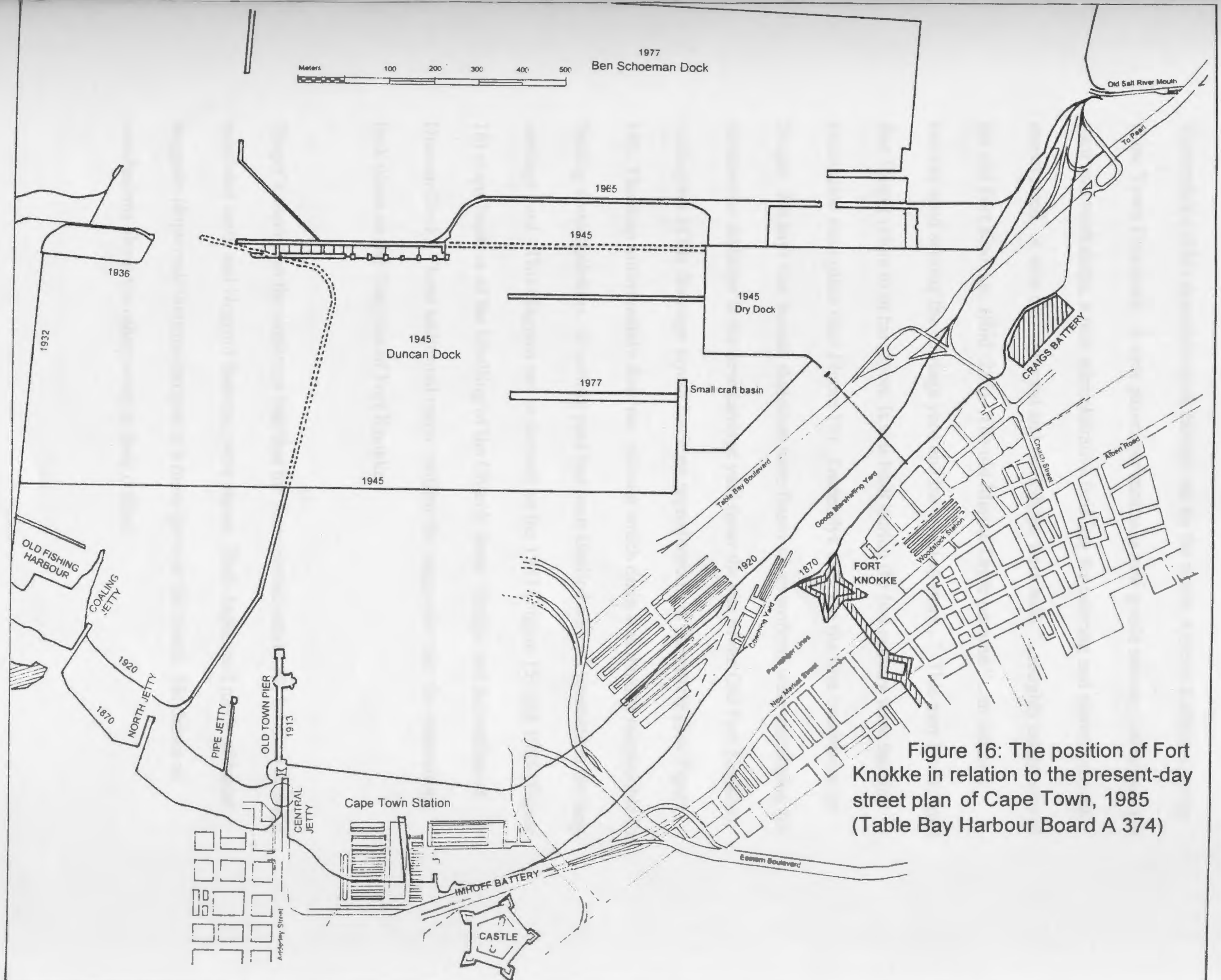


Figure 16: The position of Fort Knokke in relation to the present-day street plan of Cape Town, 1985 (Table Bay Harbour Board A 374)

Zoutendyk (1956) describes work carried out by the South African Railways on the Cape Town Foreshore. A new passenger station, a new goods station, a new carriage yard and workshops, a new administrative building for catering and stores were all constructed. A new carriage yard and workshops were built "...roughly on the site of the old Fort Knokke...(ibid.:225). The old Marine Drive became "...an internal railway road serving the carriage yard and the catering store..." This may be the road that Singer refers to in his report. It was built during the last century were the first excavation took place (See Figure 15). Zoutendyk refers to the first excavation by Singer. He says that human skeletons were found when workers were excavating for stormwater drainage in the new carriage yard (near the site of the Old Fort Knokke). A diagram of the drainage layout has been reproduced from the article (See Figure 14). The map unfortunately does not indicate which drain was the one responsible for finding these skeletons. A sorting yard has been labelled which I presume is the new carriage yard. This diagram can be located on the 1953 (Figure 15) and 1985 (Figure 16) maps because of the labelling of the Church Street Bridge and the outline of Duncan Dock. These additional maps confirm the suggestion that the excavations took place on the East side of Fort Knokke

Singer's theory on the skeletons was that the first approximately 19, because of their mutilated teeth and Negroid features, were slaves. Their haphazard mode of burial suggests shipwreck victims dumped in a mass gave on the beach. He draws no conclusions about the other seven in their coffins.

ANATOMICAL ANALYSIS

I am fortunate in that Henrietta Rose-Innes did a project in which she examined all of the remains to determine the minimum number of individuals, their sex, age and possible origins . This task was a considerable one for an undergraduate study, made more difficult because of the limited information available about the site.

Cranial measurements were taken where possible. These cranial indices were selected because they fall within the ranges of variation for different population groups, for example Caucasoid or South African Negro (Rose-Innes 1993). These measurements were taken on adult crania only. Stature estimations were made from the measurements of long bones using a technique developed by Feldesman et al. (1990). Sex was estimated by examining the size and shape of the cranium, mandible and pelvic bones. Estimations of age involved examining patterns of dental eruption and wear and epiphyseal fusion. The anterior ends of ribs were also used as an indicator of age. Her adult categories are defined as 21 years and older; because of the fragmentary nature of the material she did not attempted more specific age estimations. The teeth studied were only those attached to part of a mandible or maxilla. The minimum number of individuals (MNI) was calculated by counting individual bones. Her MNI was 31: 21 adults and 10 juveniles more than Singer's estimated 19 and 7 =26. She identified at least 7 as being male and 13 as female. She suggested that at least 6 of the juveniles are female, however she does not explain at what age one can begin to classify sex. She also stated that many of the individuals, under 21 years, are even younger.

Rose-Innes observed a high incidence of cribia orbitalia, which is present in ten individuals. Other pathologies include periosteal infection (SAM 4762), arthritic lipping and a spurred patella indicating stress and overuse (SAM 4780) but these incidences are low. She also discussed the patterns of 'mutilation' as well as the occurrence of caries, dental disease and dental wear.

Cranial measurements indicate that the population is not homogenous. She concludes that there are two distinct groups:1) individuals who show Negroid like features and includes female juveniles. The other group includes European type characteristics and are adult and male- these being the presumably, higher status individuals that were in coffins. The shallow common graves may not be from a single event and the two excavations could date from different times. She concludes that the specimens with 'mutilated' teeth were most probably slaves- as this practice is a tradition among many African peoples and she also suggests that the most likely explanation would be that these are shipwreck victims.

The fact that they were buried on the beach, instead of in a proper and more secure burial ground, supports this notion. Most slaves at the Cape came from Madagascar and only a few were from mainland Africa (ibid.). The high incidence of cribia orbitalia caused by a deficiency of iron in the diet may indicate an impoverished background. Her analysis will be referred to in the chapter that follows on sampling strategy.

I was fortunate that I had the advantage of a breakdown of skeletal remains . The most obvious clue to the origin of these people was that some of them had decorated teeth. This is a custom that was not practised in the Cape .....

DENTAL MODIFICATIONS

Two interesting forms of tooth modification can be observed. The first is intentional tooth decoration and the second is pipewear, a wear pattern caused by the habitual smoking of clay pipes.

INTENTIONAL: TOOTH DECORATION

Tooth decoration can be defined as "...The intentional deformation or alteration of the natural appearance of teeth..." (Handler et al. 1992). Decoration was practised by nearly all African people of Angola and central Africa until recently, when it has started to go out of fashion (Van Reenen 1964) (See Figure 17). It was also practised in North America, South America, Mesoamerica, India, South East Asia, Phillipines, Japan, Malay Archipelago and New Guinea. Specific techniques used by these people will not be discussed as they are not relevant here (Milner & Larsen 1991). Decorations were performed during puberty tribal identification and/or for aesthetic reasons (Van Reenen 1964). It was practised on both sexes. Inlays of gold were popular in South America. Inlays are not found in African patterns of alteration. The techniques that will be discussed here are ablation, filing and chipping.

Ablation involves the deliberate removal of teeth. It is, however, difficult to demonstrate archaeologically (Morris 1989). Osteologists need to consider the possibility of accidental trauma or tooth agenesis and loss from decay (Milner & Larsen 1991). The sample material from Fort Knokke is fragmentary, and has either

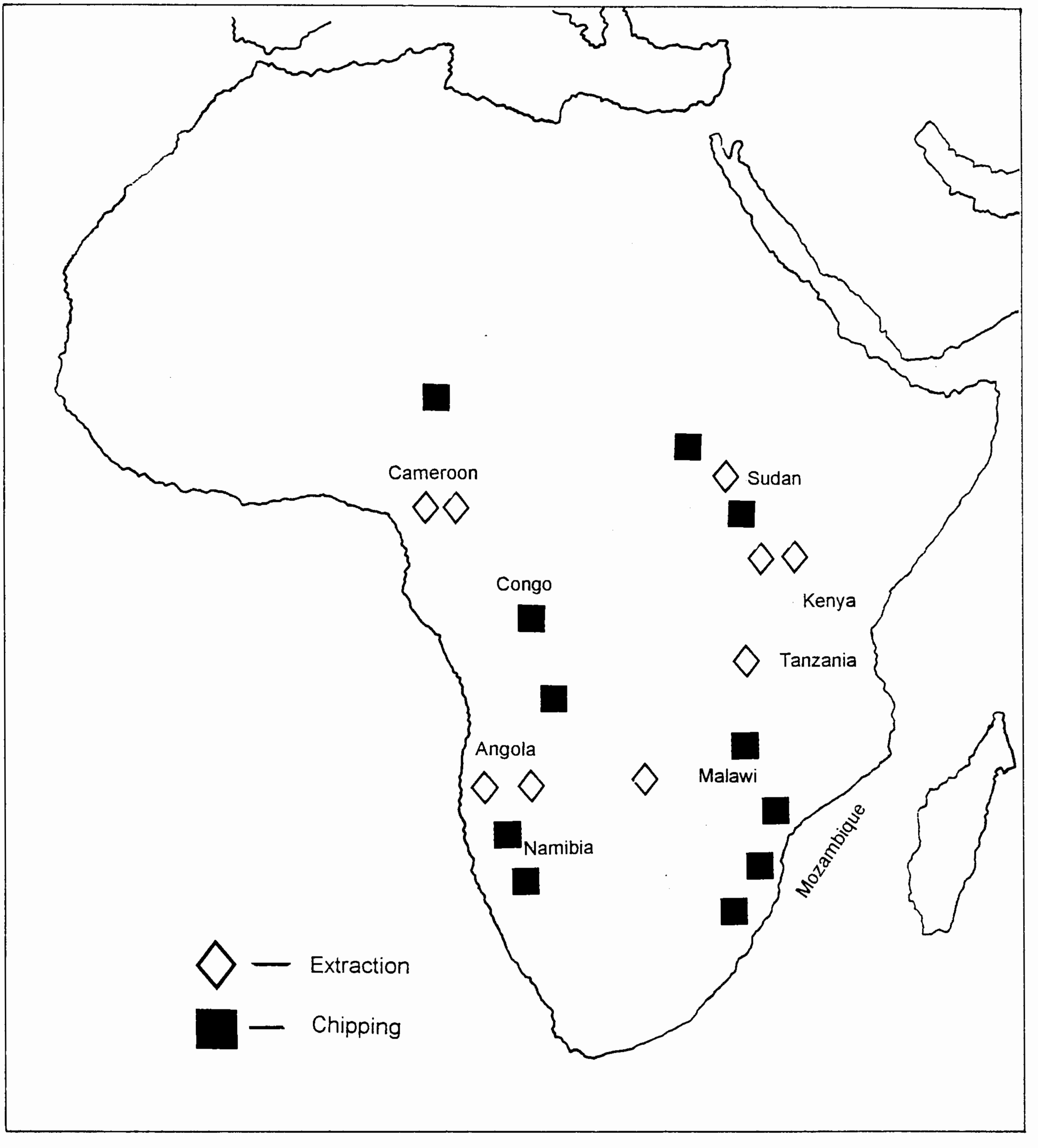


Figure 17: Some central African countries where tooth decoration is practised.

maxillae or mandibles missing from many individuals. For these reasons it was decided not to investigate possible ablation patterns.

An attempt has been made to survey comprehensively the African ethnographic literature that describes tooth decoration. Many of the reports are old ethnographies and/or reports on physical anthropological curiosities. Few recent studies have been performed in this area. The reports used do not involve up-to-date physical anthropological techniques.

Tooth extraction was common practice among many East and Central African groups and the process of removal has been described elsewhere (Driberg 1923, Hollis 1905, Hollis 1909, Roscoe 1923 & Roscoe 1915). There are also examples of filing and ablation that occur together. The Herero peoples of Namibia knock out mandibular incisors and they filed a V-shaped between the maxillary first incisors (Van Reenen 1978b, 1985). A combination of alteration techniques can also be seen in the A-Kamba of east Africa, who inhabit the area just north of Kilimanjaro. Here the upper second incisors are filed to points with a tiny chisel. Chips are taken out of the upper first incisors to form a triangular space. The two first incisors from the mandible are knocked out. It is interesting to note that if they lose one of the sharpened incisors they insert false ones from the tooth of an ox, or preferably a hartebeest whose teeth do not discolour (Hobley 1910).

Filing is the scraping of a tooth by means of file or chisel as described above. It is supposed to be less painful than chipping. Singer (1953) notes that he observed a

Xhosa man with unusually filed teeth. Small v's were filed using a carpenter's file and this was performed purely for cosmetic reasons.

Chipping of teeth involves a number of techniques and patterns. Original accounts of observations do not always differentiate between chipping and filing. In Angola the Ovimbundu chip notches to form an inverted V-shape between the upper first incisors (Childs 1949). Van Reenen (1964,1978a, 1978b & 1986) describes tooth decoration practices amongst the people of Namibia. The Kavangas remove the mesial tips of the first maxillary incisors leaving an inverted V-shape, in addition western Kavangas remove the two mandibular first incisors. Van Reenen (1986) describes the technique used by these people, "...The subject sits or lies on the ground with his or her head on the lap of the operator. Sometimes the operator has to grip the subjects head between his knees if he or she protests too much. A stick or wooden wedge is then placed between the molar teeth in order to keep the lips and tongue out of the way. Pieces of teeth are chipped away until the operation is complete. In the beginning the teeth are not painful, but as the operation proceeds they begin to ache....".

The Cokwe people from North East Angola remove mesial and distal tips of all maxillary and mandibular incisors, making them look like canines. The Wanyemba are from central Angola and they cut "... an almost rectangular wedge out of the mesial two-thirds of the maxillary first incisors..." (Van Reenen, 1986). Livingstone in Waller(1880) also observed this pattern among "... the Machinga, a Waiyay tribe..." whom he encountered on his way down the Rovuma River to Lake Nyassa in Northern Mozambique.

The Liberian Kruboys also chip an inverted V-shape in the maxillary first incisors (Hambly 1937). Various methods of decoration are practised in the Congo (Hambly 1930). The peoples of the Congo Basin filed their maxillary first and second incisors to sharp points (Singer 1953).

In East Africa the Yao chip their maxillary first and second incisors into sawlike points. The ethnographic sources are not in agreement as to when this takes place. Singer (1953) suggests about 15 years of age for both sexes. His source for this information is Werner (1906). Hambly (1930) says 'tribal initiation' is between the ages seven and eleven. Other forms of body decoration practised by the Yao include: scarification, and the women of Nyaja origin wear the pelele (lip ring). In 'The Natives of British Central Africa', Werner (1906) describes the tooth decoration of the people who live around Lake Nyassa. He describes the Yao but his illustrations show some variation in the patterns of decoration. In one photograph chips have been removed from each central incisor, and the other pattern has little chips removed from the incisors (see Figure 18). The Anyika of North West Nyassa have a triangular gap between their maxillary first incisors. Livingstone (1880) describes and illustrates rounded chips taken out of the maxillary first incisors of a woman from the West side of Lake Nyassa. The Makua tribes file each separate tooth into a point. It is not clear whether this is performed on both the top and bottom incisors (Hambly 1930). Other groups are listed in Singer (1953) such as Sudan, the Northern Transvaal and Nigeria. The Makonde (or Maconde) of Tanzania also practice decoration even today, including in Dar-es-Salaam itself (Saetersdal 1995, Pers. comm). This is performed

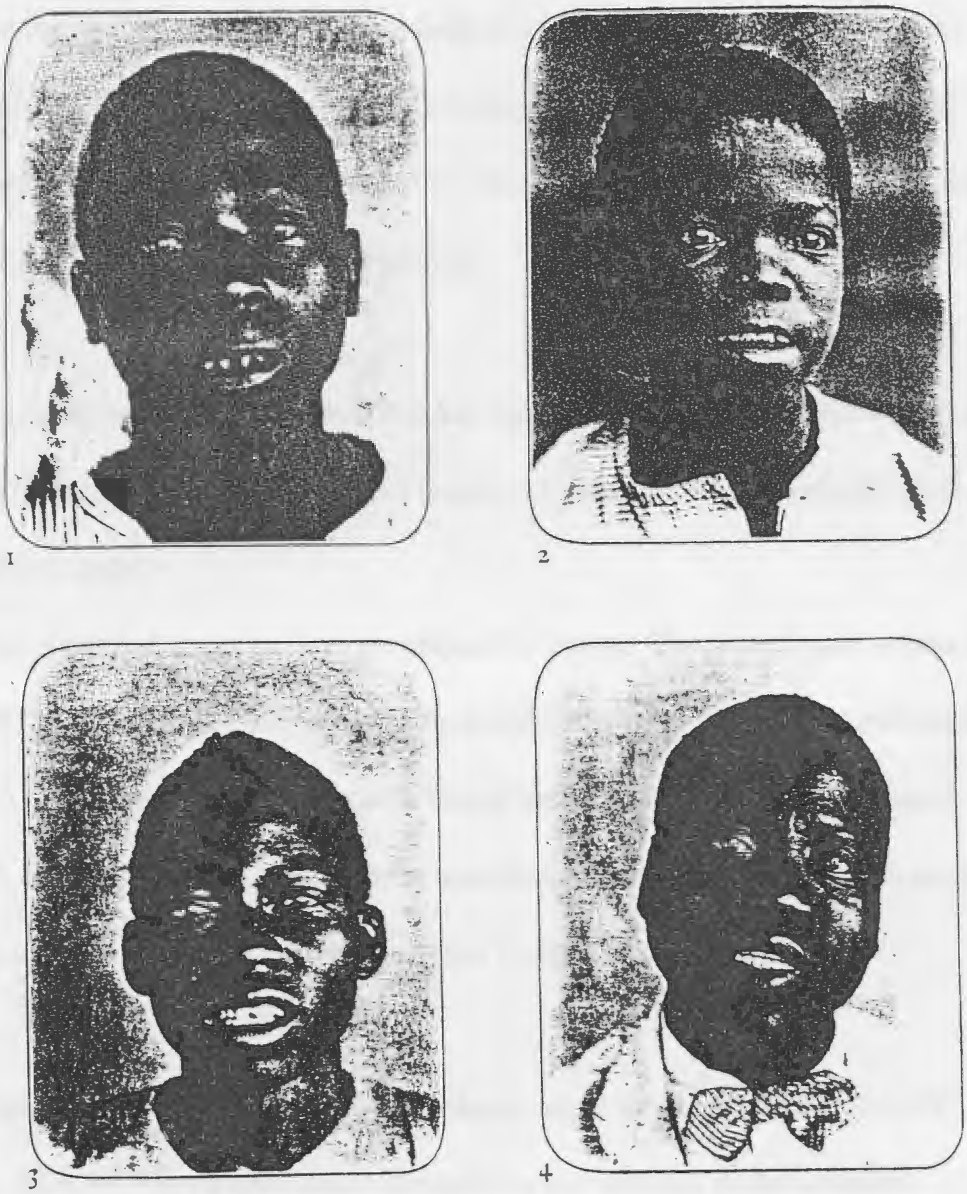


Figure 18: Fashions in tooth chipping: 1) Makua, 2)and 4) Yao, and 3) Anyika and other North-end (Lake Nyassa) groups (Werner 1906)

on boys and girls. Two designs have been observed. The first design involves chipping the teeth to points from the gum to the apex of the tooth. This is performed on the upper and lower incisors. The second method involves the pointing of teeth from halfway down the incisor. Saetersdal notes that most of the Rovuma (River) tribes use these techniques i.e. Makua, Yao, Matambwe, Mwera etc... Tattooing and filing of teeth is still present but is declining.

A very interesting feature of the Fort Knokke material is that there are four different patterns of decoration. There are also a number of individuals with unaltered teeth. The patterns include:

i) all four upper and lower incisors are chipped to points. This pattern can be seen in SAM 4872 (UCT 5407). Unfortunately the mandible is missing from the collection, although it was initially present because Singer has a photograph of it in his paper (1953).) SAM 4773 (UCT 5401) has the same pattern with only the mandible present. (In this instance the maxilla is missing.) (See Figures 19 & 20)

ii) a notch between the first incisors and pointed lateral incisors (SAM 4774:UCT 5402-4, 5616-9). This is an unusual combination not recorded in the literature although it is similar to an example found in Florida that will be discussed below (See Figure 21).

iii) a square chip removed from the distal corner of the maxillary first incisor (SAM 4776C: UCT 5405-6). Unfortunately no other incisors are present for this individual.

Figure 19: Pointed mandibular incisors (SAM 4773, UCT 5401)
Figure 20: Pointed maxillary incisors (SAM 4872, UCT 5407, 5621-2)

Figure 21: Notch between maxillary first incisors, diagonally chipped maxillary second incisors (SAM 4774,

Figure 22: Rectangular notch out of first incisor (SAM 4776C, UCT 5405-6, 5620)

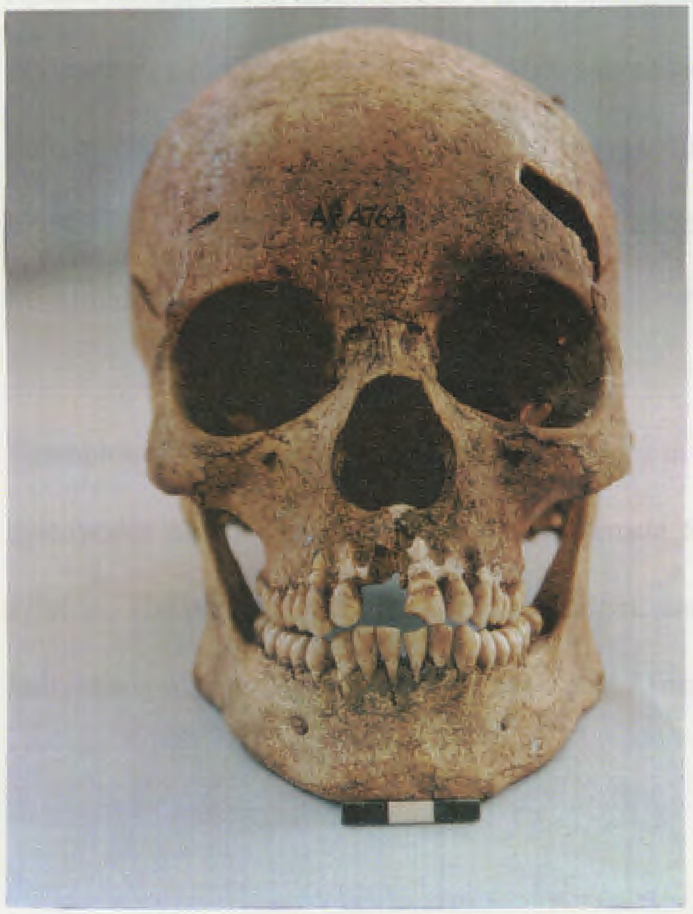


Figure 23: Round chip from first incisors (SAM 4764, UCT 5628-9)

This specimen does not appear in Singer's original report and he may have overlooked it (See Figure 22).

iv) a rounded or semicircular chip off the mesial corner of the maxillary first incisor (SAM 4764:UCT 5628-9). It is likely that if the other first incisor were present it would have a similar notch and together they would form an inverted wide V-shape or U-shape. Livingstone (1880) observed a similar instance. (See figure 23)

It seems that this group of skeletons from Fort Knokke were a mixed group brought from the hinterland of Mozambique. SAM 4872 and SAM 4773 have teeth chipped to points like those of the Maconde, Yao or Macua. SAM 4774 and 4776C show unusual patterns that are not described specifically in the literature. A notch from the maxillary first incisors is, however, a feature of North and West Nyassa and could indicate a member of the Anyika. The Maravi who inhabited the West side of Lake Nyassa have not been mentioned as a group specifically in ethnographic accounts. Livingstone (ibid.) noted the presence of decorated teeth in this area during his last journey and it involved a rounded notch to the maxillary first incisors, not unlike SAM 4764. (The next chapter will consider which groups in the area around Mozambique were affected by the slave trade.)

