Glass Beads as Indicators of Contact and Trade in Southern Africa *ca.* AD 900 - AD 1250

Sharma Jeanette Saitowitz

Thesis presented to the University of Cape Town
in fulfilment of the requirements for the
Degree of Doctor of Philosophy

January 1996

ABSTRACT

Luxury goods, used in mediaeval long distance trade *ca.* AD 900-1250, found an important market among the Iron Age peoples of southern Africa. Indirect evidence of this trade can be seen in the form of archaeological collections of glass beads at sites throughout Africa and Southeast Asia. Thousands of beads have been found at Iron Age sites in the eastern Transvaal Lowveld and at inland sites along the Limpopo Valley and in Botswana. Similar looking types of beads, referred to as small *seed* beads, were also used in the Muslim mercantile networks and maritime trade in the Indian Ocean, and have been found at coeval sites throughout Southeast Asia, particularly at entrepôt ports in India, eastern and western Malaysia and Thailand. At the commencement of the Iron Age occupation of southern African sites, glass beads of any kind were very rare.

From *ca.* AD 900-1000, Islamic influences spread southward along the African east coast. This coincided with the marked increase of glass beads found in southern Africa. Their presence is direct evidence of foreign industry, external trade and contact.

The beads are widely believed to have originated in India, and to have been distributed through Arab traders in the Indian Ocean. Exports would have included gold, possibly ivory, and other raw materials. Archaeology has much to contribute towards documenting these activities. The identity and location of the bead sources is important to an understanding of early contact and economic and political developments in southern Africa. The trade connection coincided with the beginning of a critical sequence of events in the cultural history of southern Africa, which culminated in the formation of an incipient state at Great Zimbabwe (AD 1250-1450) from precursors at Mapungubwe and related sites.

This period corresponds in time with an important episode in Islamic history, when Muslims conquered Egypt and the Fatimids moved their capital eastwards, in AD 969, from Tunisia to al-Qahira (Cairo) next to the well established cosmopolitan port entrepôt of al-Fustat (now old Cairo). Texts, chronicles, glass weights, scribal notes and receipts confirm that it was already a successful industrial centre with a history of glass-making when the Fatimids gained control of Egypt.

In this thesis I have addressed two aspects of research to investigate the trade networks associated with internal and foreign contact: (1) the manufacturing origins of the beads, and, (2) who brought them to southern Africa. Glass material from Egypt, Palestine, Syria and Southeast Asia was used for comparison, and as possible source material. Scientific techniques were used to confirm these operations.

The beads were described, classified, and sampled selectively for physical and chemical analysis. Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) was used to determine the rare earth elements (REE) composition. The results show that a particular glass, used to make beads in Egypt, is the same as that used to make some of the beads found at sites in the northern and eastern Transvaal. They document the existence of a trade link with the Mediterranean via the Red Sea 1000 years ago.

Until now, both the origin of this contact and the extent of indigenous responses were largely unknown. These findings cast a different light on maritime trade along the east coast of Africa from a millennium ago.

PREFACE

The research on which this study is based has been supported by the Anglo American De Beers Chairman's Fund Educational Trust and the University of Cape Town Research Committee. Beads and glass material were provided by A. Meyer (University of Pretoria), N. J. van der Merwe (University of Cape Town) and E. Wilmsen and J. Denbow (University of Texas). The Egyptian material was loaned by the Van Riet Lowe Collection, housed at the University of the Witwatersrand. Most of the Southeast Asian samples were provided by Peter Francis Jr. (U.S.A). Maud Spaer (Israel Museum) provided fragments of Islamic glass bracelets and George Scanlon (American University at Cairo) provided archaeological material from Fustat. Robert Brill (The Corning Museum of Glass, NY) kindly donated the glass standards used in the electron microprobe analysis. Adi Haji Taha arranged for me to visit sites in Malaysia that were the sources of associated with study material used in this thesis.

My thanks are due to my supervisors, Professor Nikolaas J van der Merwe (Department of Archaeology, UCT) and Associate Professor Dave L Reid (Department of Geological Sciences, UCT). Associate Professor James Willis and Mr Richard S Rickard, also of the Geological Sciences Department, were very generous with their time.

I am grateful to Revil Mason (Archaeological Research Unit, University of the Witwatersrand) and Tom Huffman (Department of Archaeology, University of the Witwatersrand) for allowing me access to the Van Riet Lowe Bead Collection. I am also particularly grateful for the generous collaboration of Andre Meyer (University of Pretoria) and Peter Francis Jr. (Center for Bead Research).

Analysis by laser ablation inductively coupled plasma mass specrometry was carried out at the Anglo American Research Laboratories (Pty) Ltd., the only facility of this kind in South Africa at the time of my research. I would like to express my deep appreciation to Dara Grigorova, Jan de Brüyn, Alexander Barzev and Nanette Vermaas for their collaboration, and kindness shown to me throughout. Richards Bay Minerals provided comparative analytical data.

