Application by **LINDA MBEKI** to undertake research entitled:

The Geographic Origins Of The Non-European Underclass At The Cape Of Good Hope During The Colonial Period

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Abstract

This project will combine strontium (Sr) and oxygen (O) isotopic ratios with craniometric data to attempt to pinpoint the geographic origins of the non-European underclass from the historic burials excavated at Cobern Street, Cape Town. Life histories have been reconstructed for the individuals from Cobern Street, however attempts have yet to be made to trace mobility throughout their lives. This information can be extrapolated to tell us about the slave networks in existence in the Indian Ocean world during the early modern period.

Strontium isotopic ratios determined from human tissue can tell us about the geology of an area, while oxygen isotopic ratios are an indication of the geography (altitude, climate etc) of a place. Thus if we determine the isotopic ratios of these elements from teeth that grow at different stages in an individual's development, we can determine the geology and geography of the area s/he resided in during these stages. We will apply this principle to the Cobern Street individuals to determine their origins and movement before arrival at the Cape.

Craniometric measurements together with multivariate statistical methods are used to deteremine variations among human populations. The greater the number of variables measured and the greater the sample group, the better the assessment. By using multiple craniometric measurements from 53 intact skulls from the Cape colonial period in conjunction with isotopic data from multiple parts of teeth, we plan to pinpoint the origins and movements of the Cobern Street individuals.

Background

The Dutch East India Company (VOC) intended the Cape of Good Hope to be a refreshment stop for ships travelling between the Netherlands and its colonies in the east. The indigenous Khoisan did not constitute an adequate workforce; therefore the VOC began to import slaves from West Africa but mostly from East Africa, Madagascar and Asia. Cape Town soon became a cosmopolitan settlement with different categories of people, and a non-European underclass that consisted of slaves, exiles, convicts and free-blacks (people of non-European ancestry not in a state of bondage). The VOC kept detailed records at the Cape; however the non-European underclass is under-represented in the historical record, thus the need for its interrogation by the archaeological record to gain a full understanding of societal dynamics at the Cape during the early modern period.

Over the past two decades, several historic burials have been discovered during building developments. The relatively intact Cobern Street inhumations are thought to be some of the most significant finds. It has been determined that the individuals found at Cobern Street belong to a non-European underclass, some of whom may have been slaves in their lifetimes. The Cobern Street individuals are estimated to have been buried between 1750 and 1827. This is an interesting period because it includes the period of change of colonial rule from the Dutch to the English.

Aim and Justification

The aim of our project is to determine the geographic origins of the non-European underclass found at the Cobern Street site. If individuals are foreign born we would also determine their whereabouts at different periods before arriving at the Cape. The research objectives that will lead to the achievement of this aim are

- Strontium (Sr) isotope determination of tooth enamel
- Oxygen (O) isotope determination of tooth enamel
- Comparison of the isotopic data with complimentary craniometric information
- Comparison of geographic origin found by classical craniometric methods and FORDISC 3.0

This project is part of a larger project that was designed to determine the life histories of the Cape underclass using carbon (C) and nitrogen (N) isotopic ratios (i.e., diet and nutrition; Cox et al, 2001), health (Ledger et al, 2000), pathology and craniometric information. Carbon and Nitrogen isotope analyses have been carried out in combination with observed burial practices and dental modifications to determine the life histories of the Cobern Street burials. Carbon isotopic data from bone gives information on the photosynthetic pathway of the food consumed by the individuals. This information is a proxy for the general regional origins of the individuals. Nitrogen isotopic data compliments the carbon data by giving an indication of whether terrestrial or seafoods were prominent in the diets of the individuals. Craniometric data is currently being compiled and all the research carried out on the Cobern Street Individuals to date will be published as a book by Alan Morris with Fulbright financial support.

We propose to compliment these life histories with Sr and O isotopic ratio information to give a more nuanced picture of the origins and movements of the Cobern Street individuals. The historical record tells us from where slaves were bought and sold, and at what approximate point in their lives, but gives no information about the regional slave networks that they moved through before arriving at their point of sale. Our proposed research plans to shed light on this issue.