Examples of tooth decoration in black populations in the New World are rare. Recent discoveries include skeletons excavated in Grenada, St.Croix, Barbados, Cuba and Florida. The patterns found are African in origin, and it is presumed that these individuals were brought to America as slaves. African decoration can easily be differentiated from the Pre-Columbian indigenous designs and those of the North American Indians (Milner & Larsen 1991).

The skeleton found at Grenada is male, approximately 35-40 years old and his four upper incisors are filed to points while his middle two and possibly three lower incisors have been knocked out. The mesial and distal corners of the incisors are filed away in an inward curve not a diagonally straight line. This design is attributed to the people of Southern Cameroon (Stewart & Groome 1968). The Barbados sample showed three patterns of decoration (Handler et al 1982). The modifications were all on incisors, some were shaped to points, adjacent teeth were modified so that taken together they formed points and central incisors exhibited shallow semicircular indents together with pointed lateral incisors.

In the Florida example the mesial half of the maxillary first incisors and the distal half of the second incisors has been removed. The surfaces of the incisors are smooth indicating polishing (Ortner 1966). Ortner suggests three possibilities: 1) the decoration was practised in America by an American Negro, 2) The individual is of Caribbean or South American origin. But no evidence has been found for the recent practise of decoration in these areas. 3) This individual is of African origin. A pattern such as this has been seen among the Macuas of Mozambique as well as groups from the Congo. Ortner compares his example to one of the patterns at Fort Knokke.

At the Cape there have been two other excavations where decorated teeth have been found. One was at Gallows Hill (Morris 1989). The pattern here is unlike anything described above. It seems chips have been removed from the front of the incisors, hollowing them out without altering the outline of the tooth (Personal observation). A recent excavation at a cemetery in Cape Town in Cobern Street included an individual with pointed teeth. This observation was made from a photograph and the actual teeth have not been observed.

J. Handler (1994) discusses dental decoration found at the New York cemetery. This cemetery contains "...the earliest and largest number of Africans and their descendants (approximately 400) yet discovered in an undisturbed New World site..."(p.113). The question arises not only in my study but in also in those mentioned above. Are these individuals African born or are they second generation slaves who have continued their parents' local tradition of teeth decoration? Were these individuals residents at the Cape? The answer to this question lies unequivocally in isotope analysis that will indicate the diet of local inhabitants or a diet consumed in an African village.

UNINTENTIONAL MODIFICATION: PIPEWEAR

Pipe-smokers wear has been observed on two individuals from Fort Knokke. The pipewear from the individuals at Fort Knokke and elsewhere was caused by clay pipestems being held in a constant position for a long period in the mouth. Clay is an abrasive substance. The wear can also be bilateral or unilateral.

They are from the excavation of sailors or soldiers found in their coffins. (The isotopic signatures should confirm the European origin of these individuals.) SAM 4782 (UCT 5413-5) has pipewear on his maxillary right second incisor and right

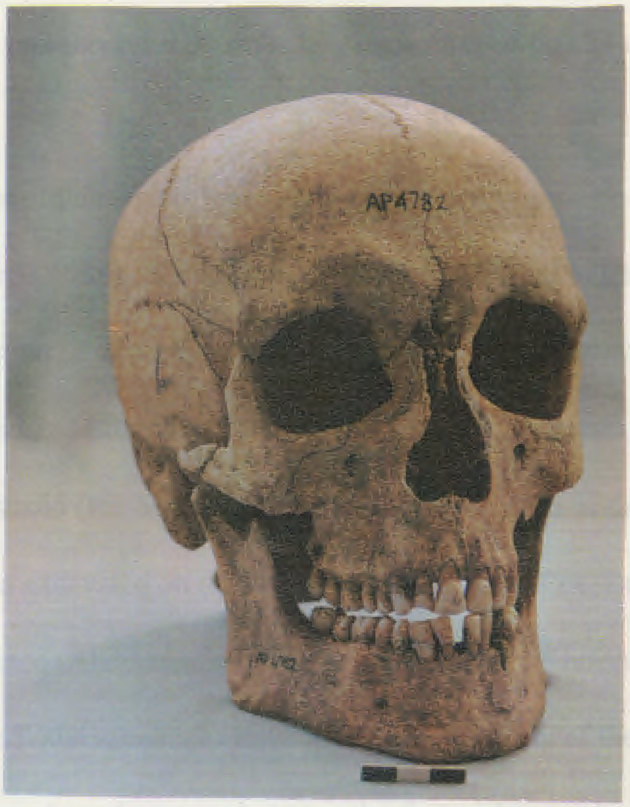


Figure 24: Pipewear (SAM 4782, UCT 5413-5)
Figure 25: Pipewear (SAM 4763, UCT 5624-5)

canine. He also has tar staining on buccal surfaces. SAM 4763 (UCT 5624-5) has pipewear on his first and second right maxillary incisors (See figs.24 & 25).

Three other examples of this type of wear have been found in archaeological material in South Africa (Morris 1988). Two individuals were excavated in Cape Town at what is now the junction of Waterkant and Loop Streets. These burials probably predate AD 1798 (ibid.). Multivariate discriminant analysis indicates that these individuals are Caucasoid (see Morris 1984 for a full description of these techniques). A third specimen was excavated on the farm Stinkwater in the Prieska district in the Northern Cape Province (Abrahamsdam). This individual has Khoisan genetic influence. The Cape Town specimens have wear at the junction of the canine and P3. The Abrahamsdam specimen has wear between the first and second incisor. These varied positions indicate the preference of the individual for holding pipes in particular positions.

SAM 4763 has calculus on buccal and lingual surfaces particularily on the lingual surface of the incisors (Rose-Innes 1992). Calculus is the result of the mineralisation of plaque, which causes a calcified deposit to build up (Hillson 1986). It is also present in the Cape Town and Abrahamsdam samples. According to Morris (1988) this is predictable because of the alkaline environment created by the unfiltered pipe smoke. SAM 4763 exhibits some caries while SAM 4782 does not. The lack of caries is also a result of tobacco smoke which, because of its bacteriostatic and bactericidal effect, reduces tooth decay. Caries is caused by low pH phases in plaque that cause the enamel, cement and dentine of teeth to demineralise. Caries can occur in the form of small lesions or large cavities (Hillson 1986).

It seems from this brief survey of the current material it seems that pipes were smoked by a variety of people. Slaves and indigenous people had access to this European custom. It was practised by both adult men and women, colonists, soldiers and sailors. It was not a luxury. Unfortunately this interesting pathology therefore does not pinpoint the origin or vocation of these men buried near to Fort Knokke.

There are other recorded instances of pipewear. For instance Handler et al. (1978) and Handler and Corrucini (1983) have observed these abrasions on 25 individuals (42%) from the slave graveyard on the Newton plantation in Barbados. Both males and females were found to have pipe-smokers wear, "...pipes were chewed significantly, judging from the sizeable facets which formed a round hole among the two lower and upper front teeth after about 5-10 years of the habit..." (Handler et al. 1983:85). Handler et al. were also able to deduce that this habit began around the age of twenty when all the permanent teeth had erupted.

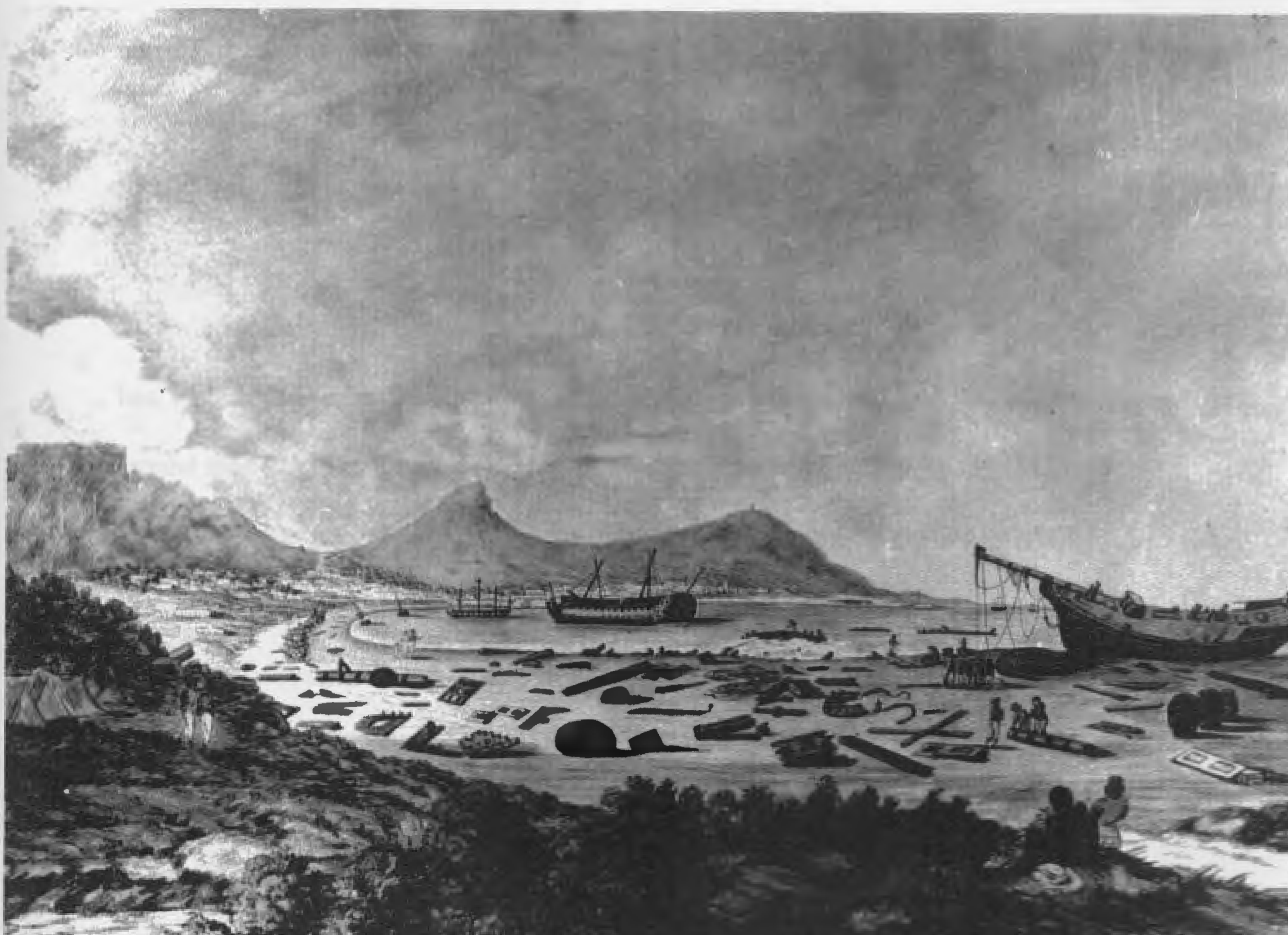


Figure 26: 'The Great Storm of 21 July 1822 showing the East Indiaman Royal George, and the wrecks of seven other vessels' (SA Library, A pic. Mend 40572)

ARCHIVES

Table Bay's notorious north-westerly wind took many lives and caused numerous shipwrecks (See Figure 26). It has been established that the burials uncovered by Singer in the 1950's are not necessarily associated with Fort Knokke. The first step taken at the archives was to determine whether any ships carrying slaves sank near the Fort and if any other bodies (the sailors or soldiers) would have been buried near Fort Knokke.

Malcolm Turner(1988) has written a book called Shipwrecks and Salvage in which he has, with the help of archival records, determined which ships sank in various areas around the coast (See Figure 27). I was particularly interested in the area near to Fort Knokke. He has given brief descriptions of each vessel which I narrowed down to a list that involved the loss of life.

There were a number of shipwrecks in 1737 and earlier that went ashore in the vicinity of Fort Knokke, which involved the loss of life. There are two reasons why wrecks dating to such an early period should be treated with scepticism. Firstly these wrecks predate Fort Knokke and it is unusual that these coffins remained undisturbed with the construction of the Fort and subsequent remodelling. The second is the shortage of wood at the Cape at the time, it is unlikely that shipwreck victims would of been afforded so much effort, especially if they were mere crew on board a passing vessel.

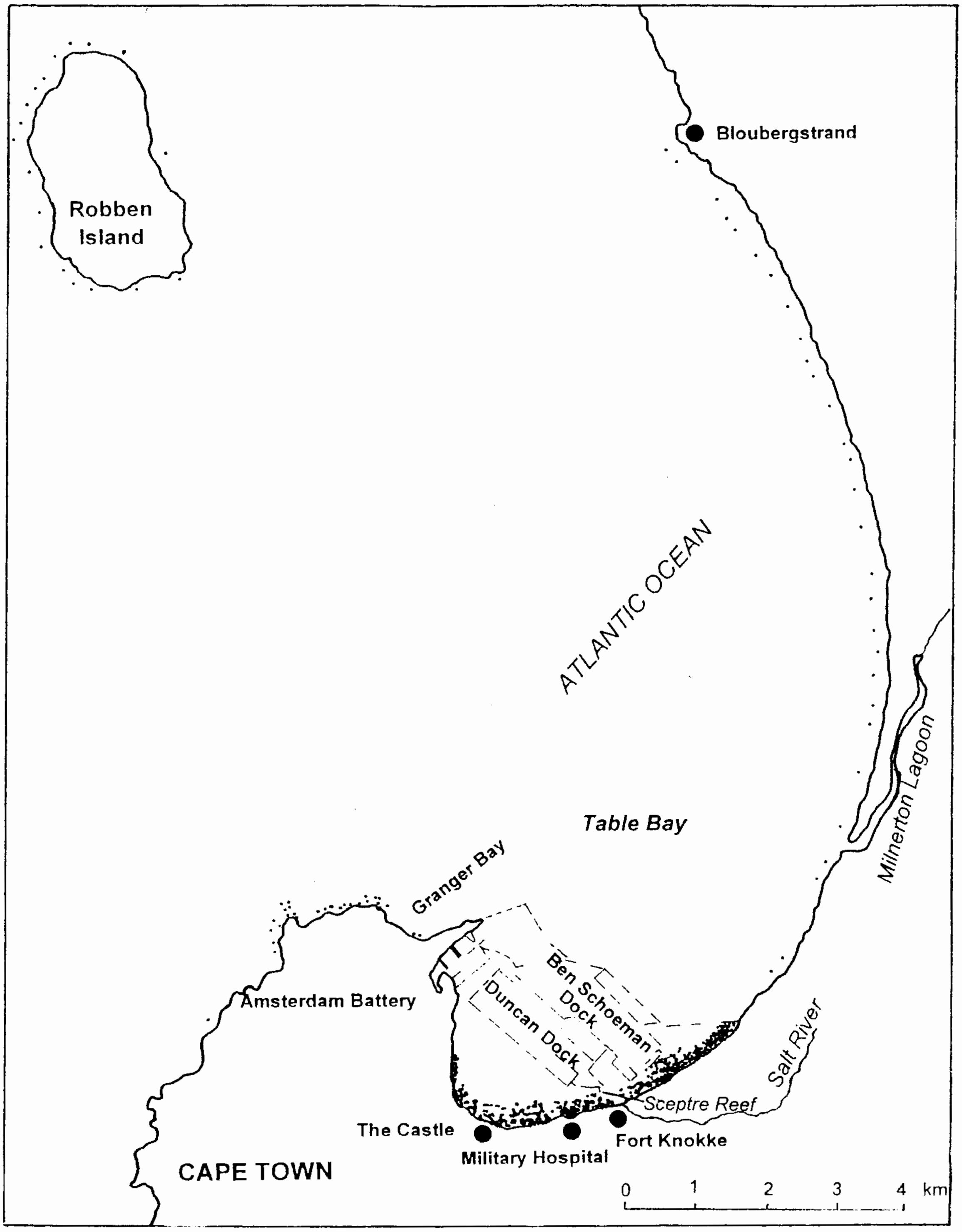


Figure 27: Distribution of wrecks in Table Bay (Turner, 1988)

Table 1: Possible shipwrecks in the vicinity of Fort Knokke:

Name of ship	Date	Number of people drowned
The Addison	16 June 1722	70 dead
City of Peterborough	17 May 1865	All crew lost
Cockburn	16 September 1850	some passengers and crew lost
De Buis	21 May 1737	only 5 survivors
Duinbreek	21 May 1737	most dead
Flora	21 May 1737	134 dead
Francis Spaight	7 January 1846	Captain and 14 crew
Goudrian	21 May 1737	many died
Haarlem	3 July 1728	many died
Iepenrode	21 May 1737	many died
Jonge Thomas	1 June 1773	138 dead
Le Victor	24 September 1782	some dead
Pacquet Real	18 May 1818	heavy loss of life
Rodenrijs	21 May 1737	six men died
Sceptre	5 November 1799	280 dead
Waterloo	28 August 1842	143 convicts, 18 women and children, 15 soldiers and 14 crew

There are more wrecks in 1722 and others during the 17th century.

Identifying the six or seven Caucasoid individuals is not a simple matter. There are many wrecks that claimed big robust sailors or soldiers. They could also have been passengers. Pinpointing exactly where Singer excavated will make the task of working out who these individuals were much easier. From the notes that Singer subsequently sent to me it is clear that there were more than six or seven individuals buried at this location. So we can rule out the Rodenrijs. This Dutch vessel of 650 tons was wrecked near the Salt River mouth on 21 May 1737 during a NW Gale while on a homeward bound voyage from Batavia. Six men died and Rose-Innes(1992) suggested this vessel as a likely candidate responsible for these deaths.

There are many accounts of the wreck of the Sceptre (Cundee 1806; Wexham n.d.; Turner, 1988). It was wrecked on Sceptre Reef in front of Fort Knokke (now buried beneath reclaimed land). In Wexham's account 3 wagon loads of dead were taken to a place near the hospital (presumably the General Hospital)and buried. About 100 bodies or more remained and they were so badly mutilated that they were buried in one grave on the beach. The bodies of the officers, except that of the Captain, were recovered but Wexham does not specify where they were buried.

An account of the wreck of the Waterloo is as follows '...The corpses of the convicts from the Waterloo ...some were buried in a cemetery in Somerset Road at a depth of five and a half foot and at Fort Knokke at depths of 4-5 ft..."(Laidler & Gelfand 1971:279). Complaints were put forward to the Medical committee who replied that there was no danger. The Cape Town Gazette states that those buried near Fort Knokke were buried in the military burial ground (9 September 1842).

The Francis Spaight was wrecked on 7 January 1846. An account in the Illustrated London News described the attempts to rescue the stricken crew that ended up unsuccessful. Twenty-one people died including six residents from Cape Town. The account does not mention where they were buried.

In July 1819 there was an interesting notice in the Cape Town Gazette "...In consequence of complaints lodged before the president and the members of the Burgher Senate that Dead Bodies are buried outside the walls of the General burial places, to the great nuisance of the public...the burial of such bodies is seriously prohibited..."(Murray,1964:22). The individuals buried in coffins would not have been within a proper burial ground. Perhaps their burial predates this declaration, making The Sceptre or an earlier wreck a possibility.

The only vessel to have wrecked carrying slaves was the Portuguese slaving brig the Pacquet Real. I have found various references to it in the Government House records. It was carrying 171 slaves from Mozambique to St. Salvador in Brazil, and arrived in Table Bay on the 14 of April 1818 after a long voyage of 71 days. It had exhausted its provisions and had been damaged by bad weather. The reason so much was written about it is that was causing much consternation among the officials at the Cape. Being a slaving brig it was not allowed to stop for supplies at the Cape because of British Abolition laws of 1808 that also applied to British colonies. However, supplies would be administered for the sake of the ailing and dying slaves, provided the Captain was prepared to pay. Captain I. P. de Souza was, however, insolvent and the officers at the Cape were considering what the correct policy should be in such instances. If he were to surrender the vessel, would the slaves be freed? The wrecking of the vessel changed the nature of this particular dilemma. Extensive documents were drawn up in case such an incident should arise in the future (Theal 1902).

The Pacquet Real was blown off its moorings and was wrecked on 18 May 1818 in a north west gale. Two local garrisons were ordered to give assistance and helped to save the crew and 140 slaves however '...18 bodies have been cast up and buried, together with 7 of those who were saved in the first instance, but who died subsequently from weakness. The remainder (100 males and 33 females) debilitated and diseased, I have thought it my duty to take under my immediate protection, and have placed them at present in our General Hospital (an insulated building) where the exertions of the Military Hospital establishment will be called forth, nearly to reanimate the unfortunate and exhausted sufferers....."(ibid.:8). The emphasis on an 'insulated building' is because it was colonial policy that slave vessels should have no contact with colonists because of the danger of smallpox (Laidler & Gelfand 1971).

Thus 25 bodies were buried together. This figure tallies up with Rose-Innes's MNI of approximately 25 slaves. The figures in the records do not quite tally: 171-25= 146 and only 133 were admitted to hospital, so 13 are unaccounted for.

There are various other letters in the archives that relate to this event. There is an account for the clothing given to the slaves (Cape Archives, C.O.92). A Captain Blasdell of the 60th regiment claims a reward because he risked his life while saving many of the slaves (Cape Archives, C.O.143).

The Supercargo, José Martins Gomes owned about 70 of the slaves and he wrote rather animated letters on the 22 and the 25 of May asking permission to inspect the remaining slaves in the hospital. He was extremely 'concerned' that he was about to lose the money he would have obtained from the sale of the slaves. He concludes "....well Your Excellency will determine what is most proper, that the decision at the end may be able to save the proceeds of the voyage..."(ibid.: 11).

There is also a letter from Charles Blair, the controller of customs, to say he had taken possession of the slaves. It is interesting that the number of slaves has increased by one (to 134) from the previous account. Blair was Collector of Customs from 1808 to 1826 and like most other officials at the Cape at the time, he used his office for personal advancement. These remaining 133(4) slaves became Prize Negroes (Saunders 1985, Theal 1902). They were distributed by Blair to private and other individuals preferably to those from whom he could benefit personally. Tracing all of the slaves was not within the scope of this project. Seventeen were apprenticed by His Majesty's fiscal, to Mr Robert Hurt, "...in his capacity of superintendent of the government farm..."(C.O. 324/20/D). The term 'Prize' negro is derived from British wartime nomenclature. A ship seized in war and kept by the capturers was termed a 'prize' and so were the slaves captured at sea.