Special thanks are due to John Henry at the Sea Fisheries Research Institute in Cape Town, Caitlin Lewis, Richard Perez, Belinda Hofmeyr, Royden Yates, Penny Berens and Ethleen Lastovica. I am indebted to Frank Coleman, without whose editorial assistance and encouragement this project would never have been completed.

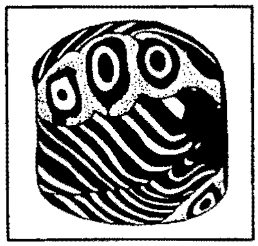
Lastly, but by no mean least, I was inspired by my family Charles, Nicole, Romy, Danielle, Raymond and Pauline, and, the memory of my late parents Alfy and Gladys to complete this work.

TABLE OF CONTENTS

List of Figures

List of Tables

1



INTRODUCTION

The main objective of this research is to examine the internal and external trade and contact in southern Africa, AD 900 - 1250, with emphasis on the Limpopo Basin, eastern Transvaal and Botswana, using glass trade beads excavated from archaeological sites as source material. Glass beads are found at most Iron Age sites in southern Africa from *ca.* AD 800-900 onward. The only local glass bead technology involved the remelting of small imported beads in clay moulds to make larger ones. All other beads were imported from external glass producing centres. The beads are widely believed to have originated in India, and distributed by Muslim traders in the Indian Ocean, who utilised the the seasonal cycle of the monsoon winds, hence the term 'trade wind' beads to provide a trade connection between India, China and Africa. This presumption has endured since the 1930s.

The period AD 900 - 1250 encompasses a critical sequence of events in the cultural history of southern Africa, which culminated in the formation of an incipient state at Great Zimbabwe from precursors at Mapungubwe and related sites. It also coincided with the dramatic rise of dar-al-Islam which controlled religious, political and commercial activities across three continents. The social processes which gave rise to incipient state formation in southern Africa are considered by most investigators to include indigenous responses to external trade. Success was contingent on the expansionary role of Islamic enterprise. This component is, arguably, the most important of all.

In this thesis I evaluate some of the events of early trade which culminated in the sovereignty of the Fatimids who ruled Egypt from their capital of al-Qahira (Cairo) AD 969-1171. This period coincided not only with the extension of Muslim trade and commerce but also with the perfection of early Islamic glassmaking. I also review the history of this glassmaking and production at al-Fustat[1] (now Old Cairo - *ca.* AD 642-1168) and specific *type* site glass beads. The period also marked the appearance of glass beads at southern African sites.

I examined the glass beads - a major component of this trade - from all the important southern African Iron Age sites, and also from Egypt, the Near East and Southeast Asia. Visual examination and classification was carried out on over a hundred and fifty thousand beads. Various analytical procedures were used to determine the elemental composition of many of them for comparative sourcing studies. Chemical analysis for the major, minor and

[1]. Al-Fustat, sometimes spelled Fostat or Foustat is now referred to as Fustat

trace elements was undertaken with positive results, especially using the Rare Earth Element (referred to as REE), which showed positively that some beads excavated in the northern and eastern Transvaal[2] are identical to beads that were produced in Fustat a thousand years ago.

Previous work, including chemical analysis, done by researchers such as Davison (1972) (see chapter 2.2.3) failed to find the source of any of the beads found at southern African sites. Davison determined that most of the glass beads found in Africa had a very long time span and regional distribution, and were therefore not chronologically diagnostic. She concluded that glass beads offered very little potential for pre-historic studies for southern African. I question this conclusion with chemical evidence to the contrary.

1.1 POSSIBLE SOURCES

For centuries, masses of glass beads have been imported into southern Africa from external sources. The glass beads that entered the region from *ca.* AD 800 onwards are very similar in make and shape, and are found in a limited range of colours. This was presumably due to the restricted number of varieties available on the market before European contact. Acceptance of these particular types of beads established a pattern, or precedence, of consumer demand that has continued in southern Africa for centuries. Over time, the selection of beads was copied by various manufacturers to capture the highly lucrative market. So successful are the imitations that they are visually indistinguishable from one another.

There is good reason to believe that trade during the pre-colonial period relied on networks of exchange and barter, and that glass beads were a form of currency. This is explained by the desire or 'ready market' of indigenous communities to trade gold, ivory and fresh produce for glass beads with Muslim Arabs, Portuguese, Dutch and English merchants. Historical records refer to beads being used in return for goods as diverse as land, cattle, gold, copper, ivory, slaves and tortoise shell. Later, glass beads became signifiers of social standing among many indigenous black populations in southern Africa, and have been incorporated into their culture in the form of decorated beaded clothing, communication and religion.