The Sr isotopic ratio of the geochemistry of a person's surroundings is reflected in his or her bones. The metal is taken up from soil by plants and absorbed by animals, both of which humans consume (Bentley, 2006). The O isotopic ratio in humans depends on climate and geography (Laffoon et al, 2012). Together, these two techniques have been used to study remains from late Roman burials in Britain; prehistoric, early and late medieval burials in Britain (Budd et al, 2003); and the Middle Horizon in the south central Andes (Knudson and Price, 2007) to determine the regional mobility of individuals during the periods. Sr and O isotopic ratios have been used in conjunction with craniometric information to determine diversity in the Roman York population (Leach et al, 2009).

A rough comparison between differentiation among genetic markers and the differentiation among craniometric traits was undertaken. It was found that the latter, like the former are relatively small among modern human populations in major geographical regions (Relethford, 1994). Be that as it may, it is still possible to determine geographic origins from

craniometric data. Craniometric data has been found to be of great value when seen in light of the historial context (Van der Merwe et al, 2010) in the study of excavated nineteenth-century miners involved in the Southern African migrant labour network. Luckily, the archaeological context of the Cobern Street individuals is well understood and we will have a good foundation to build on.

Our study will represent the first combination of Sr and O isotopic analyses with craniometrics to study the mobility of the Cobern Street individuals and indeed the first study of its type on the people who traversed the Indian Ocean during the early modern period.

The Faculty for Earth and Life Sciences (FALW) at the Vrije Universiteit will benefit from this collaboration because a line of research explored in the group is the reconstruction of slave women's identities in Dutch Colonial Cape Town. The Cobern Street collection contains individuals from the non-European underclass in the Cape and there is a high probability that our isotopic research will lead to findings that will tell us about the regional slave networks from which they originated. The historical record gives information about the point of sale of slaves, not necessarily their point of origin or movement before arrival at the Cape. An example of a slave name would be Jan van Madagascar. The naming of slaves was often done by those who transported them or were responsible for their sale and was one of the first steps towards erasing the identity of the captives. We wish to restore their dignity by revealing an aspect of their true identities.

The department of Human Biological Anthropology (HUB) in the Faculty of Health Sciences at the University of Cape Town will benefit from the collaboration because Sr and O isotope ratio analyses have yet to be performed on the Cobern Street individuals over whom it has curatorship. This type of analysis is one of the specialties of the FALW. One line of research being undertaken in the HUB is the use of dental anthropology to determine mobility, a topic that is of great interest to the FALW as well. We foresee a long-term relationship between the two institutions due to these overlaps.

Anthropology in both countries will benefit from the cross-pollination of ideas and expertise from both institutions in the study of a topic that is of importance to both South Africa and the Netherlands. Two women Ph.D. candidates will be involved in the project, one Dutch, Lisette Kootker, the other South African, Linda Mbeki. This project is essential

for their doctoral training, and they aim to be involved in the publication of the results, helping them on their way to becoming established academics. Moreover each department belongs to a wider national and international network that the other will now have access to.

The Mauritian Archaeology and Cultural Heritage Project partly focuses on Dutch colonial slavery and the movement of people around the Indian Ocean. Building on the success of this project, we plan to reach out to the investigators in the future and to researchers in other countries where the VOC had a strong presence such as Sri Lanka, India and Indonesia, broadening our international collaboration.

Literature Review

Our project relates to other research on archaeological reconstruction of human mobility. The application of strontium (87Sr/86Sr) and oxygen (18O/16O) isotope analysis on archaeological human organic tissue has matured into an established tool for providing information about human residential mobility in (pre)history (Erickson, 1985; Price et al, 2001; Bentley et al, 2002; Bentley, 2006; Price et al, 2006; Evans et al, 2007; Shaw et al, 2009; Montgomery, 2010; Schwarcz et al, 2010; Towers et al, 2010; Price et al, 2011; Slovak and Paytan, 2011). While strontium isotope ratios are a geochemical proxy for palaeomobility, oxygen isotope ratios are dependent on climate and geography. Together these complimentary techniques will enable us to pinpoint an individual's possible area of provenance.