From 1808, since Britain had abolished the slave trade in its colonies, it began attempts to stop the trade elsewhere. A small naval force was stationed in Cape waters to intercept trade from the East on its way to the Americas (Saunders 1984:36). By 1818 2000 slaves had been 'freed' at the Cape. These slaves were not released unconditionally. They were apprenticed for periods of fourteen years (ibid.). Saunders (1985) suggests that the conditions under which they lived were little different from slaves. This new workforce suited the colonists and eased them through the transition to the post-slave trade era.

However in 1817 Britain signed a treaty with Portugal that allowed them rights to seizure north of the Equator only. So in the two decades after 1815 the only addition to the slave Negro population at the Cape were those abandoned when the Pacquet Real sank in 1818 (ibid.). Under the circumstances the decision of what to do with the survivors was not an easy one. It was eventually decided "... to enlist those Negroes in the Land or Sea Service, or bind them, as apprentices..." (Theal 1902:488).

CONCLUSION

The Pacquet Real was the only slave vessel to have been wrecked in this area. For this reason and since the figures tally up for the number of individuals I feel secure in presuming that this was the event that caused their deaths. The origin of the other individuals is more difficult to discover because of the uncertainty of site location and the incompleteness of the excavation, not to mention the numerous wrecks in this area.

THE PORTUGUESE SLAVE TRADE

The mechanisms of the Portuguese slave trade will be discussed in this chapter with special attention being paid to the African populations in the vicinity of the Port of Mozambique. The area north of the Zambezi includes three unconnected highlands, the Livingstone-Nyassa highland, the Namuli highland and the Angonia highland (Nelson 1984). People from the area west of Lake Nyassa (now Lake Malawi) in the modern country of Malawi were also victims of the slave trade and will also be discussed here.

MOZAMBIQUE

The rainy season in this part of the world spans about December to April. The rest of the year is dry and that was when all the major social activities and long distance trading occurred. The South West monsoon, during August, September and October, was the favourable wind for vessels departing for Brazil via the southern most tip of Africa. This was the peak trading time and caravans arrived from the interior with slaves and other goods. The predominant vegetation is woodland savannah (Brachystegia and Julbernadia). Maize is grown in the Yao highlands east of Lake Nyassa and southern Malawi and other highland areas of East Central Africa. It was grown from at least the mid-eighteenth century and probably earlier (Alpers 1975). Manioc was only introduced to the mainland in 1768. Pearl millet and sorghum are also grown. Hunting and fishing also provide part of the diet. The keeping of cattle was limited to a few pockets because of the tsetse fly.

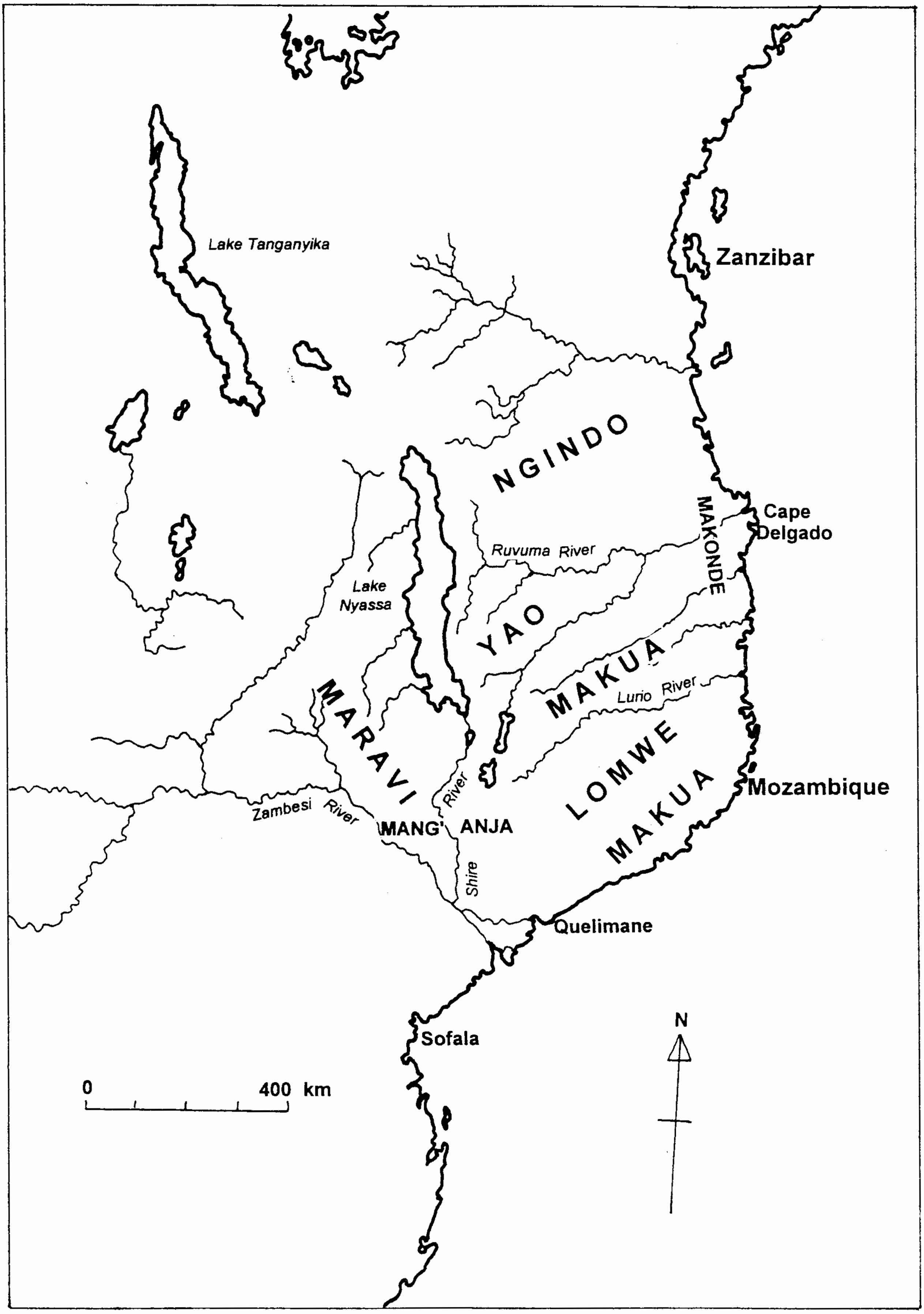


Figure 28: The peoples of East Central Africa (Alpers 1975:9)

THE PEOPLE OF MOZAMBIQUE

Alpers (1975) identifies three societies that were present in East Central Africa during the nineteenth century who were affected by the slave trade and the Portuguese residents on the coast. These are the Makua-Lomwe, the Yao and the Maravi (See fig.28). The other group from further north who played an integral part in the slave trade were the Swahili. They dominated the Marave and the Makua who were their source of captives for the slave trade (Hafkin 1973). These are the groups in the area around the Port of Mozambique, where the Pacquet Real embarked on its ill-fated voyage to Brazil.

The Swahili are patrilineal. The other groups however are matrilineal. The Makua-Lomwe, Yao and Maravi also have similar religious practises. They all practise cicatrization and tooth decoration (these groups have been mentioned earlier in the chapter on tooth decoration). Alpers (1975) also suggests that there is also an underlying linguistic unity, all the languages belonging to the Central Bantu language family. Yet each group has different terminology when referring to each other.

MAKUA-LOMWE

These groups are separated as they have distinct dialects. They have been agriculturists for centuries although through the recording of oral histories it seems that they subsisted by hunting in earlier times. Salt and iron were key commodities in bringing communities together through trade. The Makua obtained their salt from the coast. The earliest account of iron making was in 1785. Makua elephant hunting was also significant, before the demand for ivory, as a source of food and therefore the Makua could respond to the needs of international trade. It also meant however that elephant hunters spent long periods away from their villages. Fighting took place between the Makua, making the society as a whole vulnerable. Male victims were decapitated and women and children taken captive (Alpers 1975:8).

YAO (ROVING CARAVANERS)

The Yao were primarily agriculturists with sorghum as their staple food, together with maize and manioc which was introduced in the late nineteenth century. They also hunted and gathered and did some fishing. Domestic stock was introduced during the second half of the nineteenth century. The Yao had access to some salt and were accomplished ironworkers unlike the Makua who had a long drawn out labour intensive process (ibid.). Their involvement with international trade began with ivory until the growth of the slave trade at the end of the eighteenth century. The Yao are known in this part of Africa as roving caravaners. Yao caravans are an extension of the regular elephant hunting; these caravans obtained ivory and later slaves. Initially they raided villages but later became traders with other groups doing the actual procurement of goods. Salt was essential in regional trade and "...was a source of capitalisation for international trade..." (Alpers 1975:20). The ideal life for a Yao was to be a traveller. The Yao felt that if a man hadn't visited other countries he wasn't a man.

MARAVI(MARAVE OR MANG'ANJA)

The Maravi region west of Lake Nyassa was densely populated. These people kept to the confines of their country and traded within these bounds: weaving (they produced durable cloth), smelting, cultivating mainly sorghum as well as pearl millet, yams, bananas, beans and ground nuts. The Mang'anja men were more closely associated with the agriculture process. Southern Malawi has rich sources of salt and iron ore, and the region contained many elephants.

So in the hinterland of Mozambique there was variation in subsistence strategies due to productivity of the land, modes of production and the unequal distribution of salt and iron which facilitated exchange. The Maravi (Mang'anja) had the richest and most varied economy, they were self sufficient and had a more equitable division of labour and a more highly developed state system. The Makua-Lomwe were only marginally agriculturalist and long absences from home for the men to hunt was part of the economy long before international trade, thus allowing them to shift their energies when the demand did arise. The Yao were in-between the two: they had a more abundant agriculturalist society, however the absence of salt and a characteristic wanderlust caused them to travel. The Yao and Makua women were important in the agricultural process therefore freeing up the men to hunt and trade. Yao society became increasingly stratified because of the wealth acquired by some from trade. Slavery changed these societies' economic values. Even the Mang'anja suffered: they were ravaged by foreign slave traders and the neighbouring Yao (Alpers,1975).

THE SLAVE TRADE

Slaves, both for export and domestic use, were an important part of Portuguese society in Mozambique (Hafkin 1973). The Portuguese kept registers of all their transactions. The slave register was dominated by Makua names, then Yao, Marave and others from Quelimane, Sofala and Inhambane. It seems that the domestic slaves had a hand in acquiring slaves from the interior for export. More slaves were kept than were needed in the households and these went to the interior to find more slaves and when the ships arrived often found themselves onboard. "...Thus, in many ways the domestic slaves on Mossuril (place near to Mozambique port) fazendas (plantation) were simply adjuncts to the barracoons, the enclosures that held slave in anticipation of export vessels...."(ibid. :71).

The first half of the nineteenth century in Mozambique saw a continued and rapid growth of the slave trade. The demand came from the Arabs, Brazilians, French, Spanish in Cuba and the Americans who looked at East Africa for their slaves in the wake of the effective British anti slave trade campaign in West Africa. Slaves, by 1809, had become the most important item of commerce overtaking ivory. Most of the demand came from Brazil (See Figure 29).

In 1819, the year after the wrecking of the Pacquet Real, according to D. Fr. Bartholomeu dos Martires, Prelate of Mozambique, sixteen Brazilian ships embarked from the port of Mozambique. The Brazilians bought 9242 slaves. 1804 died at Mozambique and of the remaining 7438 embarked 2196 died on the voyage, a mortality of 27,7% on the voyage alone (Alpers 1975:212). This high death rate was

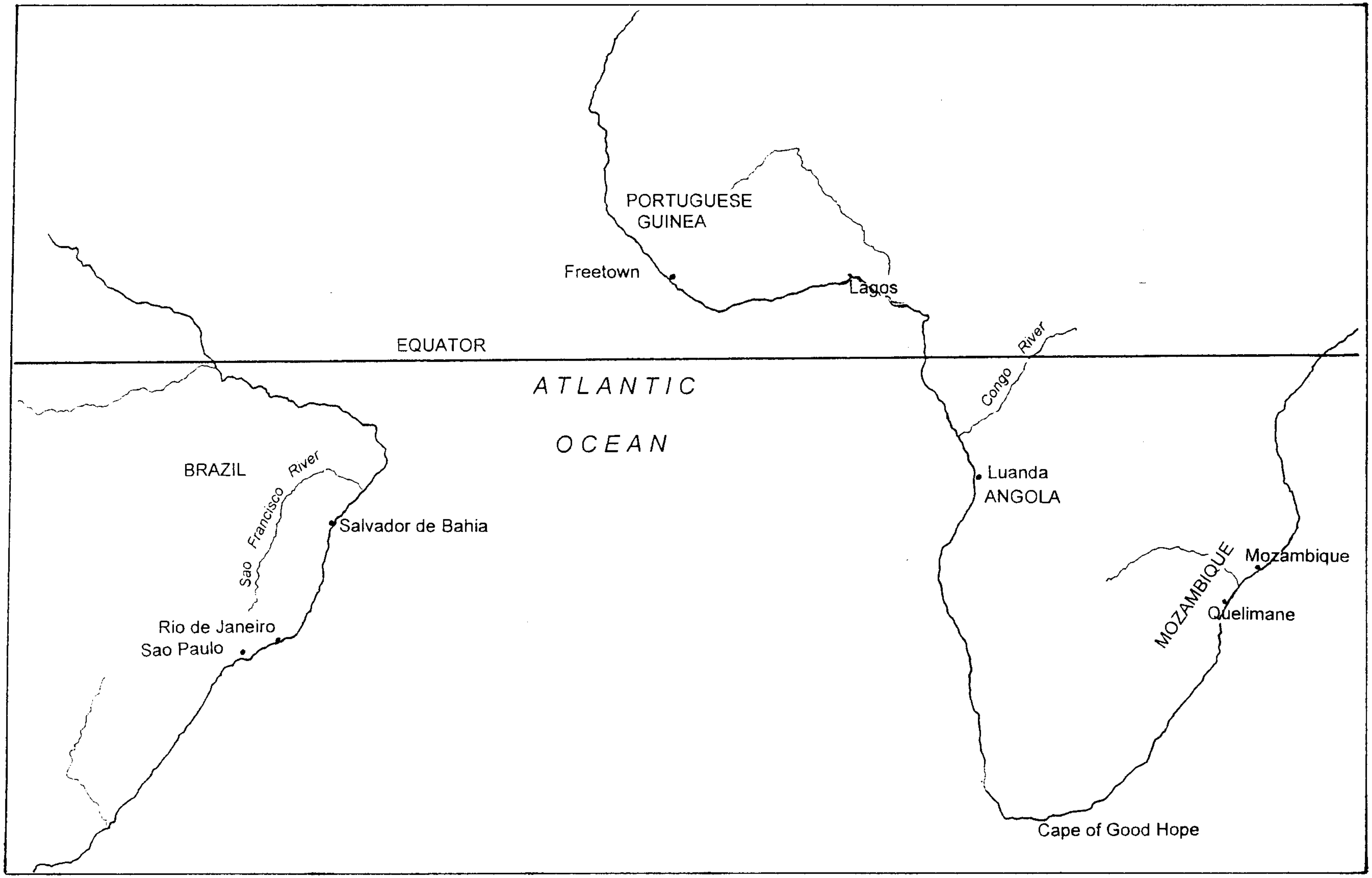


Figure 29: Brazil and Africa (Conrad 1986:25)

especially typical of the Yao not only because of the debilitating journey to the coast, but also because of susceptibility to disease. Makua were preferred as slaves (Jackson Haight 1967). The government of Mozambique commented that many of the slaves were not from immediately around the city but were brought in Yao caravans from as far inland as Tete (Maravi).

Between 1822 and 1830 (excluding 1826) 40 000 slaves left Mozambique, bound for Brazil alone. These numbers are conservative: "...about 1/4 or more may be added to that number (8-10000 per annum) who were smuggled out illegally (Alpers 1975: 212).

Why did these people submit to slavery? It seems that in most cases they were totally unaware of their fate. Many of those captured were outcasts of society or guilty of some crime against society and accepted their fate as just reward (Alpers 1975). Often the family connected to the ousted individual were also enslaved.

R.P Waters said in1837 about Mozambique "... (the) city is a depot for slave vessels.....many of the slaves are children between the ages of ten and fourteen..." (Beachey 1976:17). The Makua, because of their proximity to the coast, suffered most from the slave trade to the Mozambique coast. The slave trade in the long run weakened the economy, society and the political structure of the Makua who inhabited the coastal hinterland. Conflict with the African traders of the interior was caused by the Portuguese sending their own parties in search of slaves and by the 1850's the chiefs of the Makua were raiding each other's people. An account by Frederic Elton, the second British consul at Mozambique (at the end of the nineteenth century), tells of burned and desolated villages after slave raids and of the general uneasiness and suspicion of the Makua people (Alpers 1975).

By the late nineteenth century the trade in exchange for African goods was in consumables and in luxury items "...none of which contributed positively to African methods of production..." (Alpers 1975:31). Thus economic development became disastrously skewed leaving these groups underdeveloped.

SUPPRESSION

The suppression of the slave trade began in 1807 with the Slave Act which prohibited any slave trade in British colonies. Then Britain attempted to focus the humanitarian zeal of the anti-slave trade campaign on East African waters. However at the same time the demand from European markets for the products of slave labour increased. These forces of international trade tempered Britain's attempts to stop the slave trade.

The first treaty signed was the Anglo-Portuguese Treaty of Friendship and Alliance of 1810 which was merely a promise of co-operation in the gradual abolition of the slave trade. The terms of the treaty were in fact misinterpreted by British vessels in the Mozambique Chanel who were capturing the French Islands. They took the treaty as giving them the right to seize Portuguese vessels on their way to Brazil. The British cruisers also halted the trade between Mozambique and Bourbon and Mauritius (Haight 1967). These developments shifted some of the trade emphasis from Mozambique to Zanzibar, with its Arab traders. The misinterpretation caused tension and resentment between the two nations and the Prince Regent of Portugal was no longer inclined to assist the British in the halting of the slave trade. A further treaty was signed in Vienna early in 1815 which declared illegal all Portuguese trade in slaves on any part of the African Coast north of the Equator (ibid.).

The Brazilian and Mozambican colonists were untouched by the humanitarian zeal that affected the British. The slave trade was viewed as essential for survival. After 1815 the Brazilians could no longer obtain slaves from West Africa thus Mozambique looked forward to an increase in trade (See figure 29). The result was a revival in the slave trade. Slaves were allowed to be taken to Brazil if they were in vessels flying a Portuguese flag and had passports and were from ports between Cape Delgado and the Bay of Lourenco Marques. At the Port of Mozambique the Portuguese were no longer permitted to trade with foreigners, who began buying their slaves in Arab territories and areas south of Mozambique, where customs duties could be avoided. The Portuguese therefore lost considerable revenue. The trade should have stopped with the Brazil's Independence in 1825 because the treaty of 1817 only permitted the Portuguese to trade between their African territories and her transatlantic possessions. But Portugal did not prohibit this trade (Conrad 1986).

The Transatlantic slave ships were known as 'tumbeiros': bearers of the tomb. These vessels were always overcrowded. Slaves were closely packed into the hull to save space and were chained up to avoid rebellion (see Figure 30). There was no proper ventilation or sanitation. The slaves were fed beans, maize and flour which was often spoiled, sometimes with some 'noxious' fish and limited amounts of water. The

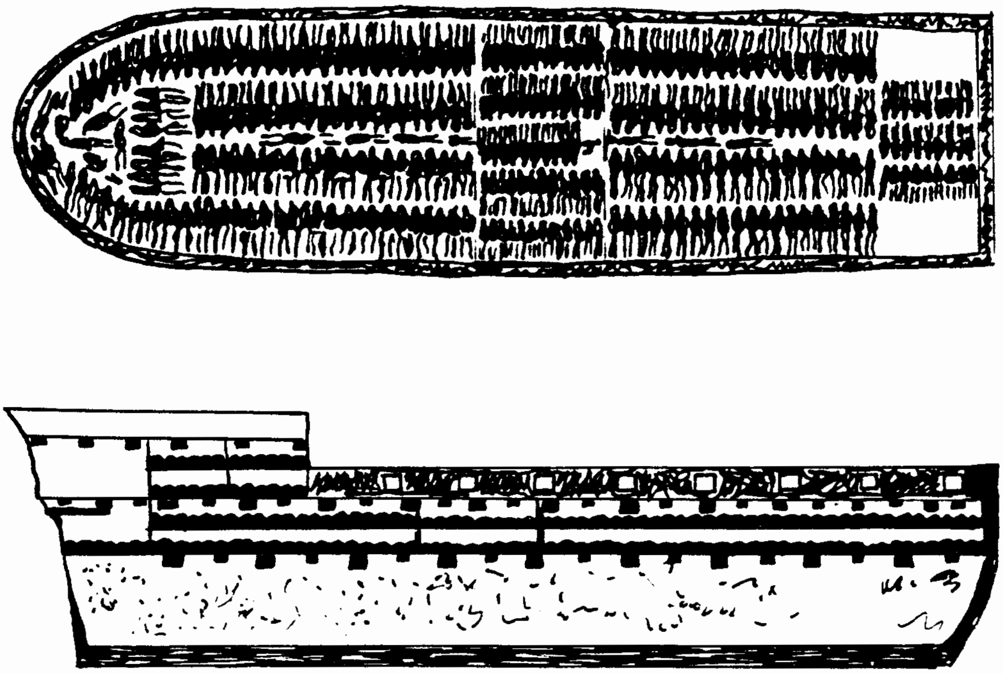


Figure 30: Slave ship (Encyclopaedia Britannica)

voyage from Mozambique to Brazil took approximately 60 days and the voyage from West Africa approximately 34 days (Conrad 1986). Conrad has estimated from various sources that approximately five million slaves were introduced into Brazil and the total for all Africans involved, i.e. those who died when caught, on the way to port, awaiting embarkation, at sea and in Brazilian slave markets amounts to far more. Why did the Brazilian slave trade continue for 300 years? It was primarily due to the economic gain of the trade. But a continued supply of slaves was necessary because of the high death rate. Slaves were cheap and abundant and the owners often neglected them. The slave population did not reproduce itself, because there were more men than women, marriage was discouraged, no care was given for the children and all slaves were vulnerable to new diseases. In 1872 a male slaves life expectancy was 18,26 years whereas the (non-slave) Brazilian population was 27 (Conrad 1986). (And in the mean time the French, Dutch and Americans, the principal traders, continued unhindered.)

The British navy continued their attempts to halt the slave trade by searching vessels at sea throughout the nineteenth century. More treaties were signed between the colonial powers allowing a right of search of slave vessels. The United States only signed in 1862 at the outbreak of the Civil War.

The suppression was not an easy objective as even one successful voyage brought great profits to traders. Thus the traffic to Brazil was not to end before 1850 and to Cuba in 1862. The initial efforts were concentrated along the coast. The inland trade continued unabated until European explorations into Africa became more frequent in the second half of the nineteenth century.

LIVINGSTONE'S ACCOUNTS OF SLAVERY

The Zanzibar market

Livingstone (1880) observed 300 slaves available for sale in 1866. He recognised them as being from Lake Nyassa and the Shire River because of their markings and tattooing. He describes the selling process "... The teeth are examined, the cloth lifted to examine the lower limbs, and a stick is thrown for the slave to bring, and thus exhibit his paces...". They were being bought by "Northern Arabs and Persians".

Along the Rovuma River

From Zanzibar Livingstone's expedition moved up the Rovuma River toward Lake Nyassa. Along the way they found evidence of the routes of slave traders. As they travelled they found dead captives who were apparently murdered by Arabs when they couldn't keep up with the rest of the group. The traders were so angry at the financial loss they would rather kill the slave than let him or her be taken by another trader or go back to their village (See Figure 31). The Arab slave traders were aware of the route Livingstone was taking and avoided making contact with him. Slaves were also abandoned when they were too weak to continue and were left with their slave sticks around their necks. They were often too weak to speak or move and died where they were left (See Figure 32). Livingstone observed that 'some were quite young'. Some individuals were found dead, bound to trees and many slave sticks lay along the path from those who had been freed, although probably only to be resold.