Glass artefacts have been found at many Indian sites from the first millennium BC, through the medieval period, and into the 19th century. However, very few securely dated specimens are available for analysis. A popular assumption is that the beads found in southern Africa originated in India. Large quantities of glass beads and glass waste material have been recovered during various excavations at the site of Arikamedu, situated on the eastern coast of India, approximately 3km south of Pondicherry. Arikamedu, also known as Virampatnam, was a maritime commercial centre in the early centuries of the Christian era with Mediterranean trading links. It has been identified in ancient texts. Peter Francis, Jr. (Director of the Center for Bead Research, Lake Placid), suggests a long period of bead-making at Arikamedu. Francis supplied comparative material in the form of glass 'scrap' or waste from Arikamedu (1989-1992 excavations - Universities of Pennsylvania and Madras) and one small blob of glass from Purdalpur. This sample was made with locally

[2]. The term 'Transvaal' is so well established in the archaeological record, that at this period of flux in South African provincial nomenclature, I continue to use it as a geographical standard.

found salt used at a modern primary centre between 1975-1980: the Arikamedu material ranges in time from *ca.* BC 50 to the late medieval period (Francis, pers. comm.).

Reliably documented sources show that Fustat was already a successful industrial centre and cosmopolitan entrepôt, with a history of glass-making, when the Fatimid dynasty gained control of Egypt. These include published and unpublished chronicles, evidence of pilgrims, travellers and diplomats, and the fortuitous treasures found in papyri troves and the mercantile documentation of the Geniza collection (Scanlon 1990:2). It was a clearing and forwarding centre for exotic trade goods and glassware from other glass-houses within the Islamic world. While the entrepôts which supplied and traded glass and glass beads could have changed many times, the most likely primary glass producing centres of known origin were in Egypt, Tunisia, Palestine, Syria, Mesopotamia and Persia. High-quality glassware has been excavated from within the city of Fustat, including distinctive bead types termed *Fustat Fused Rod Beads* as well as glass coin weights used for accurate gold weighing.

Fustat is a primary source candidate for the production of beads found in southern Africa. To test this connection, several beads reported to have been made in Fustat, including 'Fustat Fused Rod Beads', were chemically compared with glass material from Arikamedu and Purdalpur together with beads excavated from the twenty southern African sites. One hundred and forty samples were analysed.

1.2 GLASS BEAD STUDIES IN SOUTHERN AFRICA

A strong tradition of glass bead studies existed in the archaeology of southern Africa, before radiocarbon analysis replaced beads as a dating method for Iron Age sites. From an initial impetus in the work of MacIver (1906) and Caton-Thompson (1931) at Great Zimbabwe, this tradition was continued by van Riet Lowe (1955), Schofield (1951) and Summers (1958). Van Riet Lowe suggested an Egyptian or Arabic Asian[3] origin for the glass beads but he was unable to substantiate his theory with any tangible evidence (Gardner 1963:32). Gertrude Caton-Thompson commissioned British collaborator Horace Beck to analyse the beads from Great Zimbabwe[4]. Beck postulated an Indian source for the beads from Great Zimbabwe, comparing them, by a 'look alike' process, with beads that he had seen from Tangal and Southeast Asia. He based his findings almost entirely on visual observation and on his personal knowledge and experience of working with bead collections from all over the world. He ruled out a possible Mediterranean origin. Many researchers perpetuated this assumption, some adding alternative suppliers from bead manufacturing centres in the Pacific-Rim (Van der Sleen 1967; Chittick 1974; Francis 1990).

---

3. Transvaal Archives, 1952. C. van Riet Lowe - Personal. SAB. UOD. E3/1/639.

4. Horace C. Beck's (1873-1941) innovative research in glass beads resulted in the publication in 1928 of his definitive work on glass beads entitled *Classification and Nomenclature of Beads and Pendants*. His nomenclature remains standard to this day. He performed hardness, specific gravity and microscopic analyses on glass beads. Photographs which were used for his numerous articles were taken by himself and the colour representations painted by his wife. Over the years, he acquired a comprehensive collection of beads from all over the world which he used for comparative analysis.

Beck (1931:235) made a big issue out of the fact that no faience material, in the form of beads or small sculptures, was found at Great Zimbabwe. He endorsed his Indian connection by concluding that:

> *...(o)n account of the absence of faience, as well as the similarity of the beads, the Rhodesian specimens seem to be closely allied to the early Indian civilization.*

In 1937 Beck used microscopic examination of the beads in thin section and measurements of specific gravity to classify and compare the beads from Mapungubwe and Zimbabwe more accurately. Unfortunately, his conclusions of the origins of the Mapungubwe material were even less specific than Great Zimbabwe. His impression of the Mapungubwe beads was that they came from a very similar civilization to the Zimbabwe ones (Beck 1937:103-113), again inferring an Indian link.