One such study used Sr, O and C isotopic data in conjunction to explore mobility in the Antilles (Laffoon et al, 2012). Little difference was seen in the isotopic ratio of most individuals suggesting they originated from the same area. Two individuals stood out as the isotopic data from their dental remains suggested they were long-distance immigrants, we expect similar results as some individuals have been shown by C and N isotopes, and dental modifications to not be Cape born. The authors stressed the importance of the use of multiple lines of evidence as each one has its limitations. This is a point that was also stressed in the study of mobility in the south central Andes during the Middle Horizon (Knudson et al, 2007). Apart from central and south America, multiple isotope analysis has

been used extensively to study the people of Roman Britain. Sr and O isotopic data lead to the conclusion that some of the individuals found in a Late Roman cemetery in southern England were of exotic European origins (Evans et al, 2005). Sr, O, C and N analyses were used to explore diet and mobility in Roman Gloucester, UK (Chenery et al, 2010). The life history of an immigrant woman of high status in Roman Britain was reconstructed using isotopic data and archaeological evidence (Leach et al, 2009).

A report on the usefulness of investigating population movement throughout the ages using stable isotope analysis in Britain stated that the technique had the potential to be useful in the study of slavery (Budd et al, 2003). Some of the Cobern Street individuals were possibly slaves during their lifetimes, making our study a good test of this hypothesis. The results from this project will contribute to others' research by providing an instance of the use of isotopic data to determine mobility in the Indian Ocean world during the early modern period, something which has not been done to date. Some individuals have been found to not have been of Barbadian birth, but rather originated from the Gold Coast or Senegambia in Africa, providing proof of forced migration to Barbados (Schroeder et al, 2009). Isotopic studies on the individuals of the Newburgh Colored Burial Ground in the United States were used to determine the demographic composition of a free black population in the area (Nystrom et al, 2011).

"Craniometric characteristics are used extensively to study population structure and history in archaeological contexts" (Roseman, 2004). Skeletal analysis allows us to determine geographic origin (Brace, 1995; Ousley et al, 2009). Intra rather than inter-regional variation has been found to be more significant (Ribot, 2004). The only example of the use of craniometrics coupled with Sr and O isotopic data to determine mobility in the literature was a study to explore mobility and diversity in the Roman Empire in York, England (Leach et al, 2009). Using this multidisciplinary approach, the authors found that a significant number of individuals were not of European origin; moreover they came from a variety of different places. Our research will be the only other example of this approach.

The long-range significance of our research to anthropology is manifold. Cape colonial history is heavily reliant on the historical record. Our project, and the greater research context under which it falls, will use the archaeological record to interrogate the historical record to give a more comprehensive picture of Cape colonial society, including the

underclasses. Due to the collaboration between our groups, our findings will reach a wider academic audience than either group could attract without the other. This research adds to the body of bioarchaeological knowledge about the colonial period in the Cape but the method can be applied in other parts of Africa, indeed the world, to explore intra and inter-regional slave networks and the displacement of human beings.

Methodology

The aim to determine the geographic origins of the non-European underclass in Cape-town will be achieved through combined multi-isotope and craniometric analyses. Over the last three decades the application of strontium isotope (87Sr/86Sr) and oxygen isotope (18O/16O) analyses on archaeological human and faunal organic tissues has matured into an established tool for providing information about human residential mobility (Erickson, 1985; Bentley, 2006)

Strontium isotopes are introduced into the environment through a variety of natural processes, such as the weathering of rocks, precipitation and sea-spray (Capo et al., 1998). Ultimately, the strontium is conveyed into the skeletal tissues of humans through diet, where it substitutes for calcium in the structure of hydroxyapatite in bone, dentine, enamel and keratin. Enamel is formed during childhood and barely undergoes any change after mineralisation and during burial (Hoppe et al., 2003). Hence, the 87Sr/86Sr ratio in tooth enamel reflects the strontium intake during childhood, and can serve as a tracer of the geological area where the individual grew up, assuming that they consumed locally grown foods (Bentley, 2006). Different dental elements reflect different stages in life. By analysing all three molars, an isotopic life history between the ages of 0 and 16 can be reconstructed. The main principle of this technique is to compare the biogenic isotopic signatures from an individual to the local strontium range. Differences between the 87Sr/86Sr of an individual's dental enamel and the local strontium range indicate migration between two isotopically different geographical locations. Similarities between the local biosphere strontium signal and the individual's biogenic signal might point towards residential stability or towards residential mobility between two isotopically similar geographical locations. In the latter case, additional oxygen isotope investigations and available craniometric data will enable us to distinguish between the two strontium isotopic similar locations. Oxygen isotopes in bone

and enamel are derived from local meteoric water. Four principal parameters cause the ratio 18O/16O to decrease: (1) distance from the sea; (2) increase of elevation; (3) decrease of the precipitation's temperature and (4) increasing latitude (Longinelly 1984). Hence, we are able to distinguish between source areas with similar strontium isotopic signatures, for instance West-Africa and northern Indonesia, by additional oxygen isotope analyses.