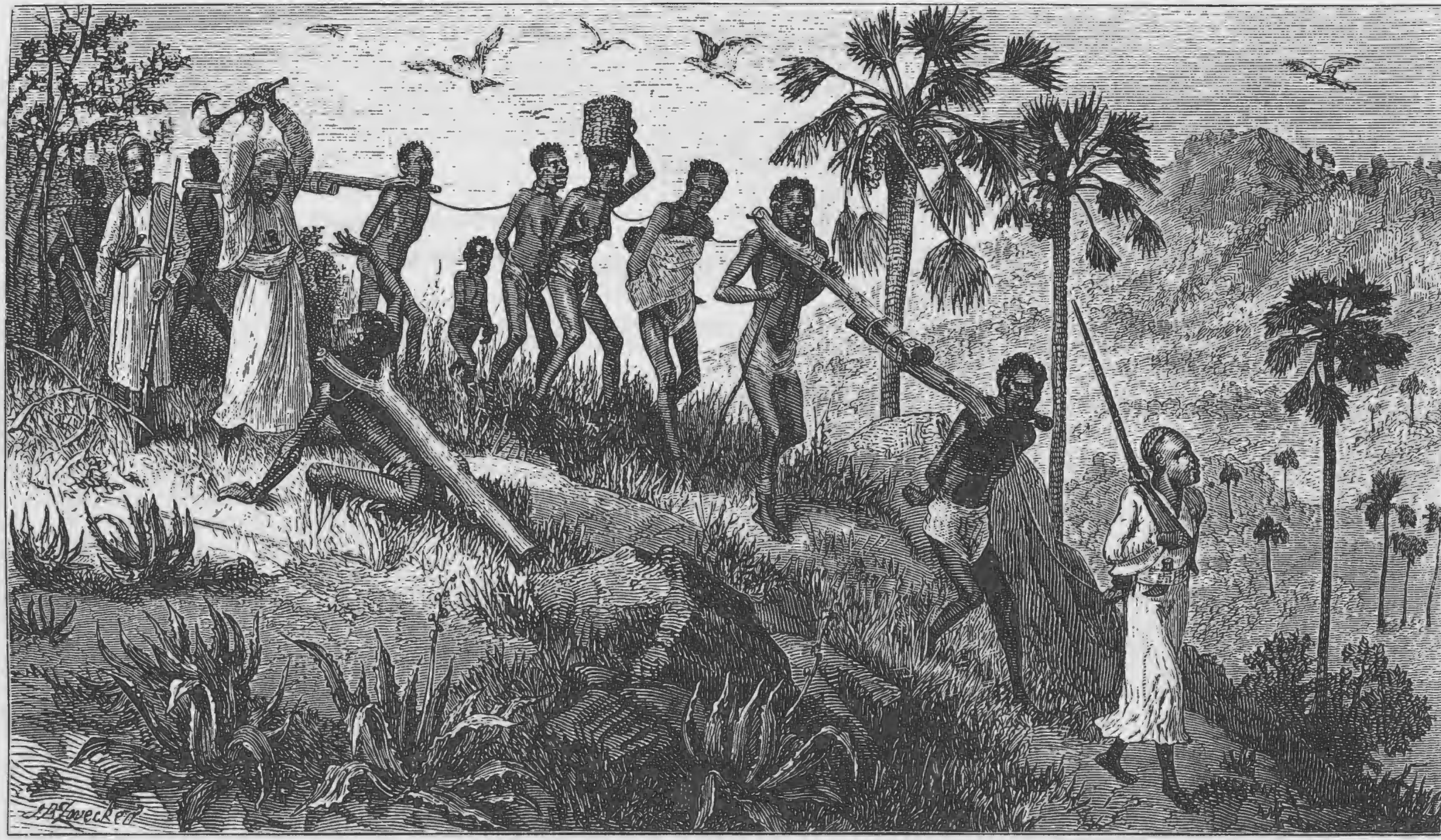


Figure 31: Slavers revenging their losses (Waller 1880:62)

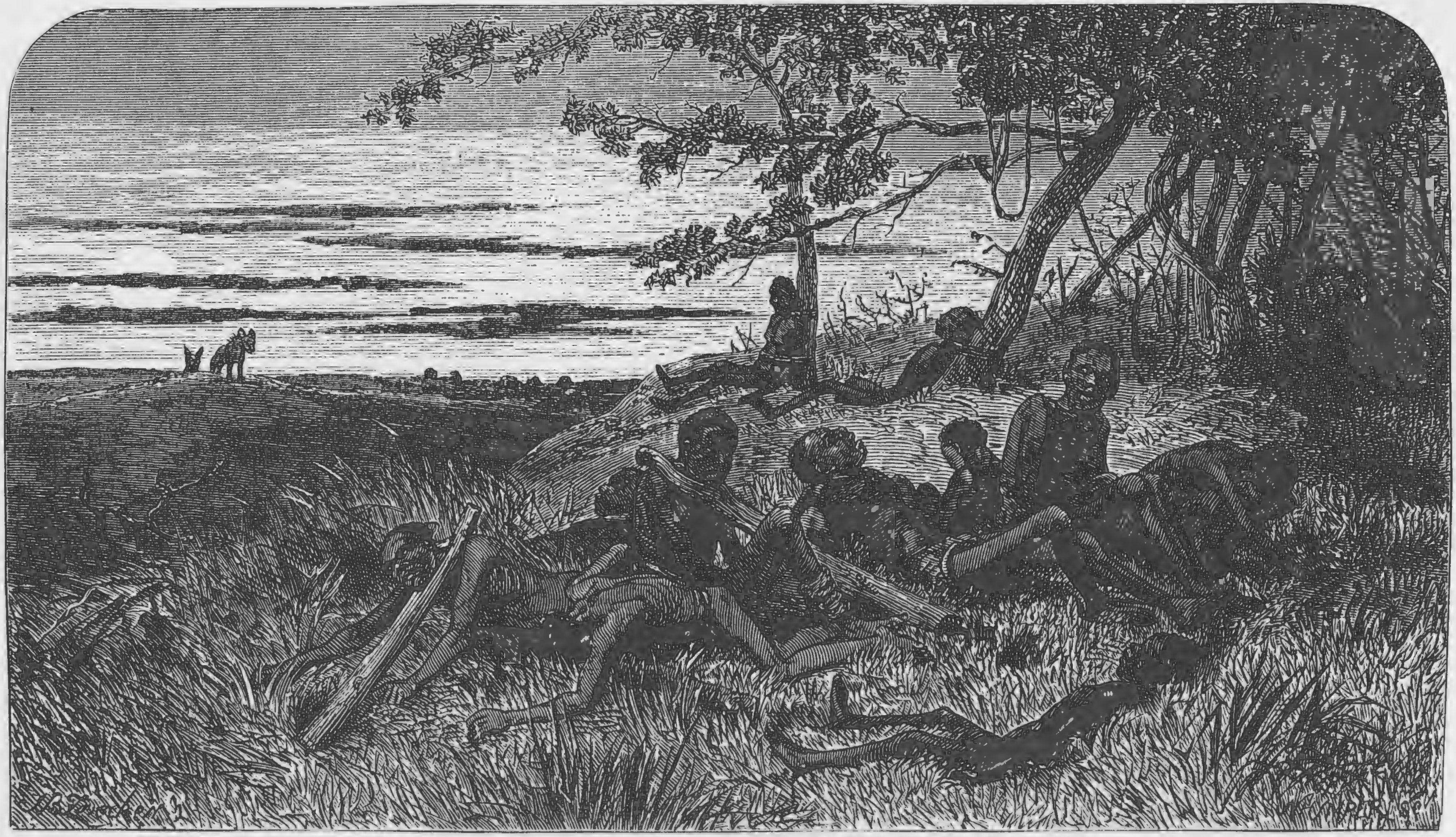


Figure 32: Slaves abandoned (Waller 1880:62)

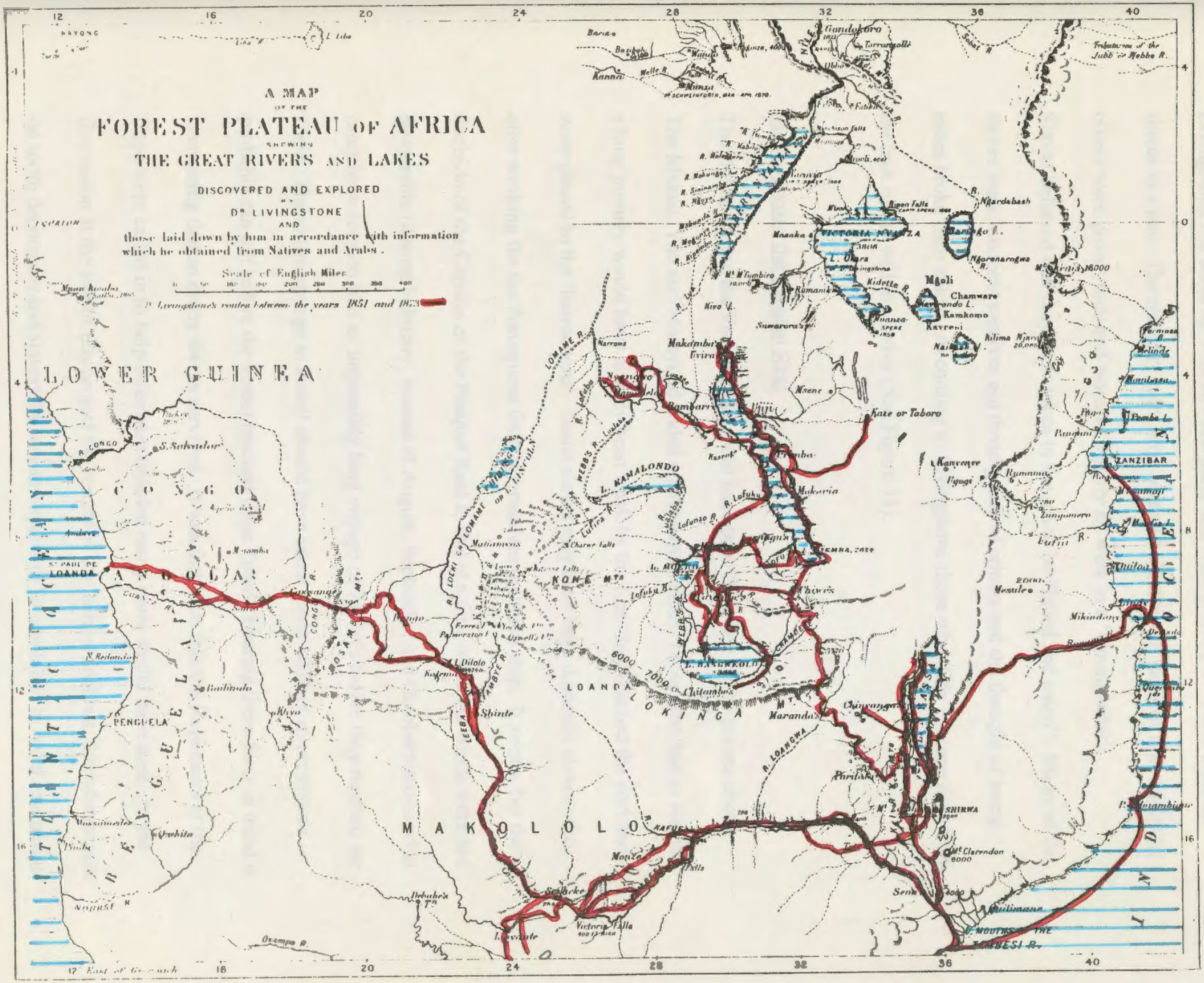


Figure 33: The Explorations of David Livingstone (Waller 1880)

Livingstone did catch up with an Arab party and went to inspect. There were 85 slaves in a pen. The majority were boys of about eight or ten years of age, while the others were grown men and women. Nearly all were in a 'taming stick'.
Slaves believed that they were taken to the sea to be "fatted and eaten". Many of the slaves were innocent captives not those guilty of crimes and the thought of being eaten broke their spirits. According to Livingstone those who didn't escape died from the lack of the will to survive (See Figure 33).

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Slaves aboard the Pacquet Real

The slaves aboard the Pacquet real could have been from any of the groups above. The Makua, Yao and Maravi all ended up at Mozambique. Those who had to survive a long journey would have already been weak by the time they reached the port and were placed in the 'barrocoons'. Some slaves may have been domestic slaves who, after working for the Portuguese found themselves on board ship. It seems that the decision of the Captain of the Pacquet Real to sail at a time when the winds were not favourable (during February, instead of August, September and October)caused what must have seemed like an impossibly long voyage of 71 days before they reached the Cape. The entire voyage to Brazil should have taken about 60 days so provisions probably ran out before the vessel reached Cape Town. Bearing these facts in mind it is amazing that so many slaves survived. It was fortunate that the Regiments at the Cape were called in to help otherwise unaided many more would have died. In the discussion at the end of this project the results of the isotope analysis, the information on tooth decoration and slavery in Mozambique will be combined in order to attempt to discern more about who these slaves were.

ISOTOPE MEASUREMENTS ON HUMAN SKELETONS

Carbon and nitrogen isotopes

Light stable carbon and nitrogen isotope measurements can be used to determine the diets of humans. The basis of this phenomenon is fractionation. Fractionation occurs when different isotopes of the same element are separated out, due to differentiation caused by physical and chemical reactions. These variations are predictable and occur in a patterned way in nature. For example, in the case of carbon there are different pathways through which plants synthesise carbon containing compounds using carbon dioxide from the atmosphere. There are three photosynthetic pathways C_3, C_4 and CAM. For the purposes of this project we are interested in the first two. C_3 plants consist of most trees and shrubs and cultivated food such as manioc, wheat, barley and rice. C_4 plants consist of most tropical grasses and also crops such as maize and sorghum (Van der Merwe 1982).

Carbon is taken into the human diet by eating plants and/or the animals that eat them. Carbon is found in bone. Analysis of calcified tissue results in an isotope ratio which can be interpreted because of our knowledge of C_3 and C_4 pathways. For carbon the isotopic ratio that we consider is ^{13}C to ^{12}C.

Nitrogen gas (N_2) is a common constituent of the atmosphere, and is fixed into plants through different processes. The study of nitrogen isotopic signatures can allow us to distinguish between marine and terrestrial organisms as well as plants that are nitrogen fixers or non-fixers. In nitrogen the isotopic ratio we consider is ^{15}N to ^{14}N.

Carbon and nitrogen isotope techniques can be applied to archaeological human bone so that we can discover what people in the past were eating. This method is a direct way of detecting diet in addition to traditional archaeological studies of faunal and other subsistence related debris/material/artefacts.

STRONTIUM

$^{87}Sr/^{86}Sr$ isotopes reflect the geology of the home environment of the individual whose collagen is being studied. This assumption works especially well in the past; from about 100 years ago and further back in time. Modern humans eat food brought into their home imported from other countries. This technique has been used in addition to carbon and nitrogen which give biological information. The method derives from a dating technique in geochemistry. Old rocks have higher $^{87}Sr/^{86}Sr$ than those recently formed. For the purposes of studies on historical and Holocene skeletons the $^{87}Sr/^{86}Sr$ values are effectively constant during this recent period (Sealy: 1989). $^{87}Sr/^{86}Sr$ is taken up into plants and animals through soils. The $^{87}Sr/^{86}Sr$ for coastal regions is 0,70923 (De Paolo & Ingram 1985). Therefore we would expect humans living in coastal belts eating some marine food to have values around this figure. Terrestrial animals in the south western Cape had values >0,715 (Sealy 1989). A sheep and cow bone respectively from Vergelegen gave values of 0,71283 and 0,71373 respectively (Sealy et al.1993). It seems that, at the Cape, the terrestrial signature is higher than the marine thus enabling us to discover from which zone an individual's food came.

Unfortunately this is a relatively new technique and a large comparative database of values has not been determined. However using this method on skeletal remains can help the analyst to discover whether individuals are local or foreign and whether they form a heterogeneous or homogeneous population. $^{87}Sr/^{86}Sr$ can be measured for different skeletal parts in order to determine whether an individual moved to another place during their lives. This presumption is based on the principles of bone turnover mentioned below.

CONCEPTS AND TERMINOLOGY

Before continuing it is necessary to define certain terms and concepts which will be used in the text from now onwards. Isotopic ratios are expressed as delta (δ) units as follows:

$$\delta\, ^{13}C = \left(\frac{^{13}C/^{12}C_{sample}}{^{13}C/^{12}C_{standard}} - 1 \right) \times 1000\ ‰$$

$$\delta\, ^{15}N = \left(\frac{^{15}N/^{14}N_{sample}}{^{15}N/^{14}N_{standard}} - 1 \right) \times 1000\ ‰$$

Results are reported in parts per thousand (‰) relative to the internationally accepted standard. Marine carbonate fossil from the Peedee formation in South Carolina is the standard for carbon. This standard has run out and other standards are used in laboratories around the world with known values so that results can be compared. The nitrogen standard is atmospheric air. Nitrogen isotope δ values are usually positive relative to the standard. Carbon isotope δ values for organic materials are negative compared with the standard and usually range from -28 to -5 ‰.

Composition of bone

The majority of research on the stable isotopes in archaeological bone has been done on collagen. Collagen is the structural protein that forms the organic matrix of bone. It is "...studded with crystals of calcium phosphate in the form of hydroxyapatite..." (Katzenberg 1992:107). Organic material comprises 30% of dry bone, of which 85-90% is collagen. 70% of dry bone is inorganic.

In a study performed by DeNiro and Schoeninger (1983) on the collagen of rabbits and minks who were raised on monotonous diet, only small variations in isotope ratios in different parts of the skeleton, in order of 1‰ or less were observed. The differences between males and females were negligible. If an individual is eating a uniform diet throughout life isotope ratios of different bones are effectively the same. We do know however that different body tissues have their respective formation histories.

BONE GROWTH AND TURNOVER

Skeletal structures obey different growth patterns. Growth is the process through which bone increases in size by increasing the number of cells and the intercellular material between them (Stout 1992). The main phase of growth is completed at maturity (adulthood); however this does not mean that bone is 'fossilised' (Hillson 1986:177). Bone continues to 'turn over', this process is known as remodelling. Remodelling involves the "...sequential removal(resorption) and replacement(formation) of old lamellar bone with new lamellar bone..." (Stout 1992:23). The rate of turnover has not been clearly established. The rate is of importance in isotope studies because it can determine the period of dietary history (Kennedy 1988).

Bone collagen in adults reflects a dietary average as it is laid down over a period of about ten or more years (Libby et al. 1964). Other estimates range to ≥ 30 years (Lovell et al. 1986). It has been established that remodelling rates vary according to age and bone type (Klepinger 1984). Spongy or cancellous bone, ribs for instance, are likely to turn over faster because of "...its thin bony structures fed by abundant blood vessels..." (Sealy et al. 1995).

The information that is available on bone turn-over comes largely from bio-medical studies, especially those estimating the effects of radioactive isotopes (from both internal and external sources) on body tissues. The 'Report of the Task group of Reference Man' is an extensive study to estimate the radiation dose to the human body. The idea is to define a reference individual in order to calculate dose. Every part of the human body has been analysed including bone. The annual turnover rate if the skeleton was calculated by using the turnover of calcium and strontium or were based on various quantitative histological methods (ICRP 1975). The turn-over rates listed below are mostly based on the inorganic component of bone which is not the same as turnover in the organic component. Young children have a higher turnover than adults: 1 year = 100-200%, 3-7 = 10%, 8 =1%, the turnover during adolescence was small. Values calculated for adults between the ages of 20-60 = 0,3-3 %. According to this study vertebrae turnover faster then other bone: 1 year = 72%, 5-6 = 20%, 10 = 30%, 20 =24% and adults 8%. Trabecular bone turns over 3 -10 times faster than cortical: cortical = 2,5 % per year (40 years for 100%), and trabecular 10% per year (10 years for 100%)

Table 1: Calculated turnover rates for different bones per year in adults (n=8) between 36-86 years of age (ICRP 1975:75).

Bone	Mean (%)	Range (%)
Ribs	4,7	2,2-10
Spine	8,3	3,6-20
Skull	1,8	0,6-4,6
Patella	3,6	2,4-5,0
Ilium	6,5	5,9-7,2
Femur	2,9	1,2-5,6
Proximal or upper end	5,7	2,6-9,4
Distal or lower end	2,5	0,8-4,2
Shaft	2,0	1,5-4,2
Tibia	1,1	0,4-2,6

TEETH

Dental tissues are not modified much after being deposited. Tooth enamel is formed during childhood and does not undergo remodelling. Dentine occurs in primary, secondary and sometimes tertiary form. Primary dentine is laid down during tooth formation and it is followed later in life by the formation of a smaller amount of secondary dentine around the pulp cavity. If a tooth is injured or decays, tertiary dentine is deposited (Hillson 1986). Therefore we can assume that isotopic signatures in the collagen of healthy teeth reflect mostly diet during childhood. Of the permanent teeth the first molars and first incisors emerge first. These are followed by the second incisors and third premolars, fourth premolars and canines and then the second molars. Third molars can appear in the late teens or adulthood or not at all (ibid.).

Therefore isotopic ratios of teeth reflect mainly diet in childhood, compact bone would suggest an average signature and ribs a more recent signature. Therefore we can observe any dramatic change of diet and possibly lifestyle by studying the isotopic ratios from different skeletal elements. Sealy et al. (1993,1995) have pioneered this more detailed use of isotopes on historical skeletons found in and near to Cape Town. A discussion of this work will take place below (See other studies).

OTHER STUDIES:

EUROPE AND NORTH AND SOUTH AMERICA

The use of stable isotope analyses in archaeology began in the 1970's (Vogel & Van der Merwe 1977). Since then a considerable number of studies have been performed (See Kennedy 1992 for a review). For the purposes of this project studies on historical skeletons are of particular importance.

Schoeninger et al (1983) compared the isotope values of historic people dependent on fish based diets with agriculturists. They also compared prehistoric people with different subsistence bases. The objective of this study was to show that $^{15}N/^{14}N$ ratios of bone collagen can be used to reconstruct the relative amounts of marine and terrestrial resources used by prehistoric and historic human populations. Marine organisms have higher $^{15}N/^{14}N$ ratios than terrestrial organisms and this difference is carried up through the food chain to humans. Samples were taken from three historic groups whose diets were composed of about 85% marine food. They are Alaskan Inuit and the Haida and Tlingit people from the Northwest Coast of the United States. Their δ^{15} N values range from +17 to +20 per mil and they have enriched $\delta^{13}C$ measurements. The Havihuh agriculturists from New Mexico and the manioc farmers from Columbia, South America had $\delta^{15}N$ values that range from+6 to +12 per mil. The Havihuh are maize farmers and have the most positive $\delta^{13}C$ values, because maize is a C_4 plant (See figure 34).

There is a progressive enrichment of $\delta^{15}N$ from lower to higher trophic levels in food chains i.e. from phyto-plankton, algae, zooplankton, fish and marine mammals. This should be considered when interpreting human bone collagen $\delta^{15}N$ values. Schoeninger et al (ibid.) conclude that the use of both $\delta^{15}N$ and $\delta^{13}C$ values can help to clarify and form more reliable dietary reconstructions.

Schoeninger (1989) analysed collagen from six Dutch whalers buried at Spitsbergen. Their average $\delta^{13}C$ value was -19,2 per mil and $\delta^{15}N$ was 12, 2‰. Their diet on board ship consisted of bread, cheese, salted or smoked meat and fish, groats (the grain of oats derived from the husks) peas and beer. They usually undertook one or two trips a year, each lasting four to five months. The whalers were from poorer regions of the country and their diets at home were similar to those on board ship. Their isotope values are tightly clustered: within the range of variation discussed earlier in the mink study indicating 'monotonous' diets.