Despite the fact that Beck used specific gravities to amplify his results, Van Riet Lowe considered the Zimbabwe bead analysis superficial. He could not condone the fact that Beck had not used any other methods of analysis, such as spectroscopy (Transvaal Archives, July 1940 - February 1950)[5].

Although the evidence is inconclusive, the notion that the beads found at southern African sites between *ca.* AD 900 - 1250 were made in India still persists. However, Tampoe (1989:139-143), has very adequately shown that, although goods may have been obtained at an Indian port, it did not necessarily mean that they were Indian in origin.

In 1956 van der Sleen coined the phrase 'trade wind' beads, referring to beads used in Indian Ocean trade. Because of their visual similarity they have long been recognised as forming a vague series. In 1972, Claire Davison also adopted this terminology. I believe that these particular beads were only introduced into southern Africa later by Portuguese traders, who could either have bought or commissioned them from manufacturers in Southeast Asia or Europe.

While Horace C. Beck was considered the pioneer of glass bead studies in the United Kingdom, undoubtedly Clarence van Riet Lowe was his counterpart in South Africa. During 1935 and subsequently, van Riet Lowe acted as director of field operations at Mapungubwe and undertook specialist analysis of the glass beads recovered from the site. He published several papers and was an authority on Venda beads. His main publication on Mapungubwe beads, although written in 1940, was published posthumously. Van Riet Lowe became the first director of the Bureau of Archaeology established by the South African Government and discovered over 300 archaeological sites (Malan & Cooke 1962:39). He travelled extensively overseas representing South Africa at various international conferences, until his retirement in 1955.

1.2.1 The Van Riet Lowe Bead Collection

Van Riet Lowe devoted much of his time and energy to building up a assemblage of beads, and with the assistance of many collaborators he succeeded in bringing together a large

---

[5]. Transvaal Archives, July 1940 - February 1950. Director Archaeological Survey. A letter to R. Summers dated 10th December, 1948. Part III. SAB. ASW. Vols. 32-33. B11/5.

collection from all parts of Africa, including Zimbabwe, the West Coast and East Coast of Africa, Egypt - Palestine, India, Ceylon, and Indonesia (Cohn 1959:75).

Egyptian beads represented in the collection range from pre-dynastic (BC 3400) to Islamic. The earliest beads are from El Badari, consisting of shell (ostrich and sea shells), carnelian and other stone beads. More recent pharaonic beads are mainly glazed cylinders with small red and yellow spacer-beads between them. Many of the beads and pendants were supplied by G. Brunton and came from Matmar (the ancient Muthis, north of Badari and south-west from Siut in Upper Egypt) and Mostagedda in Middle Egypt, which Brunton excavated in 1927-1928. Some of the beads from Great Zimbabwe were identified by the Museum of Arabian Art in Cairo as being of early Islamic origin (Cohn 1959:77).

Van Riet Lowe also accumulated a comprehensive selection of traders' sample bead cards. The collection is now housed in the Archaeology Department at the University of the Witwatersrand. Many of the beads, particularly the Egyptian source material used in this study, were obtained from the Van Riet Lowe Collection.

A valuable source of information pertaining to this collection is housed in the Transvaal Archives, Pretoria: voluminous amounts of archival material confirm his interest in and fascination for glass beads and their origins. A letter dated 20th June 1945 to Capt H. B. Gilliland is only one of many examples (Transvaal Archives, July 1940 - February 1950)[6]:

> *Your precious package of glass beads, ceramics and glass wares from Zeila [British Somaliland] and Saada Din island reached me safely a few days ago. The ceramics are interesting and informative in that among many mediaeval Arab types we have five fragments of Chinese celadon ware of the Sung Dynasty. This gives us a chain of Sung wares from Mapungubwe to Memphis and the Nile delta - including Zimbabwe, Tanganyika, the Sudan and Somaliland. The older types of glass beads also reveal valuable links.*

1.3 ARCHAEOLOGICAL CONTEXT OF THE RESEARCH

Earlier work by Horace Beck and Claire Davison established a precedent for evaluating small monochrome glass beads found in South Africa as having originated in India. In addition, Davison considered the 'trade wind' group, defined by van der Sleen, as unsuitable temporal indicators for cross-dating archaeological sites, because they were so widely distributed. She inferred that, because they were so similar visually and so 'extraordinarily conservative', they offered few possibilities for comparative research.

Peter Francis Jr supports a Southeast Asian origin for many of the beads, which he has termed Indo-Pacific beads, and suggests that they have been found at archaeological sites in West and southern Africa.