A fundamental component for the interpretation of the isotopic data, therefore, is the availability of accurate maps showing the spatial variations in strontium and oxygen isotope signatures. Under the supervision of Gareth Davies, the department of Petrology at the VU Amsterdam has conducted hundreds of strontium isopteran analyses over the past years in West- and South Africa and the Indonesian archipelago. Literature provides us with supplementary isotope data from India. For the interpretation of the oxygen isotope data, the IsoMAP database will be consulted. IsoMAP predicts the spatiotemporal distribution of isotopes in environmental materials 'using models of isotope- fractionating processes and data describing environmental conditions' (Bowen, 2010). A 18O/16O prediction map will be transformed into statistical estimates of the likelihood of the samples to have originated from either Africa or Asia. Additional information about geographical origin is provided by the craniometric data. By quantifying skeletal characteristics an attempt can be made to define the ancestral identity of an individual (e.g. African, Asian). This method requires an appropriate reference database. Therefore, FORDISC 3.1 will be used to statistically indicate the individuals physical affinity to one of the reference populations. Moreover, we propose the comparison of ancestry derived from classical craniometric methods with results derived from FORDISC to investigate the reliability of the program which has recently caused some controversy (Elliot and Collard, 2012).

The archaeological human material has been excavated, analyzed and sampled before. One major research ethical dimension, however, concerns the destructive research on human remains. The answers to the research questions in this application are not available by other non-intrusive methods. To reduce the damage to the material, novel isotope extraction techniques will be used. For strontium isotope analysis no more than 2 mg of enamel powder is required. For oxygen isotopes analyses approximately 5 mg of enamel powder is needed. Cranial measurements have been used in the past to support a racist agenda, however we stress that our interest is not in determining "race", if such a thing exists, but in the geographic origins of the Cobern Street individuals.

The sampling, extraction and measurements will be performed by Ph.D. candidates Lisette Kootker and Linda Mbeki. Isotopic data interpretation will be carried out by Gareth Davies, Lisette Kootker and Linda Mbeki. The craniometric data has been collected by Alan Morris. The FORDISC analyses will be performed by Linda Mbeki under the supervision of Dr. A.E. van der Merwe (Amsterdam Medical Centre). The integration of the bioarchaeological data with the archaeological evidence and written resources will be performed by both co-PI's under close supervision of both applicants. The publication of the integrated data will be co-authored by both applicants and co-PI's.

Sample collection will take place in Cape Town. The sample selection will be similar to the dataset Cox et al. (2001) have used in order to be able to integrate the data. The strontium extraction will take 5 days and the oxygen isotope analyses will be performed in 4 days. The FORDISC analyses will be performed within 7 working days. Hence, the collection and analyses of the samples will be finished within 3 months. The remaining months will be used to critically analyze the data and to combine all available bioarchaeological, archaeological and historical evidence to be able to create an accurate reflection of the slave networks in the Indian Ocean world.

Budget

	EUR €	US $
Travel		
International Travel		
1 x round trip airfare AMS-CPT-AMS	750	970
Local Travel/Transportation requirements/fuel		
Vehicle Rental (5 days @ $50/day) *		250
Sub-total for Travel		1,220
Living Expenses [food and lodging]		
Per Diem in Cape Town ($75/day x 5 days) **		
375		
Sub-total for Living Expenses		
375		
Other Costs Associated with Research		
SAHRA Permit Fee	10	13
FORDISC 3.1 license	covered by VU University	
Lab/Analytical Costs		
83 oxygen isotope analyses @ €20	1,660	2,150
83 strontium isotope analyses @ €250	20,750	26,867
Sub-total for Other Costs		29,030
Supplies and Equipment		
Bags, tags, markers	covered by VU University	
Dremel® drills and accessories	covered by VU	
University		
Eppendorfs®	covered by VU University	
Sub-total for Supplies and Equipment		
0		
Other sources of aid received		
Institute for Geo- and Bioarchaeology (the Netherlands)	-4000	-
5,180		
Total Budget		25,445

* It is necessary to rent a vehicle to safely visit the collection at the University of Cape Town on a daily basis. Price includes rental, maintenance and fuel costs.