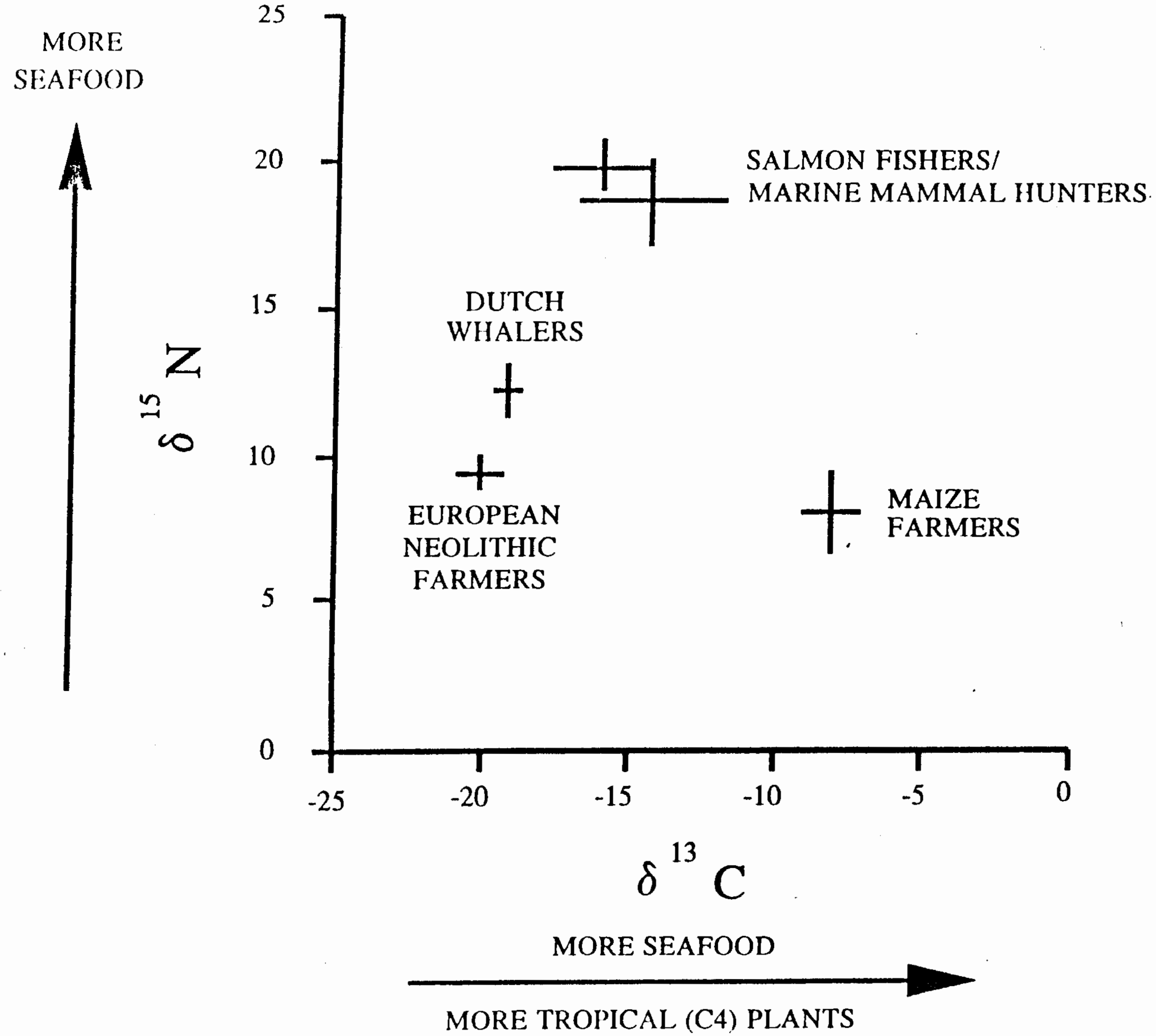


Figure 34: $\delta13C$ and $\delta15N$ values for archaeological human skeletons from different parts of the world. Sample sizes are: European Neolithic farmers (n=8), Dutch whalers buried at Spitsbergen (n=6), Haida and Tlingit salmon-fishers from northwestern North America (top most set of values)(n=8), Alaskan Inuit (n approx. 20), Havisu maize farmers from New Mexico (n=10). Values taken from Schoeninger (1989) & Schoeninger et al. (1983).

Other historical studies include those by Katzenberg (1991a) on the skeletons from Snake Hill military cemetery. This sample of 29 individuals showed considerable variation. These foot soldiers of the Northeastern United States were drawn from different regions and the staple grains eaten in these areas varied from wheat, rice (C_3) or maize (C_4). Some of these soldiers were American Indian and others were of European origin, so Snake Hill isotope results were compared to other studies of indigenous North Americans and Europeans. Their average $\delta^{13}C$ value was -15,8 per mil, indicating a mix of C_3 and C_4 foods.

Kennedy (1989) studied $\delta^{13}C$ values for various European populations. Nine individuals from the Mary Rose (sunk in 1545), representing British soldiers have an average $\delta^{13}C$ of -19,1per mil. This sample was taken from rib fragments. Their shipboard diet included fish, meat (venison, beef, chicken mutton and pork), vegetables (peas), fruits (wild cherries and plums), and nuts (hazelnuts). Fishing was also practised. There was also beer for the regular crewman and wine for the officers. From historical sources sixteenth century English seamen ate well (ibid.p.85-86). Kennedy also performed isotope analysis of individuals from France. Rib samples were taken from 35 skeletons dating from the fifteenth to the seventeenth centuries. French dietary habits are described as less nutritionally adequate than those of the English but the average here is -19,0‰, very similar to the Mary Rose.
Ten tibial shaft fragments were sampled from burials in the city of Tubingen in southern Germany. The average here is -19,7‰. This average is slightly less enriched than the French or British and this has been interpreted as displaying the least input by marine-based carbon.

Johansen et al (1986) have studied the carbon isotopes of Norwegians from inland and coastal areas and from prehistoric and historic sites. The $\delta^{13}C$ range is -12,8 to 22,7 parts per mil. The Stone/Bronze Age samples from southern Norway from coastal sites with agriculture -19,0; -19,8 and 22,2‰ , these more negative values are due to farming and the inclusion of terrestrial protein as opposed to marine protein.

Katzenberg (1991b) has analysed individuals who lived in South Ontario in ninteenth century Canada. They were expected to have $\delta^{13}C$ values reflecting consumption of wheat, barley, oats and rye, all C_3 plants, with some C_4 in the form of maize and sugar cane (molasses and or rum). The mean $\delta^{13}C$ value for the Harvie family is -18, 7‰ and the mean $\delta^{15}N$ is 12,4‰.

AFRICA AND SOUTH AFRICA

Ambrose (1986) and Ambrose and DeNiro (1986) outline the results of isotope analysis of historic and prehistoric African populations from Kenya, Tanzania and South Africa. The populations studied all have reasonably well known diets. In these studies carbon and nitrogen isotopes are used to distinguish marine foragers from people who consumed terrestrial resources, pastoralists from farmers, farmers consuming grains from those consuming non-grain crops and camel pastoralists from capri-bovine pastoralists.

One of the objectives of this project is to compare my results to those from a skeleton buried under the floor of the ruined slave lodge at Vergelegen in Somerset West. This slave lodge was abandoned in the first half of the nineteenth century. The isotopic analysis indicated a tropical origin for this woman in her youth and a change of diet and place of residence during adulthood. This was determined by comparing values for teeth, long bone and rib. The isotope signatures were consistent with a slave identity (Sealy et al. 1993). Slaves at the Cape were brought from Indonesia, India, the Malaysian peninsula, Madagascar, East and West Africa.

Isotopic analyses are available for two other skeletons from historical sites at or near Cape Town. The same technique of taking samples for carbon, nitrogen and strontium isotope analyses from teeth, long bone and rib was employed. Excavations at the original Fort built by Jan Van Riebeeck's men in 1673 revealed a burial. The precise date of the burial has not been determined but it was probably during the second half of the seventeenth century. This individual was probably either a sailor or a soldier (Sealy et al. 1995).

A skeleton was also excavated at Oudepost 1, a Dutch East India Company Outpost about 100km north of the main settlement at the Cape of Good Hope. The individual was male and was between 45 and 60 years old. It is suggested that these are the remains of a soldier in the service of the Dutch East India Company who died in the late seventeenth or eighteenth century. A second possibility is that this individual died on board a passing ship and was buried at Oudepost.

SAMPLING STRATEGY

The Fort Knokke skeletons are housed at the South African Museum. All the material is labelled Fort Knokke with no indication whether they are from the first or second excavation. Rose-Innes's project (1992) was used as a guideline to the contents of the many boxes available as she was able to discern through anatomical study whether the skeletons were from the first or the second excavation.

Samples for isotopic analysis were taken from bone associated with different individuals with decorated teeth, from Singer's first excavation. They are probably slaves and their isotopic signatures will serve as confirmation. Samples were also taken from some robust male individuals, Singer's subsequent excavation.

FIRST EXCAVATION

SAM-AP 4773 (UCT 5401, UCT accession numbers are given to all samples processed in the University of Cape Town archaeometry laboratory)is probably female and her maximum age is 16 (Rose-Innes 1992). It is difficult to determine sex in juveniles. Skeletons all appear to be more gracile and therefore female-like (Pfeiffer pers.comm). Rose-Innes based this sex estimation on feminine features of the skull. A fragment of left mandible was taken associated with teeth (RI1 and RI2) that have been filed to points.

SAM 4774 was extensively sampled in the hope of observing any change of diet during life. Age estimation techniques applied to this individual indicate that he or she is approximately 12 years old. This age estimation was calculated using epiphyseal fusion and tooth formation. Samples were taken from the maxillary left canine (UCT 5402), the left occipital (UCT 5619), the shaft of the left femur (UCT 5403), trabecular bone of the same femur (UCT 5617), the palate (UCT 5618) and two samples of the same rib (UCT 5404, 5616). SAM 4774 has a notch between the maxillary first incisors and pointed second incisors.

Rose-Innes suggested that SAM 4776 C was juvenile and female. Samples were taken from the root of the upper first molar (UCT 5405), the left parietal (UCT 5406) and the palate (UCT 5620). These samples are all directly associated with the decorated teeth. The mandible has a left incisor with a square chip filed out of it and from the dentition this individual is a young adult, one third molar present (Ubelaker 1989).

SAM 4872 is an adult male. This box is supposed to consist of a complete cranium, however the mandible is not present. In Rose-Innes's description all four of the upper and lower incisors have filed teeth. Samples were taken from the right parietal (UCT 5407), the sinus bone (UCT 5622) and the root of the maxillary third molar (UCT 5621).

SAM 4764 consists of a complete cranium with what could be pipewear or decoration. There is a notch chipped out of the left first incisor (the adjacent teeth are missing). This notch was interpreted by Singer (1955) as being decoration. Rose-Innes (1992) suggested that it was pipewear because of its smoothly rounded arc shape. It is however unusually placed since pipe-smokers do not usually hold thier ppipes for extended periods between their first incisors. Isotope analysis will be able to clarify whether this individual is of African or European origin. Samples were taken from the sinus bone (UCT 5628) and frontal bone (UCT 5629). One third molar has erupted, so this is probably a young adult. Rose-Innes observed female features in the skull morphology.

SAM 4765 is probably female and consists of a complete cranium. She was a young person probably between the ages of 15 and 21 (Rose-Innes 1992). She has slight cribia orbitalia and is presumed to be one of the slaves. Two samples were taken one from the lower right canine (UCT 5419) and one from the left parietal (UCT 5420).

SAM 4788 consists of a cranium and three cervical vertebrae. The right canine is still erupting making this individual ten or eleven years old ± 30 months (Ubelaker 1989:64), too young to sex. It has a projective bite and also has cribia orbitalia. Samples were taken from the upper premolar (UCT 5421), the left occipital (UCT 5422) and the palate (UCT 5623).

SAM 4768 consists of three individuals. Two are young and samples were taken to assess whether they are slaves and therefore associated with the various crania that have been boxed separately. The head of the femur of SAM 4768A is unfused making it either 15-18 years if it is male or 13-17 years if it is female (Ubelaker 1989:75). Two samples were taken from this femur: from the shaft (cortical bone (UCT 5626)); and trabecular bone (UCT 5627).

SECOND EXCAVATION

SAM 4778 is a robust, adult male with large muscle attachments. He has tar staining lingually on his molars. There is a handle of sorts in this box, possibly associated with this skeleton. Samples were taken from the first molar (UCT 4778), fibula (UCT 5409) and a rib (UCT 5410). These different skeletal elements were sampled in the hope of being able to see any changes in diet that this person may have experienced.

SAM 4780 includes two robust males. Stature reconstruction has been attempted on a left and right femur with heights of 186,61 cm and 185,86 cm respectively (Rose-Innes 1992). An upper incisor (UCT 5411) and a rib (UCT 5412) were sampled but they may not be from the same individual.

SAM 4782's right femur was used for stature reconstruction and this robust male is estimated to be about 166,79 cm tall. He has pipewear on the second right incisor and right canine. A sample was taken from his upper first molar (UCT 5413). First molars are useful for stable isotopes because they are the first of the posterior teeth to form. Samples were also taken from a rib (UCT 5414) and the shaft of the left tibia (UCT 5415).

SAM 4774 is also a robust male. This box includes fragments of wood and shell. Stature estimations from the left femur indicated a height of 172,77 cm and the right femur 171,28 cm. Samples were taken from the upper second molar (UCT 5416), a rib (UCT 5417) and the humerus (UCT 5418).

SAM 4763 also has pipewear but in a different position to SAM 4782. He has a rounded arc between his right first incisor and second incisor on the mandible and the maxilla. He was less robust than SAM 4782 and was approximately 170,91 cm tall. Samples were taken from the palate (UCT 5624) and the maxillary left first molar (UCT 5625).

ANALYTICAL METHODS

CARBON AND NITROGEN ISOTOPES

Two techniques were employed in this study to extract collagen from bone.

1) Bone chunks were surfaced cleaned and decalcified in 1-2% hydrochloric acid (HCl)until all the mineral had dissolved. This process took between 10 days and two weeks. The acid-insoluble protein was then placed in 0,1M sodium hydroxide (NaOH) overnight to remove any humic acids. The collagen was then rinsed repeatedly in distilled water over a period of a week or more until it reached neutrality. The final step in the preparation process was to freeze-dry the samples.

2) A second method was used on trabecular bone and small, fragile pieces of palate and sinus bone. The technique was a combination of the DeNiro (n.d.) and Kennedy (1989) methods. Bone fragments were crushed with a pestle and mortar to form a fine powder. The powder was weighed together with fine sand particles trapped in the structure. In most cases all the sample available was used. Six out of the eight samples amounted to less than the recommended 0,5g (DeNiro). This was acceptable for our purposes because of our laboratory's mass spectrometry technology that only requires a small amount for analysis. The powdered bone was placed in a sintered glass filter cup on fibre glass paper. The filter paper was flush with the bottom and sides of the cup. Approximately 40ml of 1 M HCl was added to the cups and was left to sit for 20 minutes. The filter cups were then placed on Buchner flasks and rinsed until neutral. Each cup was rinsed at least three times. 40 ml of 0,125 M NaOH were added to the bone residue. To ensure a thorough soaking the filter cups were placed in

80ml beakers for a 24 hour period. Each cup was covered with parafilm. The samples were then rinsed until neutral. In order to solubilize the collagen 50ml of 0,001M HCl (pH 3) were added and the samples were placed in a preheated oven at 95° C, covered with foil and left for 20 hours (Kennedy 1989). The pH was adjusted after five hours. The filtrate was drained into small flasks through the cup funnel. These small flasks were placed in the oven at 75°C to reduce the sample. The sample was evaporated further and placed in small vials until almost dry.

The yield of collagen extract from this method proved to be very low. There appeared to be a build up of salts. When these samples were run on the mass spectrometer the carbon content was more or less as expected, and the size of the CO_2 peak was such that the isotope ratio measurement is likely to be reliable. The nitrogen content was low and peaks fell below what was needed for these results to be reliable. For this reason the nitrogen readings for the gels have not been cited.

The resulting collagen from both methods was weighed out to approximately 0,3 mg. These tiny samples were placed in special foil capsules. The capsules were carefully pressed to remove air and manipulated into a small ball with the help of tweezers and a spatula. These small balls were placed in special tray that keeps each sample separate until it can be loaded into the mass spectrometer.

MASS SPECTROMETRY

The samples were then loaded into the carousel of the Finnigan MAT 252 light isotope mass spectrometer. This mass spectrometer has an on-line Carlo Erba preparation unit. Each sample is dropped into the oxidising tube and combusted at a temperature of 1600° C . The products of combustion flow into a reducing column that converts nitrogen oxides into nitrogen gas. The gas moves into the Conflo device which regulates the admission of CO_2 and N_2 in sequence into the Mass Spectrometer. The ratios of the sample gases are measured against the ratios of the reference gas. The reference gas is pegged to PDB by running a series of Merck gel standards. The sample ratios are corrected to values for the Merck gel standard: $\delta^{13}C$ to -20‰ and $\delta^{15}N$ to 7,5‰.

STRONTIUM ISOTOPES

The use of strontium isotopes as a reliable source of information depends upon being sure that the results obtained are for biogenic and not diagenetic mineral. Archaeological bones are recovered from different soils. Coastal soils, for example, have circulating strontium of around 0,709. Inland soils may be derived from sandstone rocks that probably have high ^{87}Sr / ^{86}Sr (Sealy et al. 1991). The solubility profile technique was developed to remove the diagenetic material in bone (Sillen 1986).

Solubility profiles:method

This technique relies on the difference in solubility between biogenic and diagenetic apatite (Sillen 1986). The diagenetic material is usually more soluble, particularly if it encorporates carbonates.

Each sample was surface-cleaned and milled in a Spex model 6700 freezer-mill under liquid nitrogen. The procedure involved weighing out 50mg of powdered sample into an Eppindorf microcentrifuge tube. One ml of 100-mM acetic acid / sodium acetate buffer adjusted to pH 4,5 was added to the powder. The Eppindorf tube was then tapped hard in order to dislodge the sample from the bottom of the tube. The tube was placed in the ultrasonic bath for 1 minute. After centrifugation for 10 seconds, the buffer was decanted and the supernatant saved for elemental analysis. This extraction procedure was repeated eighteen times on each powder. The series of supernatants thus represented a profile of soluble mineral.

The strontium and calcium for each wash was then measured in an inductively coupled plasma atomic fluorescence spectrometer, the Jobin Yvon 138 Ultratrace ICP. This machine combines simplicity of operation and freedom from spectral interference. The sample solution is introduced into a very hot 'flame' (plasma) and the characteristic wavelenghts emitted by the various elements monitored. The high temperature of the plasma virtually eliminates inter-element interference. In this study, calcium, strontium and phosphate levels were determined. The results of this measurement can be seen in Figures 35-37. The Sr/Ca in the washes usually peaks earlier on in the profile, representing some contamination. The curves then stabilise at about 2,1 the expected ratio for bone. Washes were pooled from the plateau sections

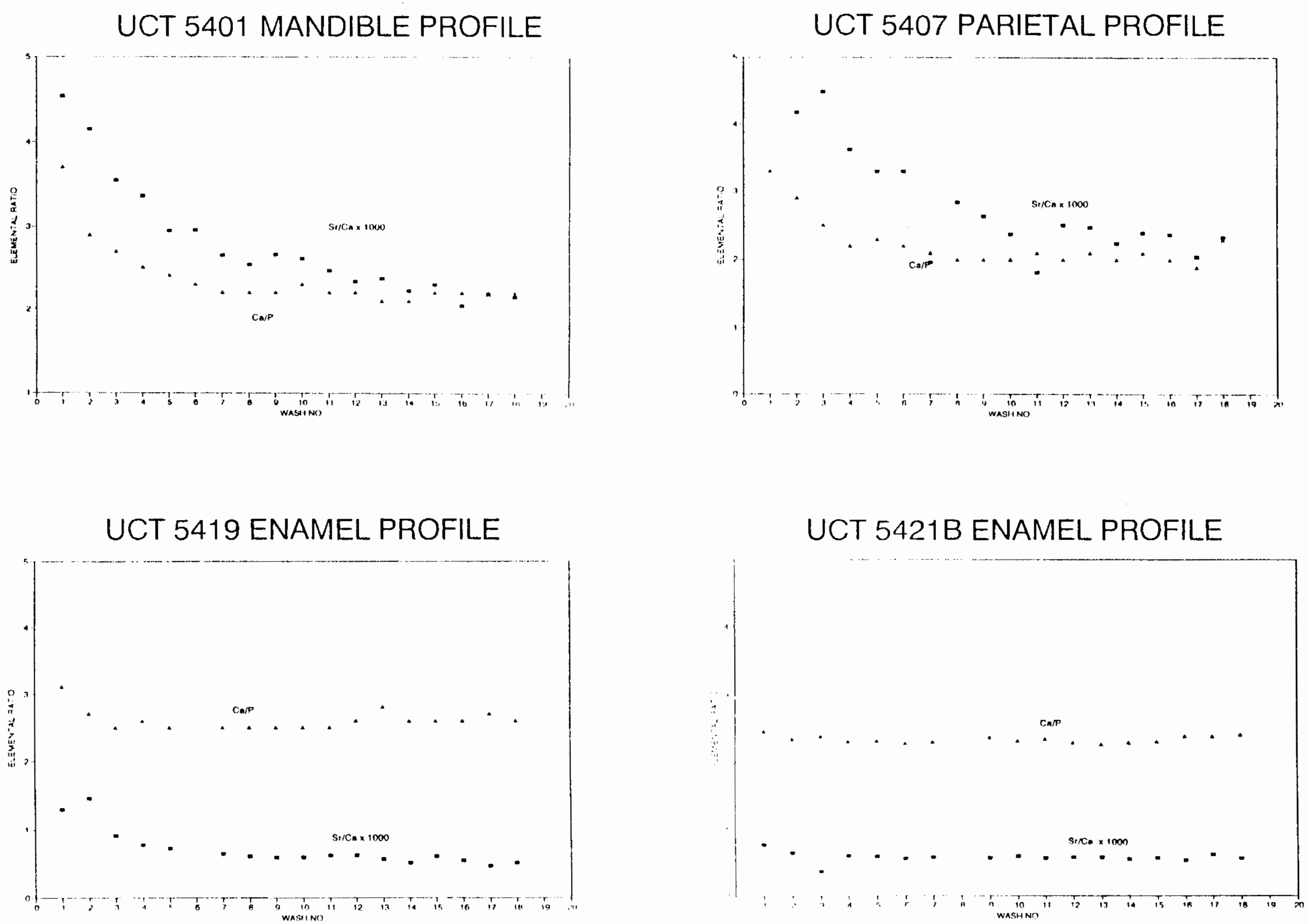


Figure 35: Sr/Ca ratios for SAM 4773 (UCT 5401), SAM 4872 (UCT 5407), SAM 4765 (UCT 5419) & SAM 4788 (UCT 5421B) Washes were pooled for strontium isotope measurement as follows: UCT 5401,11-18; UCT 5407,10-18; UCT 5419,7-18 & UCT 5421B, 10-18