Notwithstanding van Riet Lowe's suggestion that the beads could have originated in Egypt or the Near East, both the expertise of early Islamic glassmaking and the Muslim monopoly

---

6. Transvaal Archives, July 1940 - February 1950. Director Archaeological Survey. Part III. SAB. ASW. Vols. 32-33. B11/5.

of trade, particularly during the Fatimid period, have been largely disregarded. The hypothesis investigated here is that many of the glass beads found at southern African Iron Age sites from the 10th to the 12th centuries, originated in Islamic Egypt. Glass material has also been used from alternative beadmaking sites and secure archaeological contexts such as Palestine, India and Malaysia.

The majority of the glass beads used in this study were excavated from southern African Iron Age sites in northern and eastern Transvaal and Botswana. The largest collection by far is that from Mapungubwe, where good stratigraphic control and fine-screening techniques were used by the excavators, such as N. Jones, J. Schofield, J. Eloff and A. Meyer. The most striking feature of the assemblages is that at Schroda, Pont Drift and K2 the number of beads are relatively small compared to that of Mapungubwe; the latter collection numbers in the tens of thousands. In the eastern Transvaal the number of beads excavated from the earlier sites is also very small in comparison, suggesting that either (i) they were not recovered in the archaeology, (ii) they did not preserve well, or (iii) that they were just not there to start with. This could be explained by the fact that the Limpopo Basin was the nucleus of the trade, and that the merchandise spread out from there. Another observation regarding the distribution of beads is the large quantities that were buried with individual skeletons, particularly at Mapungubwe (see Chapter 6.8).

Other large glass bead collections have been recovered from Iron Age sites elsewhere, including Great Zimbabwe, Dhlo-Dhlo, Matendere and Ingombe Ilede. Earlier beads from the Dembeni Phase (9th-10th century AD) in the Comores, off the East coast of Africa, were excavated by Henry Wright (1984:13-60), and in Chibuene, Mozambique, by Paul Sinclair where a radiocarbon date indicates that the site was occupied in the 8th century AD (1982:150-164). None of these beads was included in this study.

Large assemblages of glass beads have been excavated at sites in Southeast Asia, including Burma, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia and the Philippines. Similar 'looking' bead types have been recorded in East Africa and southern Africa as well. Their exact origins are unknown.This wide distribution suggests a long distance trade network which operated throughout the Indian Ocean and South China Sea.

The glass material from Southeast Asia analysed in this work was excavated at sites from the 5th - 14th centuries AD in the Malay Peninsula and the Indonesian Archipelago (Jacq-Hergoulalc'h 1992:1), Thailand and India. The archaeology of many of these sites is associated with Megalithic cist and slab built graves constructed of large granite blocks

Although glass vessels *per se* are not often found in the pre-European archaeology of Southeast Asia, except in the straits of Malacca, in western Malaysia., large assemblages of glass beads, numbering in the tens of thousands, have been found at archaeological sites throughout both mainland and island Southeast Asia. One of the common denominators of the *small* artefactual finds is the preponderance of stone and glass beads. Comparative analysis of some of the glass material was used to establish whether the beads from Southeast Asia were chemically similar to those found in southern and East Africa.

1.4 EARLY GLASS MANUFACTURE (See Chapter 3 for detail)

The history of glass stretches back into antiquity. Glass is one of the most familiar of all materials, with a wide range of applications in the modern world. Archaeological beads provide a valuable record of glass history and technology.

Glass is a unique material. It is a non crystalline, super-cooled liquid which requires specific conditions of manufacture from raw materials that are not in the least way similar to the finished product. Although it is amongst one of the oldest man made materials, the precise origins of glassmaking are unknown. The chances are that observations during related pyrotechnologies used by metal smiths led to the discovery of siliceous slags. Ancient texts attest to the skills and knowledge of an élite band of craftsmen.

Recipes for making glass have been formulated and written in countless variations. Nevertheless, glass-making is really just heating and fusing together of no more than two or three raw materials: a siliceous ingredient (sand or quartz), a fluxing agent (soda or potash) and a stabiliser (calcium oxide or lime). A number of minerals are used for colouring, such as cobalt, copper, and manganese; iron is usually present as an impurity in the sand. Decolourants are added to the glass to eliminate these impurities.

Fluxing agents or alkalis lower the melting point of the sand or quartz to a workable temperature. Both naturally-occurring and man-made compounds of soda, containing different proportions of sodium carbonate, bicarbonate, chloride and sulphate, are used in the glass industry today. Common fluxes used to produce glass in earlier times would have been in the form of plant ash or soda ash.