** Five days are needed in Cape Town to sample the enamel powder. Addition days spent in Cape Town discussing strategy will be covered by the co-PIs.

Bibliography

Aggarwal, J., Habicht-Mauch, J., Juarez, C., 2008. Application of heavy stable isotopes in forensic isotope geochemistry: A review. Applied Geochemistry 23, 2658-2666.

Aggarwal, P. K., Araguas-Araguas, L. J., Groening, M., Kshitij, M. K., Kurttas, T., Newman, B. D., Vitvar, T., 2010. In West, J. B., Bowen, G. J., Dawson, T. E., Tu, K. P. (Eds), Isoscapes: understanding movement, pattern and process onearth through isotope mapping, Springer, New York, 33-50.

Allen, R. B., 2010. Satisfying the "want for labouring people": European slave trading in the Indian Ocean, 1500-1850. Journal of World History 21, 45-73.

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

Ambrose, S. H. and Krigbaum, J., 2003. Bone chemistry and bioarchaeology. Journal of Anthropological Archaeology 22, 193-199.

Bently, R. A., 2006. Strontium isotopes from the earth to the archaeological skeleton: A review. Journal of Archaeological Method and Theory 13, 135-187.

Bentley, R.A., Price, T.D., Luning, J., Gronenborn, D., Wahl, J., Fullagar, P.D., 2002. Prehistoric migration in Europe: Strontium isotope analysis of early neolithic skeletons. Current Anthropology 43, 799-804.

Binford, L. R., 1962. Archaeology as anthropology. American Antiquity 28, 217-225.

Bowen, G.J., 2010. Isoscapes: Spatial Pattern in Isotopic Biogeochemistry. Annual Review of Earth and Planetary Sciences 38, 161-187.

Brace, C. L., 1995. Region does not mean "race"- reality versus convention in forensic anthropology. Journal of Forensic Science 40, 171-175.

Budd, P., Millard, A., Chenery, C., Lucy, S., Roberts, C., 2003. Investigating population movement by stable isotope analysis: a report from Britain. Antiquity 78, 127-141.

Budd, P., Montgomery, J., Barreiro, B., Thomas, R.G., 2000. Differential diagenesis of strontium in archaeological human dental tissues. Applied Geochemistry 15, 687-694.

Burton, J.H., Price, T.D., Cahue, L., Wright, L.E., 2003. The use of barium and strontium abundances in human skeletal tissues to determine their geographic origins. International Journal of Osteoarchaeology 13, 88-95.

Capo, R.C., Stewart, B.W. Chadwick, O.A., 1998. Strontium isotopes as tracers of ecosystem processes: theory and methods. Geoderma 82, 197-225.

Chisholm, B. S., Nelson, D. E., Hobson, K. A., Schwarcz, H. P., Knyf M., 1983. Carbon isotope measurement techniques for bone collagen: Notes for the archaeologist. Journal of Archaeological Science 10, 355-360.

Chenery, C., Muldner, G., Evans, J., Eckardt H., Lewis, M., 2010. Strontium and sstable isotope evidence for diet and mobility in Roman Gloucester, UK. Journal of Archaeological Science 37, 150-163.

Cox, G., Sealy, J., Schrire, C., Morris, A., 2001. Stable carbon and nitrogen isotopic analyses of the underclass at the colonial Cape of Good Hope in the eighteenth and nineteenth centuries. World Archaeology 22, 73-97.

De Niro, M. J., Schoeniger, 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.

Elliot, M. and Collard, M., 2009. FORDISC and the determination of ancestry from cranial measurements. Biology Letters 23, 549-852.

Erickson, J., 1985. Strontium isotope characterization in the study of prehistoric human ecology. Journal of Human Evolution 14, 503-514.

Evans, J., Stoodley, N., Chenery, C., 2006. A strontium and oxygen isotope assessment of a possible fourth century immigrant population in a Hampshire cemetery, southern England. Journal of Archaeological Science 33, 265-272.

Evans, J.A., Tatham, S., Chenery, S.R., Chenery, C.A., 2007. Anglo-Saxon animal husbandry techniques revealed though isotope and chemical variations in cattle teeth. Applied Geochemistry 22, 1994-2005.

Gosden, C., 2006. Race and racism in archaeology: introduction. World Archaeology 38, 1-7.