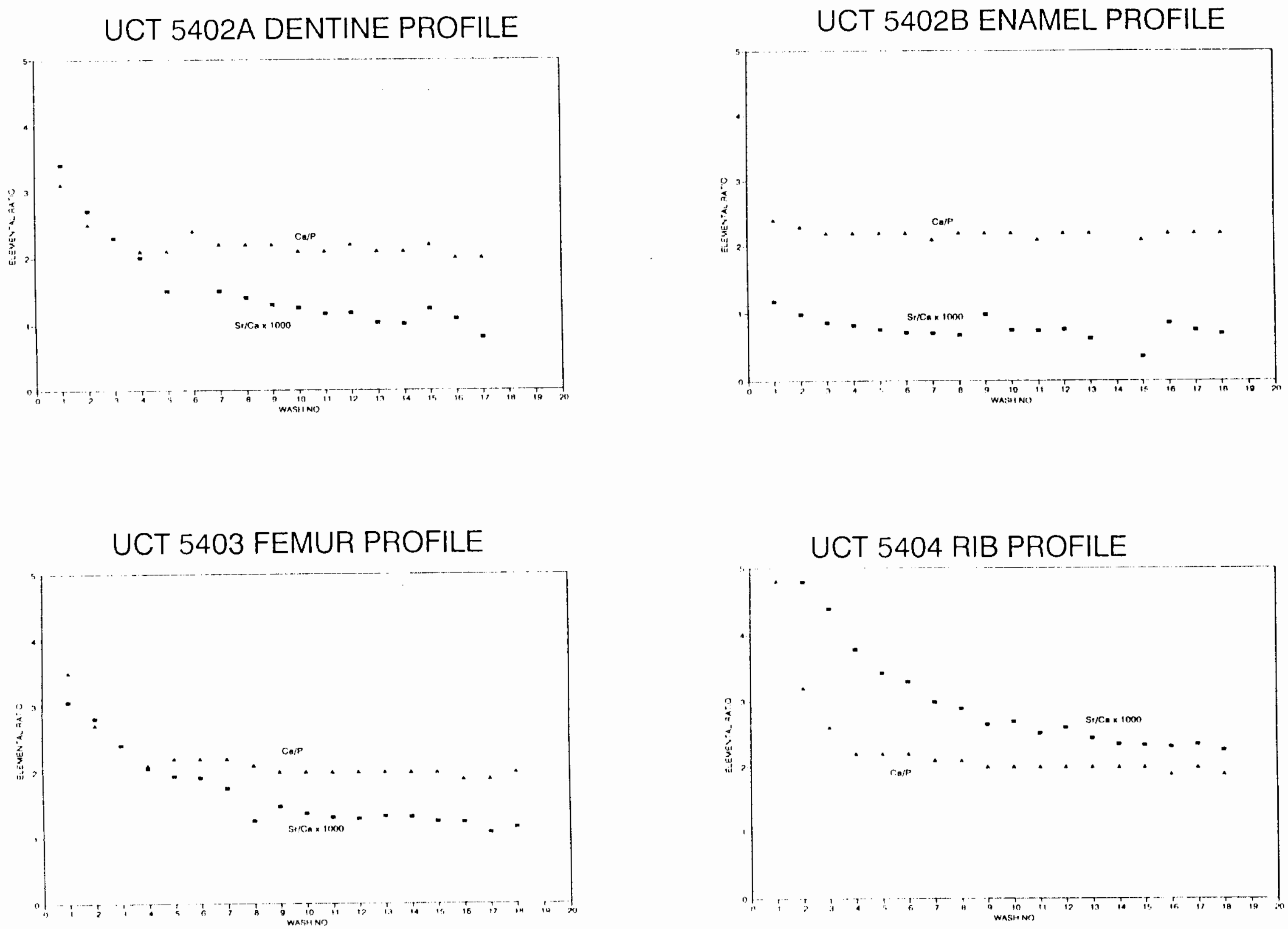
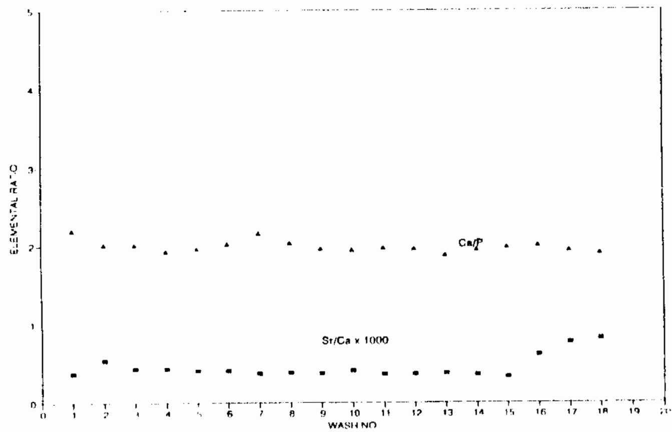
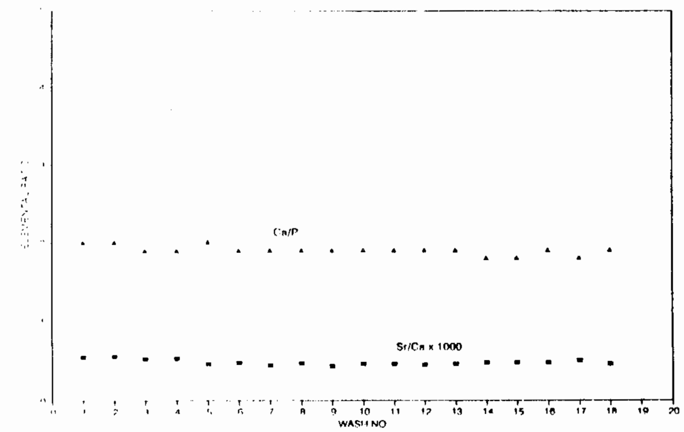


Figure 36: Sr/Ca ratios for SAM 4774 (UCT 5402A, 5402B, 5403 & 5404)
Washes were pooled for strontium isotope measurement as follows: UCT 5402A,6-14; UCT 5402B,7-18 excl.15; UCT 5403,9-16 & UCT 5404,10-18.

UCT 5408 ENAMEL PROFILE



UCT 5411 ENAMEL PROFILE



UCT 5416 ENAMEL PROFILE

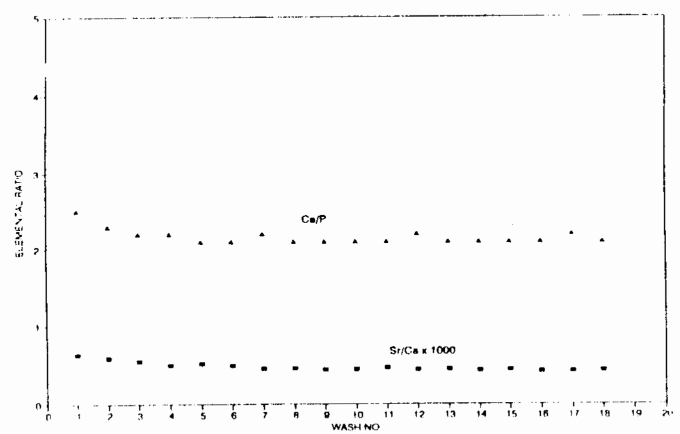


Figure 37: Sr/Ca ratios for SAM 4778 (UCT 5408), SAM 4780 (UCT 5411) & SAM 4775 (UCT 5416)
Washes were pooled for strontium isotope measurement as follows: UCT 5408,10-18; UCT 5411,all washes & UCT 5416,3-18.

of the curves. Strontium isotope measurements were performed on a VG Sector mass spectrometer. Strontium isotope results are given to five decimal places, and they have been normalised to a value of 0,71023 for the NBS standard SRM 987. This normalisation is necessary in order to compare these values with earlier studies

RESULTS AND DISCUSSION

Table 3 summarises the results of the analyses of all the skeletons. In addition Figures 38-45 represent individuals, groups and comparative results discussed below. The slave skeletons have isotopic values that indicate the consumption of tropical grains during the early stages of life, followed by a clear change of diet. This consistent trend is explained as lifestyle change and not simply normal variation. All the isotope results taken together: carbon, nitrogen and strontium indicate a heterogeneous population.

The stable isotope analyses of the European males, from the second excavation, indicate a diet based on C_3 plants which would include grasses of the more temperate zones such as wheat, barley, oats, rice and many vegetables. Western Europe has no indigenous C_4 plants. Four of these individuals show little variation within the skeleton, and similar $^{87}Sr/^{86}Sr$. This appears to be a homogenous group, with the exception of SAM 4763.

The results fell into the two groups, proposed above, based on morphological differences. Thus for a clear explanation the results will be discussed under the following headings: Slaves in transit and Sailors or soldiers: locals or foreigners.

SLAVES IN TRANSIT

Samples of tooth and bone tissue were taken, where possible, for isotopic analysis. The skeletons are incomplete, so that it was not possible to select exactly the same

TABLE 3: SUMMARY OF THE SAMPLING STRATEGY AND ALL THE RESULTS

SAM no.	UCT no.	SEX	AGE	PATHOLOGIES	BODY PART	$\delta^{13}C$	$\delta^{15}N$	$^{87/86}Sr$
4773	5401	female	max.16	RI1, RI2 + LI1 are filed to points	left mandible	-13	6,1	0,71910
4774	5402	female?	approx. 12	notch between central incisors	mandibular	-7,9	9,2	dentine: 0,71328
								enamel: 0,71399
	5403			and pointed	femur left	-7,9	8,6	0,71356
	5404			lateral incisors	rib	-20,1	11,6	0,71743
	5616				rib (repeat)	-20	11	
	5617				femur - trabecular bone	-15,3		
	5618				palate	-15,3		
	5619				occipital left	-12,2	8,4	
4776C	5405	female?	juvenile	LI1 square chip filed	root upper first molar	-11	7,8	
	5406				left parietal	-11,2	7,6	
	5620				palate	-14,7		
4872	5407	male	adult	upper and lower incisors filed to points	parietal	-12,1	5,2	0,71376
	5621				root of max. 3rd molar	-11,5	7,6	

SAM no.	UCT no.	SEX	AGE	PATHOLOGIES	BODY PART	$\delta^{13}C$	$\delta^{15}N$	$^{87/86}Sr$
	5622				sinus bone	-16,8		
4765	5419	female?	juvenile	cribia orbitalia	canine	-12,8	7,8	0,71148
	5420				parietal	-14,2	6,1	
4788	5421	female?	<21	cribia orbitalia	premolar	-14,2	9,4	0,70957
	5422				occipital	-11,3	7,1	
	5623				palate	-15,3		
4768	5626				femur-shaft	-13,2	7,5	
	5627				femur-end	-17,4		
4764	5628		< 21	chipped LI1	sinus	-17,7		
	5629				frontal	-10,2	7,8	
4778	5408	male	adult	robust , large muscular	1st molar upper	-19,3	11,9	0,70968
	5409			attachments	fibula	-19,6	11,9	
	5410			tar staining lingually on molars	rib	-19,5	10	
4780	5411	male	adult	large, robust	upper incisor	-19,3	11,2	0,70937
	5412				rib	-19,2	12,1	
4782	5413	male	adult	pipe-wear RI2	first molar	-20,3	11,7	0,70994
	5414			R canine	rib	-20	11,2	
	5415				tibia	-20,2	11	
4775	5416	male	adult	large robust	2nd molar	-19,5	12,1	
	5417				rib	-19,4	11,7	
	5418				humerus	-19,1	11,8	
4763	5624	male	adult	pipewear	palate	-13,5		
					maxillary first left molar	-16,8	11	

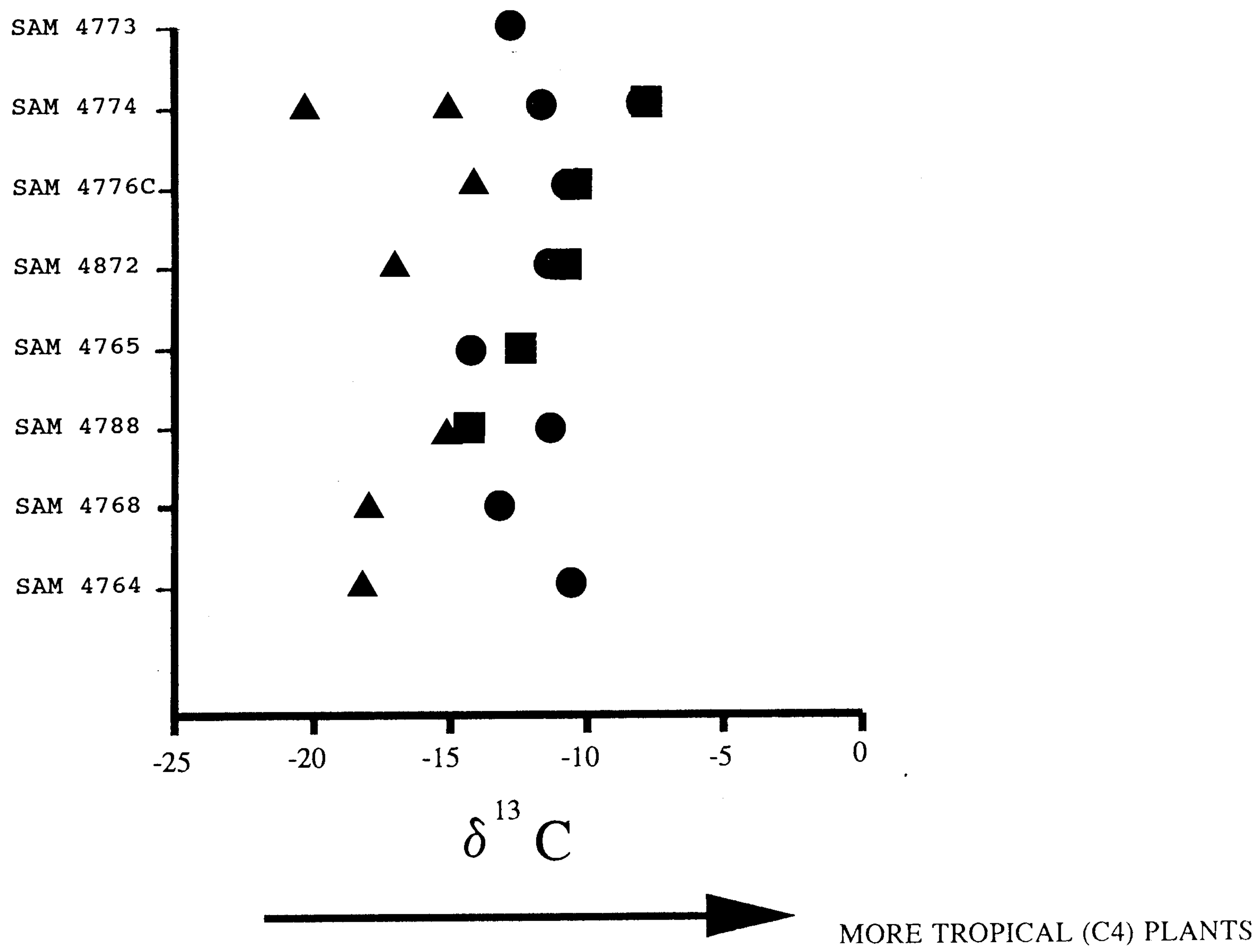


Figure 38: Carbon values for all East African slaves. Squares represent teeth, circles compact or cortical bone and triangles bones that have fast turnover rates.

bone from each skeleton. The sampling strategy involved choosing: a tooth formed in early childhood; cortical or compact bone; and bone with a fast turn-over rate, such as rib or palate. Specimens chosen contain tissue laid down at different stages of the individual's life. Pathological lesions were avoided, as were teeth that had been intentionally or unintentionally modified. A pattern has emerged, the result of different diets at different stages of life. This pattern can be illustrated by calculating a series of averages on the three categories of tissue chosen for analyses. The averages are: teeth at -11,55 $\delta^{13}C$ (n=5); cortical bone at -12,2 $\delta^{13}C$ (n=8); and bone with a fast turn-over rate (such as sinus, palate rib and trabecular bone) at -16,2 $\delta^{13}C$. In each skeleton $\delta^{13}C$ values become more depleted during life (See Figure 38).

The results of analyses from teeth indicate diet during childhood. For example, the first molar forms in the first decade of life, whereas the third molar forms later, usually in the early twenties. The average value for different teeth is: -11,5 $\delta^{13}C$ indicating a mixed diet with slightly more C_4 plant content than C_3. Their diets could have involved eating sorghum, millet and manoic. These results are consistent with what would be expected in the woodland savanna environment of Mozambique and its hinterland, which includes C_4 grasses and C_3 shrubs. Values range from -7,9 to -14,5 ‰ and it seems that these slaves spent their early years in different areas of Mozambique. This is a heterogeneous group and each individual will be discussed below in an attempt to identify them with specific groups who fell victim to the slave trade.

The average $\delta^{15}N$ for teeth is 8,36‰ with a range from 7,6 to 9,4 ‰. These values indicate a terrestrial lifestyle with the more positive numbers possibly suggesting some dependance on domestic animals (Ambrose 1986). There is a trophic level enrichment in $\delta^{15}N$ large enough to serve as an indicator of trophic level. More enriched $\delta^{15}N$ could also be the result of a marine component in the diet. SAM 4788 has a strontium isotope value of 0,70957: close to that expected in a marine or coastal environment. She also has the most enriched $\delta^{15}N$ value of 9,4‰.

Cortical bone was sampled from all eight individuals. The average $\delta^{13}C$ is -12,2 ‰, with a wide range of variation from -7,9 to -14,2‰. Cortical bone should indicate a lifetime average; it turns over slower than trabecular and cancellous bone but unlike teeth it continues the remodelling process throughout life. This average is slightly more negative than the average for teeth, indicating a marginal decrease in C_4 or an increase in C_3 consumption. Compact bone values are intermediate between teeth and spongy or cancellous bone. The teeth and cortical bone values fall within the normal range of variation expected within an individual (DeNiro 1983). An important aspect to consider when interpreting these results is that five out of eight of these skeletons are juveniles. Teeth and dense bone would have been laid down more or less simultaneously and should therefore give similar results.

The $\delta^{15}N$ average is 7‰, with a range of variation from 5,2 to 8,6 ‰. This value is marginally lower than that obtained for teeth. This less enriched value may indicate a decrease in animal protein, such as milk.

Samples of bone with quicker turn-over rates were taken from six individuals with remarkable results. The average $\delta^{13}C$ is -16,2 ‰, with a range from -14,7 to -20,1 ‰. It is clear from this wide range of values that there is considerable variation in diet within this group. All six of these slaves increased their consumption of C_3 plant foods during the last part of their lives. The forced removal of these slaves happened shortly before their deaths. Sinus, palate, rib and trabecular bone are valuable indicators of dietary change, when compared to denser bone and teeth.

The limited information available on turn-over rates has been cited earlier. It would be especially interesting to establish the period of time over which dietary change took place. The eight slaves sampled include three young adults (SAM 4776C, 4872 and 4764) and five juveniles (SAM 4773, 4774, 4765, 4788 and 4768). Bone turns over more quickly in juveniles and young adults who are still completing growth (ICRP 1975).

All of these slaves would have had to endure an arduous journey from their villages to the port of Mozambique. These slave chains have been described by Livingstone (Waller 1880). If a slave came from the region west of Lake Nyassa or from the Yao territory this journey may have taken many months. Even the Makua who lived in the hinterland of Mozambique would have had to endure a slow march and much waiting as sufficient slaves were accumulated for sale in Mozambique. Joining the slave gang would have involved a change of diet, perhaps to dry bread or manioc.

Upon arriving at the port they were placed in 'barracoons' or holding pens, until they were sold. Slaves were kept in these pens until a ship arrived to take them to their destination. Thousands of slaves died while waiting to depart (Alpers 1975). This stay at the 'barracoons' could also last for a few months, and depended on the availability of traders, vessels and favourable winds. The Pacquet Real departed during unfavourable winds. Perhaps the slaves had been waiting in the port for sufficient time for their condition to be deteriorating and it was necessary to get them to Brazil before money was lost. Captain De Souza was in debt and was possibly impatient to be on his way.

It is possible that some of the slaves took a different route, from captivity to ending up on board the Pacquet Real. Slaves were also placed in domestic households, until the owner was ready to sell them to a passing ship or trader.

The journey on board the Pacquet Real took 71 days; over two months. The change of diet seen in these slaves could have occured over as little as six months, in the younger slaves or longer in the case of the young adult slaves.

Strontium isotope results were obtained for five of the slaves. $^{87}Sr/^{86}Sr$ values range from: 0,70957; which reflects a marine or coastal value; to 0,71910. The range of 0,00953 between these values indicates that slaves came from different environments. Four strontium measurements were taken from SAM 4774: enamel; dentine; femur and rib were sampled. Variation in the third place coincides with the change in diet observed in the carbon and nitrogen isotopes.

Results for SAM 4774 are particularily striking and show a great deal of variation in the stable isotopes. A sample from a maxillary canine has a relatively positive $\delta^{13}C$ of -7,9‰ and $\delta^{15}N$ of 9,21‰. This combination can only result from the consumption of C4 grains as a staple food supplemented by some hunting and fishing indicated by the slightly enriched $\delta^{15}N$ (See Figure 39).

Two samples were taken from cortical bone. The dense femur shaft gave carbon and nitrogen results similar to the canine. The less compact left occipital bone has a $\delta^{13}C$ of -12,2 ‰ and $\delta^{15}N$ value of 8,4 ‰. The $\delta^{13}C$ value is 4,3‰ more negative than the canine value. Bone from the cranium appears to have a faster turnover rate than that from the shafts of long bones. The trabecular bone of the same femur was sampled, and indicated a substantial change of diet. The $\delta^{13}C$ value is -15,3‰. A fragment of palate was sampled with an identical result. (Nitrogen values are not reliable and have not been cited.) Trabecular bone and the palate are constantly being remodelled and are good indicators of dietary change. Duplicate analyses of a rib gave values of -20 and -20,1‰ $\delta^{13}C$ and 11,6 and 11,1‰ $\delta^{15}N$. These carbon and nitrogen values are within the normal variation expected for bone. SAM 4774 was approximately twelve years old when she died.

$^{87}Sr/^{86}Sr$ for the dentine of the canine is 0,71328 and 0,71399 for the enamel. The femur has $^{87}Sr/^{86}Sr$ of 0,71356 and the rib has a value of 0,71743. The rib $^{87}Sr/^{86}SR$ in combination with the light isotope results is compelling evidence for a change of lifestyle. Remodelling of the rib incorporated strontium of higher $^{87}Sr/^{86}Sr$. The

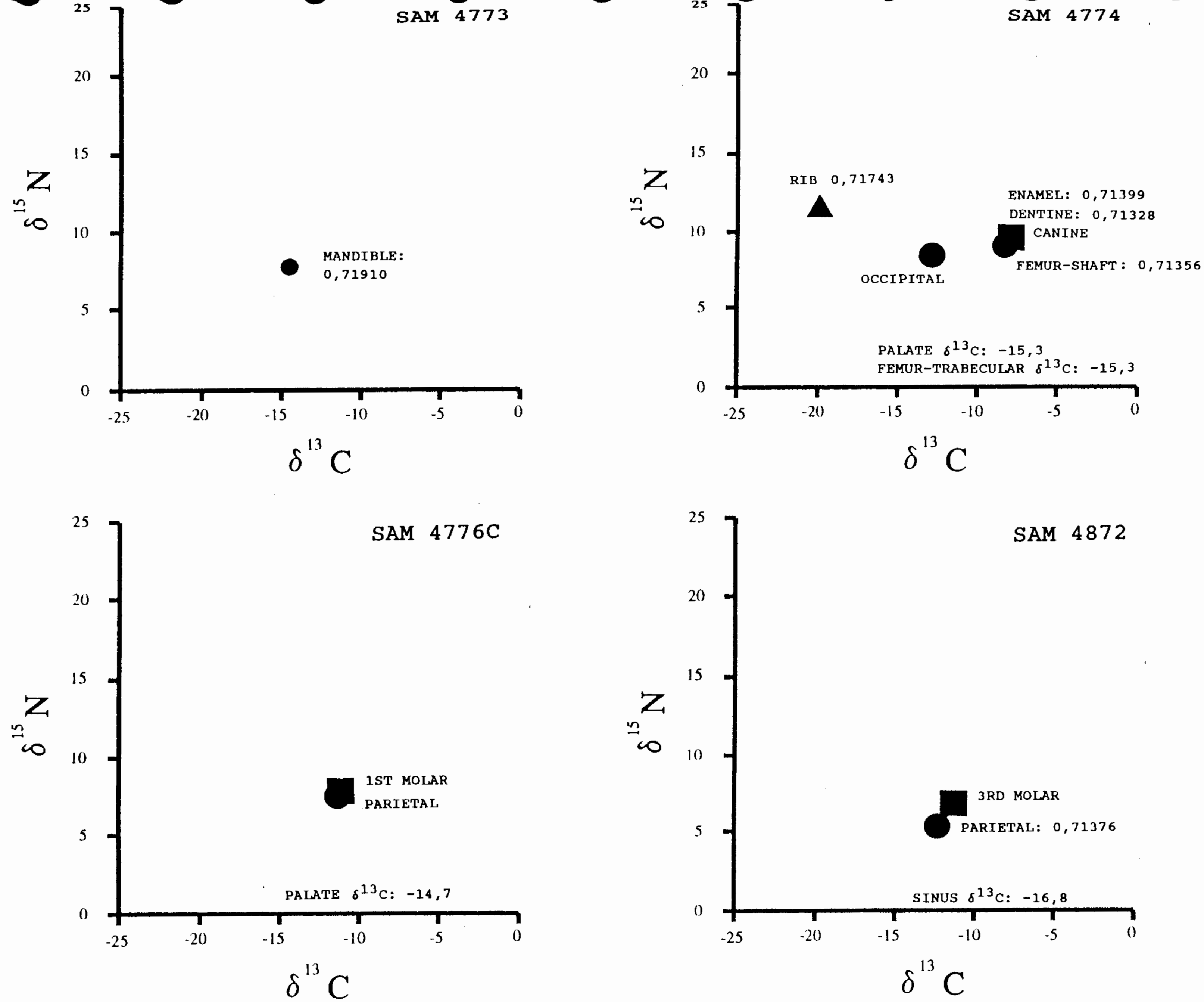


Figure 39: Carbon, nitrogen and strontium isotope results for SAM 4773, 4774, 4776C and 4872.

nitrogen isotopes (see above) have become more positive which could indicate the consumption of seafood. If there was an increase in marine food consumption, the strontium value should probably be lowered, however, in this individual the $^{87}Sr/^{86}Sr$ has increased. The more positive nitrogen values could be due to the addition of meat and/or animal products to the diet. The increased $\delta^{15}N$ could also be due to aridity, if he or she moved to an area that receives less 600mm of rain per annum.