The shortage of recorded early glassmaking sites is problematic for sourcing studies. Some researchers are of the opinion that relatively few production centres made primary glass either in the form of manufactured ware, or as ingots, blocks of glass, tiles, rods or cullet. This suggestion has led to the belief that a viable trade in secondary glass developed and decentralised or 'cottage' type industries emerged. This concept is different from that of the centralised factory production methods of even the earliest glass houses, where the raw materials of the basic batch entered and the finished glass objects came out (Cummings 1980:17).

The advantage of secondary re-working was that it avoided the necessity of moving fragile merchandise from one destination to another and saved on extra packaging costs. Additionally, re-working required far less initial investment associated with pyrotechnology and technical knowledge, and it reduced the enormous fuel consumption necessary for production. Overall it was far more convenient to use.

Glass beads and other small articles would have been ideal commodities for secondary glass production. The *drawn* method of making beads, which comprises the bulk of the material used in this work, is associated with mass production rather than individually hand made articles. Either of these two methods could have been used in larger factory warehouse type complexes or semi-privatised 'cottage' industries.

1.4.1 Islamic Glass 8th - 11th Centuries

The study of Islamic glass has been one of the most neglected aspects of all the Islamic arts, and for this reason there are many gaps in our knowledge, particularly of the early period (AD 8th 11th centuries). The results of recent archaeological excavations, however, are beginning to bridge this hiatus, and I hope the results of this dissertation will add further to this body of information. The period directly related to glass beads being imported into southern Africa corresponds to the early period of Islamic glassmaking. For convenience it will be referred to as *Early* Islamic glass throughout this thesis.

The most comprehensive and definitive works on Islamic glass were published by Carl Johan Lamm in 1929. More recently, Ralph Pinder-Wilson, formerly a Deputy Keeper in charge of the Islamic collection at the British Museum and now Director of the Royal Asiatic Society, George Scanlon (American University at Cairo), Marilyn Jenkins (The Metropolitan Museum of Art) and Christoph W. Clairmont (Glass Museum, Cologne) have all made considerable contributions in this field.

Islamic glass evolved from a long period of glassmaking history and technology and cannot be considered in isolation. Essentially, Islamic glass in the *Early* period continued in the Roman Imperial tradition after the collapse of the Empire. After an initial period of adaptation and modification, certain Islamic glasshouses developed distinctive styles and techniques. Some of the most important Islamic contributions to glass technology in the *Early* period were carving glass in relief, applied decoration, lustre painting, gilding and enamelling. The objects were used as utilitarian as well as decorative ware notably drinking vessels, medicine tumblers, mosque lamps, jewellery, coin weights and vessels for cosmetics, or perfume; glass beads and bracelets were made for personal adornment. Islamic craftsmen also made major contributions in other fields, including textiles, glazed ceramics, woodcarving and architecture.

Archaeological excavation in Fustat revealed the remains of a glass factory and undisturbed pits below and above a house which contained the remains of particularly distinctive glass beads and dated glass coin weights (Pinder-Wilson & Scanlon 1987:71). The beads, variously referred to as 'fused rod', 'Fustat Beads' and 'Fustat Fused Rod Beads', have been attributed to between AD 800-900 (Spaer 1993:4-11; Francis 1993:29).

Approximately ten thousand Islamic coin weights have survived which now are found in public and private collections worldwide. Glass weights were produced specifically to determine the exact mass of coins and weights. Glass had an advantage over other materials because it could not be cut or tampered with easily (see Ch 4.4). Modern scholars have marvelled at the fact that medieval craftsmen were able to produce glass weights precisely indicating fractions of a gram (Goitein 1967:110). They were issued under strict official control on behalf of the caliph and were stamped and dated with the ruler's, or his agent's name. Various financial directors in Egypt were responsible for distributing coin weights of different clarity and in different coloured glass. One Fatimid weight excavated from Awagust was used as a temporal marker for the site (Devisse 1992:190-215).

1.5 TRADE AND CONTACT

Studies of the effects of contact between various civilizations throughout history often focus on the role of barter or trade. Some scholars (Haas 1982; Mitchell 1994) believe that trade was the result of uneven distribution of resources which led groups of people to exchange products, such as raw materials, finished products or manpower. Trade goods, agriculture, and plant and animal domestication became the impetus for the acceleration of indigenous regional exchange. Participation in the trade system, in terms of contributing labour or exportable goods, would have provided economic gains in the form of the imported goods.

The development of an international shipping trade between several 'worlds' of Asia in the first centuries of the Christian era, the Chinese world in the Far East, the Arab world in the Far West, and, in between the Indian world, resulted in the creation of trade and supply zones of different proportions and importance.