Groenewald, G., 2010. Slaves and free blacks in VOC Cape Town, 1652-1795. History Compass 8/9, 964-983.

Hall, M., 1993. The archaeology of colonial settlement in Southern Africa. Annual Review of Anthropology 22, 177-200.

Hillson, S., 1986. Teeth, Cambridge University Press, Cambridge.

Hoppe, K.A., Koch, P.L., Furutani, T.T., 2003. Assessing the preservation of biogenic strontium in fossil bones and tooth enamel. International Journal of Osteoarchaeology 13, 20-28.

Knudson, K.J., O'Donnabhain, B., Carver, C., Cleland, R., Price, T.D., 2012. Migration and Viking Dublin: paleomobility and paleodiet through isotopic analyses. Journal of Archaeological Science 39, 308-320.

Knudson, K., J., Prices, T. D., 2007. Utility of multiple chemical techniques in archaeological residential mobility studies: case studies from Tiwanaku- and Chiribaya-affiliated sites in the Andes. American Journal of Physical Anthropology 132, 25-39.

Ledger, M., Holtzhausen, L.-A., Constant, D., Morris, A. G., 2000. Biomechanical Beam Analysis of Long Bones From a Late 18th Century Slave Cemetery in Cape Town, South Africa. American Journal of Physical Anthropology 112, 207-216.

Lee-Thorp, J. Sponheimer, M., 2003. Three case studies used to reassess the reliability of fossil bone and enamel isotope signals for paleodietary studies. Journal of anthropological Archaeology 22, 208-216.

Livingstone, F. B., 1962. On the non-existence of human races. Current Anthropology 3, 279-281.

Markell, A., Hall, M., Schrire, C., 1995. The historical archaeology of Vergelegen, an early farmstead at the Cape of Good Hope. Historical Archaeology 29, 10-34.

Montgomery, J., 2010. Passports from the past : investigating human dispersals using strontium isotope analysis of tooth enamel. Annals of human biology 37, 325-346.

Müldner, G. and Richards, M.P., 2005. Fast or feast: reconstructing diet in later medieval England by stable isotope analysis. Journal of Archaeological Science 32, 39-48.

Muskiet, F.A.J., Kuipers, R.S., Joordens, J.C.A., 2012. A multidisciplinary reconstruction of palaeolithic nutrition that holds promise for the prevention and treatment of diseases of civilization. Nutrition Research Reviews 25, 96-129.

Nelson, B.K., Deniro, M.J., Schoeninger, M.J., De Paolo, D.J., Hare, P.E. 1986. Effects of diagenesis on strontium, carbon, nitrogen and oxygen concentration and isotopic composition of bone. Geochimica et Cosmochimica Acta 50, 1941-1949.

Nystrom, K.C., Amato, L.A., Jankowitz, L.A., 2011. Strontium isotopic reconstruction of the composition of an urban free black population from the 19th centrury United States. Journal of Archaeological Science 38, 3505-3517.

Ousley, S., Jantz, R., Freid, D., 2009. Understanding race and human variation: why forensic anthropologists are good at identifying race. American Journal of Physical Anthropology 139, 68-76.

Price, T.D., Bentley, R.A., Lüning, J., Gronenborn, D., Wahl, J., 2001. Prehistoric human migration in the *Linearbandkeramik* of Central Europe. Antiquity 75, 593-603.

Price, T.D., Burton, J.H., Bentley, R.A., 2002. The characterization of biologically available strontium isotope ratios for the study of prehistoric migration. Archaeometry 44, 117-135.

Price, T.D., Frei, K.M., Dobat, A.S., Lynnerup, N., Bennike, P., 2011. Who was in Harold Bluetooth's army? Strontium isotope investigation of the cemetery at the Viking Age fortress at Trelleborg, Denmark. Antiquity 85, 476-489.

Price, D., Wahl, J., Bentley, R., A., 2006. Isotopic evidence for mobility and group organization among Neolithic farmers at Talheim, Germany, 5000 BC. European Journal of Archaeology 9, 259- 284.

Pye, K., 2004. Isotope and trace element analysis of human teeth and bones for forensic purposes. Geological Society, London, Special Publications 232, 215-236.

Ralphs, G., 2008. Green Point, globalization and the remains of the Prestwich Street Dead. Journal of the World Archaeological Congress 4, 344-352.