The $^{87}Sr/^{86}Sr$ value for the dentine is close to that of the femur. In an adult, because of secondary dentine, strontium values would be closer to that of the bone recently remodelled. In this twelve year old, the enamel values are higher, closer to that of the rib. This is because secondary dentine has not (yet) been laid down.

The spread of values indicates an early diet rich in tropical grains and poor in seafood and or meat. This was followed by a considerable change in diet seen in bone that turns over quickly. The dietary change was not over a long enough period to alter the isotope signatures of the dense shaft of the femur.

SAM 4773's mandible (UCT 5401) has a $\delta^{13}C$ of -13‰. Compact bone represents a lifetime average, which in this person's case was no more than 16 years. The carbon isotope value is rather positive, indicating a mixed diet including foods derived from tropical (C_4) grasses. The $\delta^{15}N$ of 6,1 is consistent with a terrestrial diet with very little, if any, seafood. $^{87}Sr/^{86}Sr$ is 0,71910, the highest value obtained from these specimens. A variation of 0,00953 between the mandible and the value already established for a marine environment is sufficient to suggest that this person lived inland (See Figure 39).

SAM 4776C's childhood diet included the consumption of C_4 and C_3 crops with very little seafood. A $\delta^{13}C$ value from the faster remodelling palate is 3,5‰ more negative. This young, female adult began eating more C_3 plants toward the end of her life. This change in diet occured over a short period of time, and cannot be observed in the slower to remodel parietal bone (See Figure 39).

SAM 4872 is an young adult male (minimal wear on teeth). The root of the maxillary third molar has a $\delta^{13}C$ value of -11,5‰ and $\delta^{15}N$ of 7,6‰. The third molar is the last tooth to be formed, often in the early twenties. These results indicate a mixed diet with little, if any seafood (or meat). The difference between the third molar and parietal $\delta^{13}C$ is within the range of variation for a single bone at 0,5‰. The 2,5‰ more negative shift in $\delta^{15}N$ may indicate less seafood or simply the expected normal variation. Sinus bone signatures indicate a change of diet, reflected in a $\delta^{13}C$ value of -16,7‰, probably involving the increased consumption of C_3 plants. (There is no $\delta^{15}N$ value for this bone.) Sinus, like the palate and trabecular bone, remodels at a faster rate than more compact cranial bone (See Figure 39).

Debate involving the origin of SAM 4764 has been resolved through the isotope results. The notch present in the upper incisor has been interpreted as being pipewear or tooth decoration respectively. The frontal bone has a $\delta^{13}C$ value of -10,2‰ and $\delta^{15}N$ value of 7,8‰. This individual consumed C_4 grains in a well watered

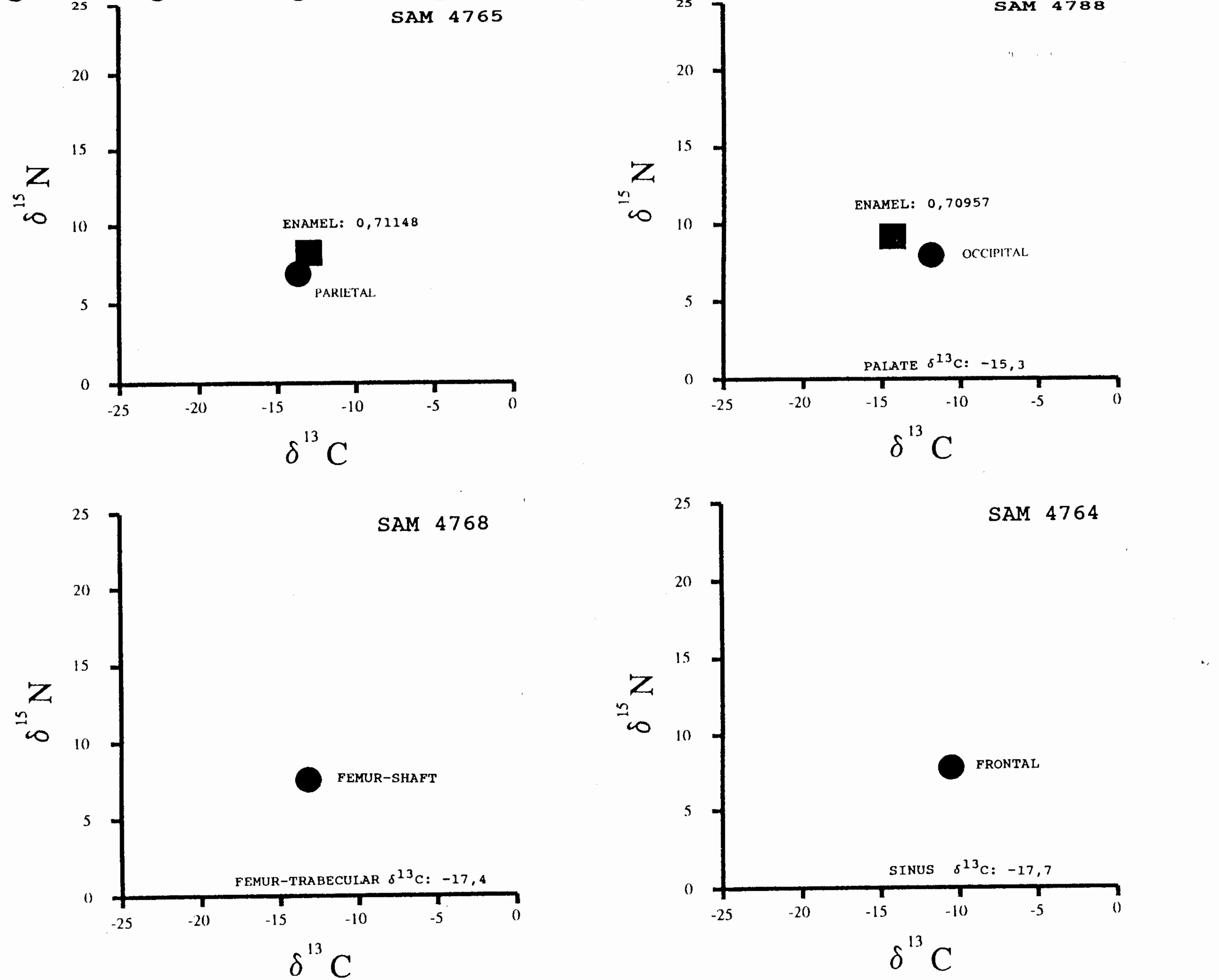


Figure 40: Carbon, nitrogen and strontium isotope results for SAM 4765, 4788, 4768 & 4764.

environment, probably in a tropical or subtropical area, since C_4 plants grow best in these regions. These values are consistent with the other slaves and the tooth modification is therefore intentional decoration, not pipewear. Her diet changed substantially prior to death and this change can be observed in her sinus bone. Her $\delta^{13}C$ becomes 7,5‰ more negative (See Figure 40).

The box labelled SAM 4768 included the post cranials of three young individuals. Samples were taken in order to assess whether or not these were slaves. Results of analysis of the shaft of the left femur of SAM 4768 A are -13,2‰ for δ^{13} C and 7,5‰ for $\delta^{15}N$. These values place SAM 4768A into the slave group. The consistent trend of dietary change can be seen in the trabecular bone of the same femur which has a $\delta^{13}C$ value of -17,4‰. The femur shaft retains a greater proportion of tissue laid down earlier in life, whereas the trabecular bone, because of its higher turnover rate, represents the most recently consumed diet (See Figure 40).

SAM 4765 does not have any tooth modification. The relatively positive $\delta^{13}C$ values and positive $\delta^{15}N$ values, place this young individual within the slave group. $^{87}Sr/^{86}Sr$ result on the canine enamel is 0,71148. This $^{87}Sr/^{86}Sr$ value is close to 0,709: the marine reading. Perhaps SAM 4765 and SAM 4788 (discussed below) were from villages where the tradition of tooth decoration was no longer practised. The slave trade destroyed communities and split up families (See Figure 40).

The premolar of SAM 4788 has a $\delta^{13}C$ value of -14,5‰ and $\delta^{15}N$ value of 9,4‰. This is the most negative $\delta^{13}C$ value obtained for a tooth and the $\delta^{15}N$ value is the most positive. The $^{87}Sr/^{86}Sr$ value is consistent with a coastal value. The series of readings for SAM 4788 go against the trend so clearly outlined above. The $\delta^{13}C$ value for occipital bone is more positive, and is more negative for the palate. The explanation for this anomaly is the age of SAM 4788, who is only about 10 or 11 years old. The premolar that was sampled had only just formed, which is why its signatures are like those of the palate. The $\delta^{13}C$ value of -11,3‰ and the $\delta^{15}N$ value of 7,1‰ for the occipital represent the diet consumed in early life. The $^{87}Sr/^{86}Sr$ result probably represents the environment prior to death (See Figure 40).

The tooth decoration observed on these individuals can give us clues to their group affiliation. Three groups in Mozambique chiped their teeth to points: the Maconde; Yao and the Macua. SAM 4872 and 4773 show this pattern of modification. The Maconde lived along the coast. The Macua people covered a region that included some coast and also inland areas. SAM 4773 could have been a member of the Yao because he or she has the highest strontium value and a positive $\delta^{15}N$ value of 6,1. Perhaps SAM 4872 belonged to the Macua group because of his inland strontium isotope value.

SAM 4774 has a notch between the upper first incisors and pointed lateral incisors. This decoration has been observed in the Anyika of north-west Lake Nyassa. SAM 4774's $\delta^{13}C$ value is very positive at -7,9 ‰ and consistent with a terrestrial C_4 based diet.

A square notch or wedge removed from the maxillary first incisors was observed by Livingstone on his way down the Rovuma River. SAM 4776C has this pattern of modification. SAM 4764 has a round notch removed from the upper first incisor, a Maravi technique. The Maravi were successful agriculturalists.

One of the objectives of this project was to compare the Vergelegen skeleton analysed by Sealy et al.(1993) to the Fort Knokke slaves. Figure 41 illustrates this comparison. SAM 4774's values are quite different, there is much larger variation in $\delta^{13}C$ within her diet which changes from fundamentally C_4 to C_3. SAM 4774's values become more negative, whereas Vergelegen's become more positive from -13,2‰ in her molar to -10,9‰ in her femur.

There is less variation in nitrogen values in SAM 4774 indicating a slight increase in seafood whereas with Vergelegen the $\delta^{15}N$ values vary from 6,7‰ in childhood to 12,4‰. It appears that the diets and circumstances of these two individuals is quite different.

The childhood isotopic values of the Fort Knokke slaves are similar to that obtained for the dentine of the Vergelegen skeleton indicating that they all had diets based on C_4 plants, probably in tropical regions. The Fort Knokke slaves have more negative $\delta^{13}C$ values later in life. Their $\delta^{15}N$ values do not become more enriched, usually the result of an increase in the consumption of seafood.

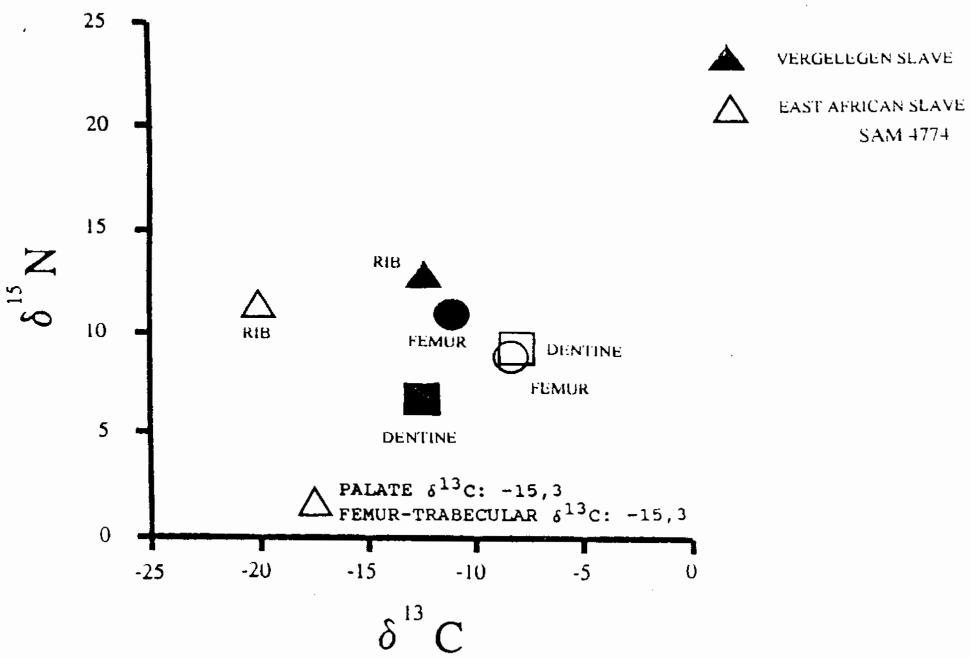
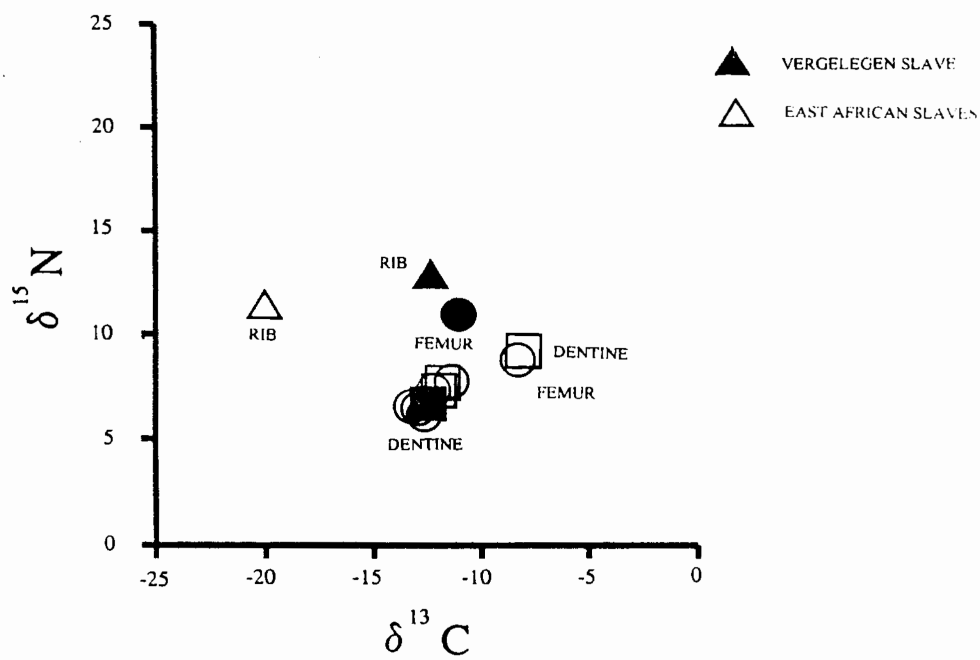


Figure 41: a) Vergelegen results for carbon and nitrogen compared to SAM 4774, b) Vergelegen results compared to all East African slaves.



The strontium isotope values of the Fort Knokke slaves and Vergelegen are different, indicating that they probably grew up in different places. The Vergelegen skeleton is probably not from Mozambique, perhaps she is from Madagascar.

SOLDIERS OR SAILORS : LOCALS OR FOREIGNERS ?

A similar strategy was applied to the skeletons from the second excavation. Samples were taken from teeth, long bones and where possible rib or bone that was known to have a faster turn-over rate. Carbon and nitrogen values for four out of the five individuals are very similar. SAM 4778,4780,4782 and 4775 all show little variation in stable isotopes within the skeleton, the maximum being 0,42‰. The average $\delta^{13}C$ values range from -20,2 to -19,3 ‰. These values are relatively negative and are consistent with a diet based on C_3 plants.

The nitrogen average values vary from 11,7 to 11,3‰%. The maximum variation is seen in SAM 4778 but is still only 1,86‰ suggesting that these individuals had a uniform diet throughout life (See Figure 42). Their diets probably contained some seafood. Such a combination of negative $\delta^{13}C$ and relatively positive $\delta^{15}N$ can only result from the consumption of C_3 grains in a temperate environment like Europe. The results obtained for this group are consistent with other studies of Europeans.

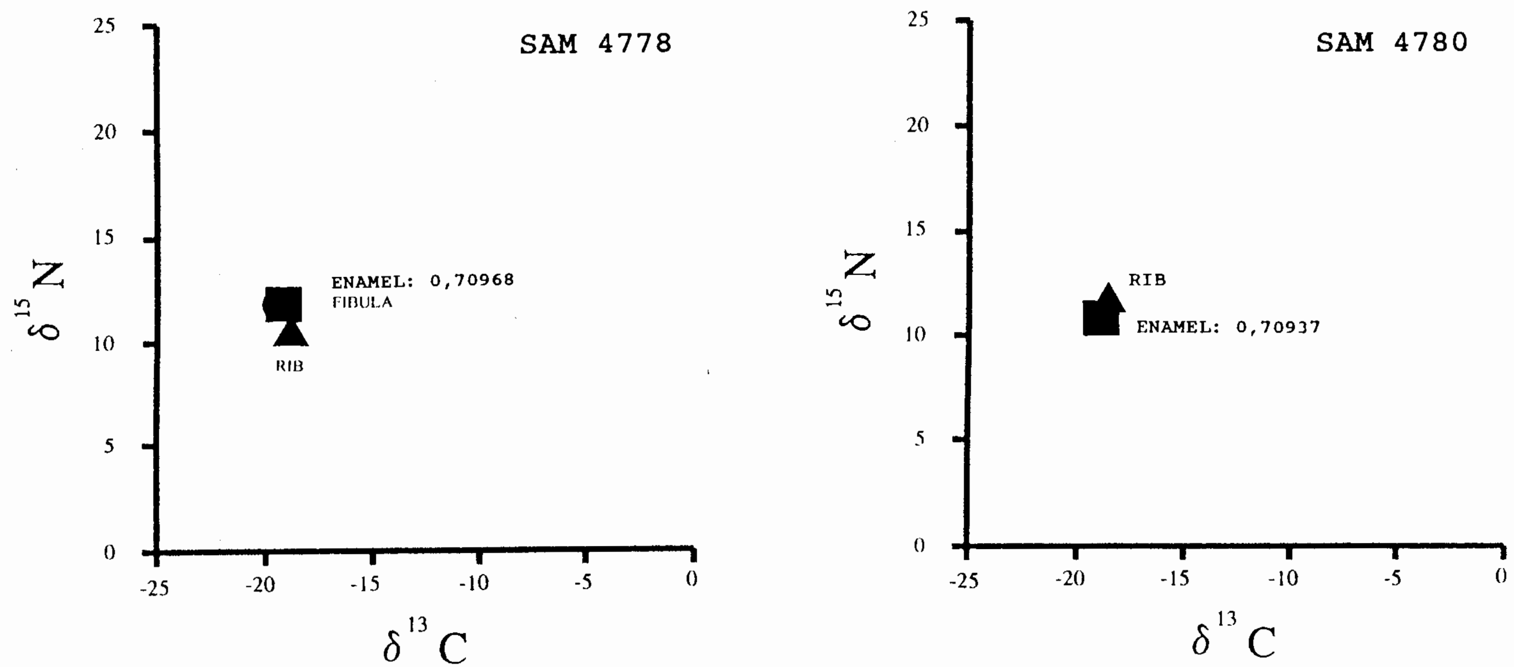
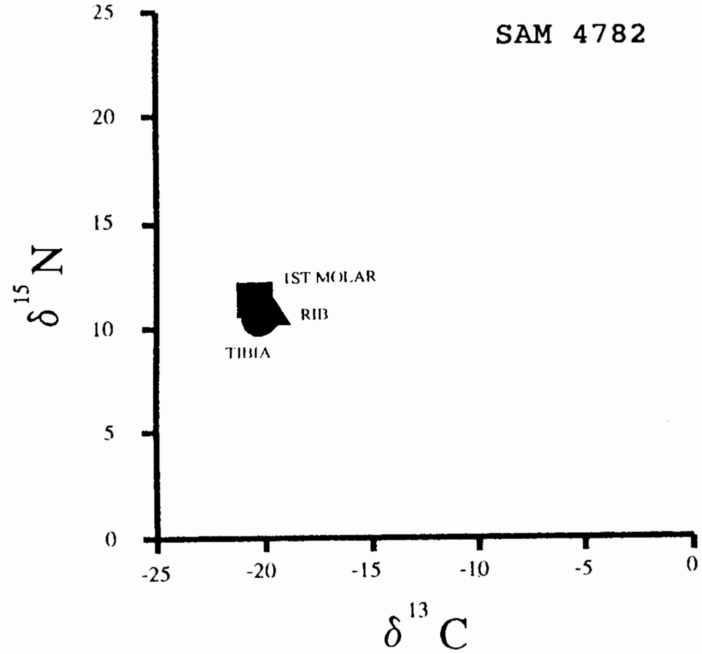
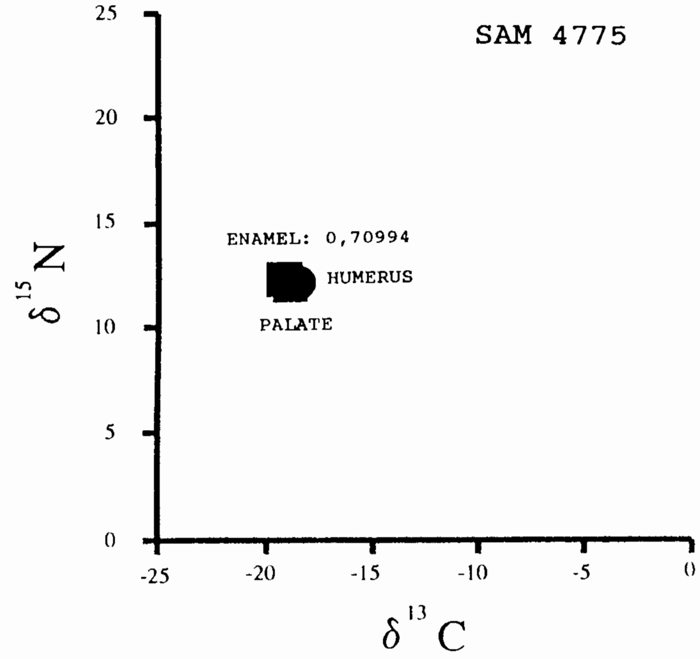


Figure 42: Carbon, nitrogen and strontium isotope results for SAM 4778 & SAM 4780

SAM 4763 was sampled because he has pipewear on his teeth and was therefore presumed to be a member of the second group excavated by Singer. SAM 4782 also has pipewear and measurements on the two individuals could be compared. The crania were placed side-by-side when they were sampled and morphological differences are immediately apparent . SAM 4763 is less robust. The isotopic results for the maxillary first molar are: -16,8‰ $\delta^{13}C$; and 11‰ $\delta^{15}N$. These values represent diet during childhood. These results are not consistent with the other individuals. The $\delta^{13}C$ value is too enriched to be based only on C_3 foods, and SAM 4763 probably did not spend his childhood in Europe. The carbon isotope value for the palate is enriched by 3,3‰. Who is this individual and how did he come to be in the same grave as the homogenous group described above? Perhaps he was a colonist who drowned while attempting to save the lives of those on board an ailing vessel. If this were the case it is unlikely that he was based at the Cape because of his enriched $\delta^{13}C$ value, maybe he was from up country. Perhaps his burial was due to entirely different circumstances or a different wreck (See Figure 43).