Safe passage and control of a long-distance trade network required stable political and socio-economic conditions to provide adequate military and sea defenses. Moving merchandise overland or in ships without restriction depended on complex and reliable networking that could supply facilities for handling, storing, packaging and processing payment of goods to and from trading outposts in areas removed from main centres. In the Mediterranean, for example, between the 11th and the major part of the 12th centuries, there was a general spirit of tolerance and liberalism, and it was a period of relatively free trade with growing activities of exchange between the nations, and the emergence of the mercantile middle-class (Goitein 1967:29). This changed radically during the 13th century, however, with oppressive clerical intolerance on the European shores of the Mediterranean and in the Muslim East.

Natural events such as seasonal land and sea conditions, and religious and everyday considerations were also important components. A letter written from Alexandria during a winter at the beginning of the 11th century describes this very well:

> *...(a) great number of travellers had been detained in the city because many ships needed repairs, and over 5000 camel loads of goods, together with the stranded merchants were left to winter in Alexandria (Goitein 1967:215).*

Life-sustaining or death-threatening situations, such as the presence or otherwise of tsetse fly, must have imposed a tremendous strain on human endurance and restricted the scope of movement for beasts of burden. And yet, in spite of many adversities even the Sahara Desert, referred to as *one of the world's greatest barriers to human movement* was repeatedly bridged by trade (Connah 1987:99).

Trading missions or expeditions often took years to accomplish. Usually merchants or trusted family members accompanied their own cargoes and conceivably spent a great deal of time away from their families. Rabinowitz (1948:162) described Raddamite merchants in the 9th century using one of four trade routes to travel to China - either one of the routes taking from between two to five years to complete.

1.5.1 Trade Routes, Goods and Volume

Trade routes

Historical sources refer to the extreme diversity of goods handled by merchants around AD 1100 for customers in the Mediterranean. However, there are sizeable areas of commercial activities such as wheat, cereals and rice staples, camels, mules or horses that are not mentioned at all, neither is the slave trade or transactions in arms and in timber (Goitein 1967:211). Even more pronounced were the limitations in respect to trade routes. One can only assume that it was not prudent to publicize the exact whereabouts of the trade routes for practical protection, for example, from pirates in the Mediterranean and bandits overland.

In East and southern Africa, no inland trade routes were mapped before the arrival of the Portuguese, although many of their early maps refer to them as being ancient. If the early maps were in error, the mistake was perpetuated. There probably would not have been any need for overland maps since there were daily stopovers and there must have been a continuity of guides. The most predictable or convenient routes would have used water transport, along lakes, river systems and by sea. Ancient overland routes from the coast would be obvious markers. Further investigation of possible land routes would be instructive.

In southern Africa, early long distance overland travel or transport and intercontinental shipment of goods was probably carried out on a very small scale. Although the volume was small, it involved luxury merchandise such as gold and ivory.

Goods

In many regions of Africa and Asia cowrie served both as an item of trade and a form of money (Vogel 1993:211). The cowrie shells of West African commerce have been almost exclusively *Cypraea moneta and Cypraea annulus,* both Indian Ocean species, the former from the Maldive Islands, and the latter from the East African coast and islands, especially Zanzibar (Johnson 1970:17). Semi-precious stone beads, including the well known carnelian agate, and cotton materials produced at Cambay (in Gujerat, north of Bombay, India) and Mantai (Sri Lanka) were also popular articles of trade (Arkell 1936:292). It is important to note that no carnelian beads were found at any of the Iron Age sites examined in this thesis, although this bead is well known to South African archaeologists from more modern sites usually associated with Portuguese wrecks (Bell-Cross 1987). Six such beads were excavated at Great Zimbabwe by R. N. Hall and are now on display at the South African Museum.

Ivory was the prime export from the eastern coast of Africa from as early as the 7th century AD. India, and later China, emerged as the major market (Sheriff 1987:78). In India most of the ivory was used to make bride bangles, an essential ornament required particularly for upper class wedding trousseaux. It is not known, however, how significant glass beads were in the ivory trade of East Africa (Thorbahn 1979:166), nor how the ivory was transported to the coast. In all probability it was carried by individuals captured for the slave trade.

From *ca.* AD 960 Europe was flooded with magnificent examples of elephant ivory carvings, many of which were sculptured from pieces more than 110mm in diameter, a measurement which is found only in African elephant tusks. Horton (1987:76) believes that this evidence, together with contemporary Muslim travellers' written reports, indicate that much of the ivory came from East Africa, from where it was exported into a network of international markets.

Volume of trade.

No recorded information exists on the size and extent of trade, nor on the identity of the merchants or middlemen involved in the internal and external trade of southern Africa during AD 900-1250. It is not thought to have been very extensive. In contrast, many documents confirm the volume of mediaeval commerce and trade at its peak in the Mediterranean, Persian Gulf and Southeast Asia which was great only in comparison with that of earlier periods. A letter written in Fustat, *ca.* AD 1000, reported that about five thousand passengers made use of the most frequented trade route between Sicily and Egypt (Goitein 1967:215), and that many of them were merchants.