Relethford, J. H., 1994. Craniometric variation among modern human populations. American Journal of Physical Anthropology 95, 53-62.

Ribot, I., 2004. Differentiation of modern sub-Saharan African populations: craniometric interpretations in relation to geography and history. Bulletins et Mémoires de la Société d'Anthropologie de Paris 16, 143-165.

Roseman, C., C., 2004. Detecting interregionally diversifying natural selection on modern human cranial form by using matched molecular and morphometric data. Proceedings of the National Academy of Sciences 101, 12824-12829.

Ross, R., 1988. The last years of the slave trade to the Cape Colony. Slavery & Abolition: A Journal of Slave and Post-Slave Studies 9, 209-219.

Ross, R., 1980. The occupation of slaves in eighteenth century Cape Town. Studies in the History of Cape Town 2, 6-12.

Sauer, N., J., 1992. Forensic anthropology and the concept of race: if races don't exist, why are forensic anthropologists so good at identifying them? Social Science and Medicine 34, 107-111.

Singh Pharswan, J., Singh Farswan, Y., 2011. Role and Utility of Trace elements in palaeodietary reconstruction. New York Science Journal 4, 43-48.

Schrire, C., 1988. The historical archaeology of the impact of colonialism in 17th-century South Africa. Antiquity 62, 214-225.

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

Schwarcz, H.P., White, C.D., Longstaffe, F.J., 2010. Stable and radiogenic isotopes in biological archaeology: Some applications. In J.B. West, G.J.B., T.E. Dawson & K.P. Tu (Eds.), Understanding Movement, Pattern, and Process on Earth Through Isotope Mapping, Springer Science, Heidelberg, pp. 335-356.

Shaw, B.J., Summerhayes, G.R., Buckley, H.R., Baker, J.A., 2009. The use of strontium isotopes as an indicator of migration in human and pig Lapita populations in the Bismarck Archipelago, Papua New Guinea. Journal of Archaeological Science 36, 1079-1091.

Shell, R., 1994. Children of Bondage. A social history of the slave society at the Cape of Good Hope, 1652- 1838. Weslyan, Hanover.

Slovak, N.M., A. Paytan, 2011. Applications of Sr isotopes in archaeology. In Baskaran, M. (Ed.), Handbook of Environmental Isotope Geochemistry, Spinger-Verlag, Heidelberg, pp. 743- 768.

Smits, E., Millard, A.R., Nowell, G., Pearson, D.G., 2010. Isotopic investigation of diet and residential mobility in the Neolithic of the lower Rhine basin. European Journal of Archaeology 13, 5-31.

Sökefeld, M., 1999. Debating self, identity and culture in anthropology. Current Anthropology 40, 417-447.

Towers, J., Montgomery, J., Evans, J. Jay, M., Pearson, M.P., 2010. An investigation of the origins of cattle and aurochs deposited in the Early Bronze Age barrows at Gayhurst and Irthlingborough. Journal of Archaeological Science 37, 508-515.

Van der Merwe, A. E., 2010. The origins of late nineteenth-century migrant diamond miners uncovered in a salvage excavation in Kimberley, South Africa. South African Archaeological Bulletin 65, 185-195.

Van Welie, R., 2008. Slave trading and slavery in the Dutch colonial empire: A global comparison. New West Indian Guide 82, 47-96.

Viner, S., Evans, J., Albarella, U., Parker Pearson, M., 2010. Cattle mobility in prehistoric Britain: strontium isotope analysis of cattle teeth from Durrington Walls (Wiltshire, Britain). Journal of Archaeological Science 37, 2812-2820.

Vink, M., 2003. "The world's oldest trade": Dutch slavery and the slave trade in the Indian Ocean in the seventeenth century. Journal of World History 14, 131-177.

Ward, K., 2007. "Tavern of the Seas?" The Cape of Good Hope as an oceanic crossroads during the seventeenth and eighteenth centuries. In Bentley, J. H., Bridenthal, R., Wigen, K. (Eds), Seascapes. Maritime Histories, Littoral Cultures, and Transoceanic Exchanges. University of Hawai'i Press, Honolulu.

Worden, N., 1985. Slavery in Dutch South Africa. Cambridge University Press, Cambridge.

Worden, N., 2009. The changing politics of slave heritage in the Western Cape, South Africa. Journal of African History 50, 23-40.

http://www.scienceinafrica.co.za/2003/march/slavery.htm