The skeleton found at Oudepost has a spread of values for both $\delta^{13}C$ and $\delta^{15}N$ that are not present in the Fort Knokke soldier/sailor skeletons (See Figure 44). The pattern that emerges in the Oudepost skeleton includes an increased consumption of seafood during life. Isotopic results for SAM 4778,4780,4782 and 4775 from Fort Knokke are consistent with Oudepost's childhood diet. The Fort Knokke individuals ate the same foods throughout life. SAM 4763 is an exception and his molar (childhood) values tend to coincide with the adult diets of Oudepost and the Fort. Strontium isotope analysis was performed on tooth enamel from three of the Fort





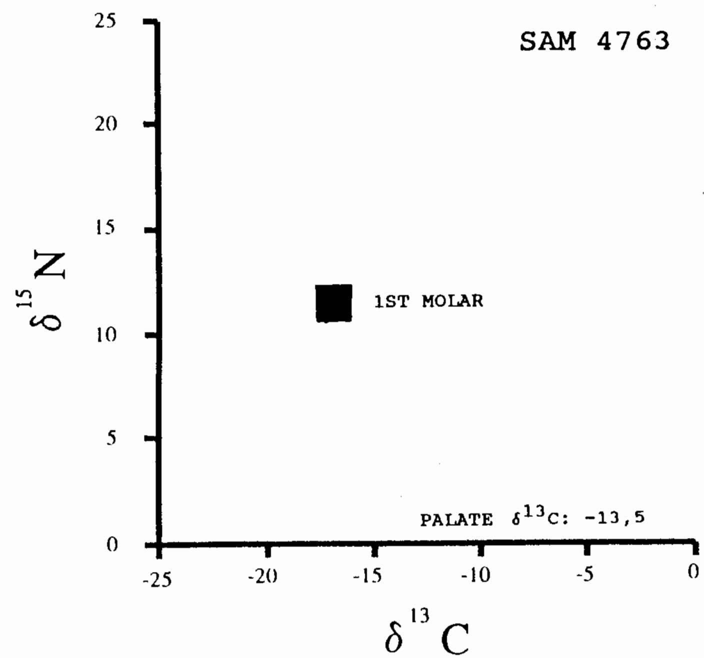


Figure 43: Carbon, nitrogen and strontium isotope results for SAM 4782, SAM 4775 & SAM 4763.

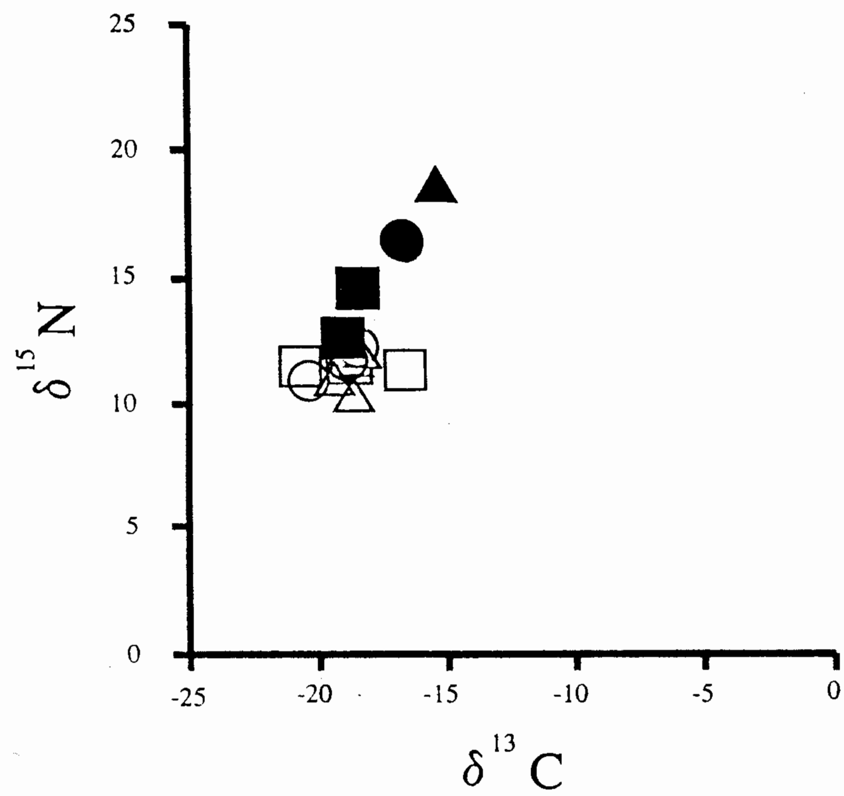
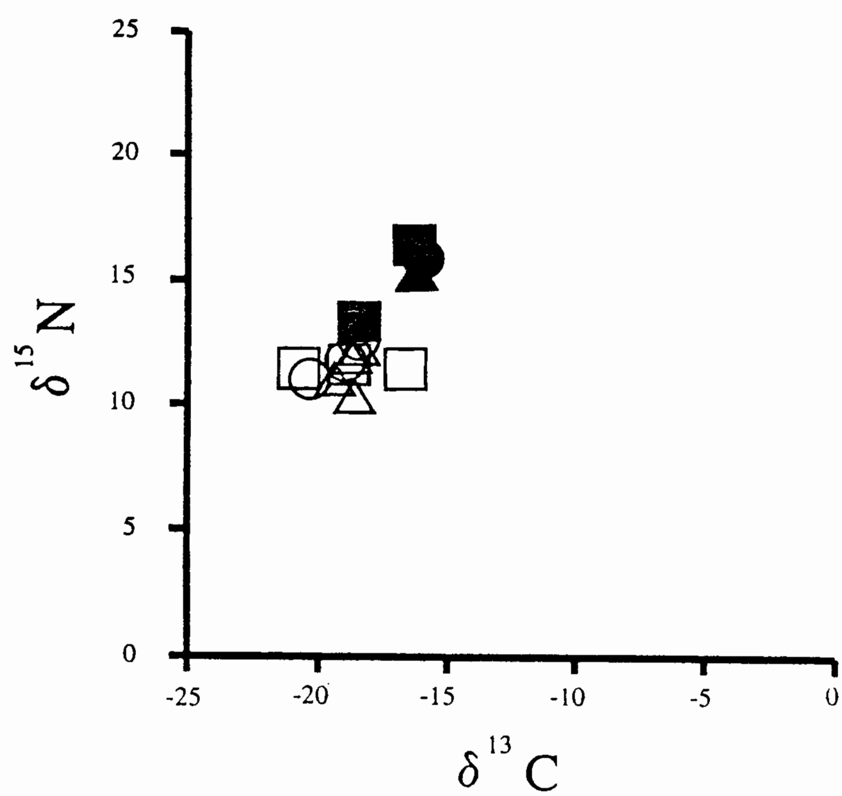


Figure 44: Carbon and nitrogen isotope results for the Fort Knokke coffin burials (solid symbols) compared to Oudepost (outline symbols) (Sealy et al.1995:295)

Figure 45: Carbon and nitrogen isotope results for the Fort Knokke coffin burials (solid symbols)compared to the Fort (outline symbols) skeleton (Sealy et al.1995:295)



Knokke coffin burials. The values are as follows: 0, 70968 (SAM4778); 0,70937 (SAM 4780) and 0,70994 (SAM 4775). The differences between these results are probably only due to normal biological variation. Hence the Fort Knokke individuals all came from the same region. Their strontium values are similar to those from the Oudepost skeleton.

The Fort skeleton shows little variation during life much like the Fort Knokke individuals (See Figure 45). Again, SAM 4778,4780,4782 and 4775 have values similar to UCT 457's first molar. Their $\delta^{13}C$ values are, however, more negative and the $\delta^{15}N$ values are less enriched.

The Fort Knokke individuals had isotopically uniform diets throughout life. Would it be possible for a soldier or a sailor to eat the same diet throughout life? Sailors and soldiers were recruited young and were certainly given the same rations on board ship or in the barracks. For a change of diet to be observed in bone there would have to be a change of environment from C_3 to C_4. The Cape climate is temperate like Europe and a change in carbon signatures would not be apparent. The soldier or sailor from Oudepost consumed progressively more seafood and this can be seen in the nitrogen values.

The only other way to explain how these individuals came to be buried on the beach and not at a proper burial ground like the nearby military one, would be that they were smallpox victims. According to Singer (1955) there are no records of people being buried at this particular area.

CONCLUSION

The area around where Fort Knokke once stood was littered with shipwrecks. The remains of many of them lie buried beneath reclaimed land. Drowned sailors, ~~sailors~~ soldiers and / or passengers were often buried on the beach where their bodies were washed up. These nameless victims were of little or no significance to the colonists and a proper burial in a cemetery required effort beyond the means of the Cape outpost.

The teeth of these historic skeletons provided information about their possible origins. A survey of published ethnographic material on tooth decoration helped to identify the groups in Africa who perform this custom. Pipewear was found on the teeth of two European burials. This information adds to studies done by Morris(1988).

Some of the skeletons analysed were those of slaves who were on board the Pacquet Real, when she sank in Table Bay. The vessel was sailing from Mozambique to Brazil when it stopped at the Cape for provisions. The isotopic profiles and the tooth decoration on these skeletons are consistent with the suggestion that these individuals may have been from the Makua, Yao, Maravi: the main groups in Mozambique that were exploited during the slave trade. The vessel sank in 1818, after the anti-slave trade campaign had begun. The remaining slaves became 'prize negroes' at the Cape.

The other skeletons are the remains of European colonists. They are robust in stature and could be sailors or soldiers. Attempts to locate a specific shipwreck that could account for their deaths have failed. There are too many possibilities.

The isotopic profiles answered the questions set out in this project:

SLAVES

1) Analyses of bone with different turn-over rates highlighted a consistent trend. The slaves changed their diets a short time before death.

2) These slaves have heterogeneous geographical origins, probably within Mozambique

3)Like the Vergelegen slave, the Fort Knokke slaves had diets based on tropical C_4 plants during childhood. Strontium isotopes indicate that they did not come from the same area as the Vergelegen slave, who may have come from Madagascar. The diets of the Mozambican slaves, prior to death, are different to the diet of the Vergelegen slave later in her life.

EUROPEANS

1) Four of these individuals had very similar isotopic values and may have come from the same area and eaten the same food. Their diets did not vary during life.

2) Their strontium signatures are all similar to one another and to the Oudepost individual. The Oudepost person, however, had a change of diet during life. The Fort Knokke results coincide with the values measured during childhood for the Oudepost and Fort skeletons.

It was beyond the scope of this project to analyse all 31 individuals. The slave sampling strategy proved successful and the eight chosen clearly show that the group was heterogeneous. The Europeans must however remain anonymous. More studies on historical skeletons at the Cape, including locals and foreigners, will help to answer questions of origins.

The use of bone, with different turnover rates for analyses has proved an invaluable tool in demonstrating changes in diet and residence during an individual's life. Rates of turnover on different skeletal elements still need to be determined. We have learned from this project that in young people, even changes of diet over a short period register in bone that turns over quickly. This is the first time that juvenile skeletal remains have been analysed in stable isotope studies of multiple tissues from the same individual. The extensive sampling of different skeletal elements from a single individual has proved to be a valuable technique. From this study, it seems that the dense shaft of the femur is especially slow to turn over. The femur is followed, in order of speed of turn-over, by the cranium, sinus, palate, trabecular bone and the fastest: the rib. The ICRP (1975) report suggests that vertebrae turn-over quicker than in other bone. Vertebrae were not measured in this project and this may be a useful bone to analyse in the future.

The techniques of analysis outlined in this project have expanded our knowledge of slave lifeways. The trauma of capture, the journey to the port and the sea voyage had both mental and physical repercussions. Isotopic investigations can help us to reconstruct aspects of life histories beyond the evidence of documentary sources.

REFERENCES

Cape Town Municipal Archives:

Colonial Office records;

CO 324/20/D. 'Prize Negroes'

CO 4840, CO 5790. Pacquet Real

CO 92. Clothes for slaves and crew.

CO 143? Captain Blasdell

CO 5790. Pacquet Real

Government House;

GH 23/5 ref. 8, 10. 'Pacquet Real'

Shipping Register;

CC 2/9. Pacquet Real

CC 2/15. Waterloo

Government Gazette: July 1819;

REFERENCES:

Aberman, L. 1993. Culemborg-Black River contextual framework. Stage B Report. Cape Town City Council.

Alpers, E.A. 1975. Ivory and slaves in East Central Africa: changing patterns of international trade to the later nineteenth century. London:Heinemann.

Ambrose, S.H. 1986a. Stable carbon and nitrogen isotope analysis of human and animal diet in Africa. Journal of Human Evolution 15:707-731.

Ambrose, S.H. & DeNiro, M.J. 1986b. Reconstruction of African human diet using bone collagen carbon and nitrogen isotope ratios. Nature 319:321-324.

Beachey, R.W. 1976. The slave trade of Eastern Africa. London:Rex Collings.

Brann, R.W. 1989. Report on inspection of remaining fortifications around the Cape Peninsula. Inter-staff Memorandum to the Western Cape Regional Representive of the National Monuments Council.

Brann, R.W. 1994. A brief history of the fortifications of the Cape Peninsula 1600-1945.

Unpublished report for the National Monuments Council, Western Cape.

Burman, J. 1984. Early Railways at the Cape. Human & Rousseau: Cape Town.

Childs, G.M. 1949. Umbundu Kinship and Character. Oxford:Oxford University Press.

Conrad, R.E. 1986. World of Sorrow. The African slave trade to Brazil. United States:Louisiana State University Press.

Craig, General. 1796. Craigs Papers:Memorandum of General Craig on the Cape defences. University of the Witwatersrand, Reference No, A24.

Cundee, J. 1806. Gleanings in Africa. London:Ivy Lane.

De Smidt, J.H.R. Fort Knokke and its neighbours. A forty years old war scare. Cape Times, 28 July 1928

DeNiro, M.J. n.d. Method for collagen gel preparation. Unpublished material.

DeNiro, M.J. & Schoeninger, M.J. 1983. Stable carbon and nitrogen isotope ratios of bone collagen: variations within individuals, between sexes, and within populations raised on monotonous diets. Journal of Archaeological Science 10:199-203.

DePaolo, D.J. & Ingram, B.L. 1985. High resolution stratigraphy with strontium isotopes. Science 227:938-941.

Driberg, J.H. 1923. The Lango. London:T. Fisher Unwin Ltd.

Encyclopaedia Britannica Volume 20

Ewart, J. 1970. Journal of his stay at the Cape 1811-1814. Cape Town: Struik.

Feldesman, M.R., Kleckner, J.G. and Lundy, J.K.1990. Femur/Stature ratio and estimates of stature in Mid- and Late Pleistocene fossil hominids. American Journal of Physical Anthropology 83: 359-372.

Hafkin, N. 1973. Trade, Society and Politics in Northern Mozambique, c.1753-1913. Unpublished Ph.D Thesis. Boston University Graduate School .

Haight, M.V.Jackson. 1967. European powers and South-East Africa 1796-1856. Routledge & Kegan Paul: London.

Hambly, W.D. 1930. Ethnology of Africa. Field museum of Natural History, Chicago.

Hambly, W.D. 1937. Source book for African Anthropology. Field Museum of Natural History, Chicago.

Handler, J.S. 1994. Determining African birth from skeletal remains: a note on tooth mutilation. Historical Archaeology, 28(3):113-119.

Handler, J.S. & Lange, F.W. 1978. Plantation slavery in Barbados: An archaeological and historical investigation. Cambridge: Harvard University Press.

Katzenberg, M.A. 1991a. Analysis of stable isotopes of carbon and nitrogen. In: Pfeiffer, S. & Williamson, R.F (eds.) Snake Hill: an investigation of a military cemetery from the War of 1812:101-106. Toronto:Dundurn Press.

Katzenberg, M.A. 1991b. Stable isotope analysis of remains from the Harvie family. In: Saunders, S. & Lazenby, R. The links that bind: the Harvie family nineteenth century burying ground. Occasional papers in Northeastern Archaeology No5:65-69.

Katzenberg, M.A. 1992. Advances in stable isotope analysis of prehistoric bones. In: Saunders, S.R. & Katzenberg, M.A. (eds.) Skeletal biology of past peoples: Research Methods:105-119. New York: Wiley-Liss.

Kennedy, B.V.E. 1989. Variation in δ^{13}C values of post-medieval Europeans. Unpublished Ph.D thesis: University of Calgary.

Klepinger, L.L. 1984. Nutritional assessment from bone. Annual Review of Anthropology 13:75-96.

Laidler, P.W., & Gelfand, M. 1971. South Africa: Its medical history 1652-1898. Cape Town:Struik.

Libby, W.F., Berger, R., Mead, J.F. Alexander, G.V. & Ross, J.F. 1964. Replacement rates for human tissue from atmospheric radiocarbon. Science 146:1170-1172.

Milner, G. R. & Larsen, C.S. 1991. Teeth as artifacts of Human Behaviour: Intentional Mutilation and accidental modification. In: Kelley, M.A. & Larsen, C.S. (eds.) Advances in Dental Anthropology:357-378. Wiley-Liss, Inc.

Morris, A. 1988. Archaeological evidence of "pipe-smoker's wear". Journal of the Dental Association of South Africa, 43:361-364.

Morris, A. 1989. Dental mutilation in historic and prehistoric South Africa. Quarterly Bulletin of the South African Library 43(3):132-134.

Murray, M. 1964. Under Lion's Head : Earlier days at Green Point and Sea Point. Cape Town: Balkema.

Nelson, H.D. (ed.) 1984. Mozambique: a country study. Foreign Area studies The American University.

Ortner, D.J. 1966. A recent occurrence of an African type tooth mutilation in Florida. American Journal of Physical Anthropology 25: 177-180.

Percival, Captain R. 1804. An account of the Cape of Good Hope. New York: Negro University Press.(reprint)

Roscoe, J. 1915. The Northern Bantu. Cambridge University Press. p.78.

Roscoe, J. 1923. The Bakitara. Cambridge University Press. p.167-169.

Rose-Innes, H. 1992. An analysis of skeletal remains of possible shipwreck victims from the site of Fort Knokke, Cape Town . Report as part fulfillment of ANT 301W (Biological Anthropology and Applied Anatomy) at the University of Cape Town.

Saetersdal, T. 1995. Private Letter to G.Cox.

Saunders, C. 1984. Between slavery and freedom. Kronos 9:36-43.

Saunders, C. 1985. Libersted Africans in the Cape Colony in the first half of the nineteenth century. International Jounal of African Historical Studies 18:223-39.

Schoeninger, M.J., DeNiro, M.J. & Tauber, H. 1983. Stable Nitrogen isotope ratios of bone collagen reflect marine and terrestrial components of prehistoric human diet. Science 220:1381-3.

Schoeninger, M.J. 1989. Reconstructing prehistoric human diet. In: Price, T.D. (ed.) The chemistry of prehistoric human bone:38-67. Cambridge:Cambridge University Press.

Sealy, J.C. 1989. The use of chemical techniques for reconstructing prehistoric diets: A case study in the south-western Cape. South African Archaeological Society Goodwin Series 6:69-76.

Sealy, J., Armstrong, R. & Schrire, C. 1995. Beyond lifetime averages: tracing life histories through isotopic analysis of different calcified tissues from archaeological human skeletons. Antiqiuty 69 (263):290-300.

Sealy, J.C., Van der Merwe, N.J., Sillen, A., Kruger, F.J. & Krueger, H.W. 1991. $^{87}Sr/^{86}Sr$ as a dietary indicator in modern and archaeological bone. Journal of Archaeological Science 18: 399-416.

Sealy, J.C., Morris, A.G., Armstrong, R., Markell, A. & Schrire, C. 1993. An historic skeleton from the slave lodge at Vergelegen. South African Archaeological Society Goodwin Series 7:84-91.

Seeman, U. 1993. Forts and fortifications at the Cape Peninsula, 1781-1829: A survey of defence works with special reference to the Hout Bay forts. Unpublished M.Sc. thesis,University of Cape Town.

Sillen, A. 1986. Biogenic and diagenetic Sr/Ca in Pleistocene fossils of the Omo Shungura formation. Paleobiology 12: 311-323.

Singer, R. 1953. Artificial deformation of Teeth: A preliminary report. South African Journal of Science 50:116-122.

Speight, W.L. 1934. Forgotten Forts: Old defensive works that have disappeared. South African Railways and Harbour Magazine.p.405-6.

South African National Society Yearbook 1942-45

Standard Encyclopaedia of Southern Africa. 1971. Cape Town: Nasou.

Stewart, T.D. & Groome, J.R. 1968. The African custom of tooth mutilation in America. American Journal of Physical Anthropology 28:31-42.

Stout, S.D. 1992. Methods of determining age at death using bone microstructure. In: Saunders, S.R. and Katzenberg, M.A. Skeletal biology of past peoples: Research methods. New York: Wiley-Liss.

Theal, G.M. 1902. Records of the Cape Colony, Vol. 12, p1-12, 29-32. Cape Town: The Government Printer

Turner, M. 1988. Shipwrecks and salvage in South Africa- 1505 to the present. Cape Town: Struik.

Ubelaker, D. H. 1989. Human skeletal remains : excavation, analysis, interpretation. Washington: Taraxacum.

Van Reenen, J.F. 1964. Dentition, jaws and palate of the Kalahari Bushman. Journal of the Dental Association of South Africa 19:1-15.

Van Reenen, J.F. 1978a. Tooth mutilating practices amongst the Ovambo and the West Caprivi Bushmen of South West Africa (Namibia). Journal of the Dental Association of South Africa 33:665-671.

Van Reenen, J.F. 1978b. Tooth mutilation amongst the peoples of Kavango and Bushmanland, South West Africa (Namibia). Journal of the Dental Association of South Africa 33:205-218.

Van Reenen, J.F. 1986. Tooth mutilating and extracting practices amongst the peoples *of South West Africa (Namibia). In: Singer, R. &* Lundy, J.K. Variation, culture and evolution in African populations:159-169. Johannesburg:Witwatersrand University Press

Vogel, J.C. & Van der Merwe, N.J. Isotopic evidence for early maize cultivation in New York state. American Antiquity 42:238-242.

Waller, H. 1880. The Last Journals of David Livingstone in central Africa, from 1865 to his death. Volumes 1 and 2. London: J.Murray.

Werner, A. 1906. British Central Africa. London:A. Constable & Co.

Wexham, B. n.d. Shipwrecks of the Western Cape. Timmins

Zoutendyk, J.F.M. 1956. Railway developments on the Cape Town Foreshore. The South African Institution of Civil Engineers Journal, July issue.