In the 13th century AD, Marco Polo described ocean going trading ships as:

> *...(b)ig ships requiring large crews ranging from 150 to 300 according to their size. They carried enormous cargos and one ship will take as much as 5000 to 6000 baskets of pepper* (Throckmorton 1987:158).

There is also no written information on the value of glass beads that could have been used either for trade, social status, personal adornment, bride wealth (lobola), medicinal or magical purposes in local terms. Neither is there any data on the contact, internal trade or exchange systems which operated in Iron Age societies. One of the most immediate questions is whether the trade was monopolized or controlled exclusively by reigning monarchs, as was the case with Zulu kings such as Shaka, Dingane and Mpande (Saitowitz 1990:19).

1.5.2 Islamic Commercial Networks

Islamic commerce and industry was connected to a wide distribution network, supported by a dominant religion, common language and politics. All of these must also have played pivotal roles in the trade and contact mechanism of southern Africa more than a millennium ago.

The centre of all Muslim pilgrimages, Mecca, occupied a strategic geographical position within Islam itself. The holy journey or *hajj* to the prophet Mohammed's home became a powerful factor, not only in promoting religious unity, but also strengthening commercial connections between all Islamic countries and imparting amongst Muslims a fairly good knowledge of all parts of the known world. Muslim geographers and astronomers made a considerable contribution to the administration by supplying formal itineraries and topographical descriptions of the different countries belonging to Islam.

Thus, from the 7th century Islamic commercial enterprise advanced through a common religion, language and administration, linked with organised banking services. By the 9th century, Islamic navigation had reached its widest extent in the Indian Ocean, deriving its chief importance from commercial relations with the non-Islamic coasts of Asia and Africa. Commercial navigation in the Mediterranean, however, was limited to localities under Muslim rule.

The Indian Ocean trade comprised a series of complex, interlinked local trading systems, which stretched from the Red Sea to China, with coastal entrepôts acting as interchange ports for an immense diversity of goods. From about the middle of the 10th century, Muslim ships had already reached the Chinese town of Khanfu (now Canton), which became an important Islamic colony and emporium of the trade with China. The Siraf Report, for example, refers to Chinese stoneware with Arabic names.

By the middle of the 13th century, Cambay had become an established entrepôt, which accessed Indian and Muslim cargo ships en route to the Malay Peninsula, Sumatra, Java, and other spice islands in the Moluccas. A direct route existed across the Indian Ocean from Malaysia and Indonesia to Madagascar, via the Maldives.

In the centuries during which 'the Medieval Islamic Empire' flourished, sea trade was by no means the only means of transport. Caravan traffic was the most common means of travelling and trading between Islamic countries, especially the pilgrim caravans to Mecca. However, caravans had crossed the steppes of Africa and Asia long before the appearance of Islam. It has just become customary to associate caravan trade with Muslim dealings. Important overland routes led out of the Empire, first those to India and China, southern and central Russia, and the African trade-roads (Kramer 1931:99).

The period of Islamic expansion and commercial enterprise directly related to this study is the Fatimid caliphate, centred in the cities of Fustat and al-Qahira (Cairo) which deserves some explanation. The Fatimids originated in North Africa, where they ruled Ifriqiya, an area roughly corresponding to that of Tunisia and parts of Algeria today. After a number of attempts to subjugate Egypt, Fatimid caliphs finally gained sovereignty and built their new walled capital next to Fustat. The new city became the administrative and cultural centre. Fustat was already an old town, inhabited mostly by traders and artisans.

The location of al-Qahira and Fustat provided strategic waterway networks which linked not only Upper with Lower Egypt, the East with the West, but, more importantly, the South with the Mediterranean. The routes stimulated trade, and, the waterways especially assured an uninterrupted supply of provisions and raw materials (Kubiak 1987:131).

Fustat was founded as the seat of a military garrison for Arab troops in the conquered country of Egypt. It became a centre of manufacture of both glass, initially, and, much later, lustre pottery, and later the site of many important excavations. Hundreds of glassmakers moved to Egypt from other Islamic dominions. Archaeological excavations in Fustat discovered the remains of a glass factory and undisturbed pits, in which large deposits of glass fragments and dated glass coin weights were found.

By the middle of the 10th century, Muslim traders were active along the northern coast of Africa, the Atlantic coast, nearly the whole of Spain, Sicily, Crete, Sardinia and Cyprus.

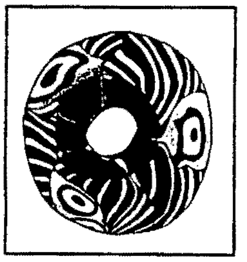
They were also trading in southern India, Ceylon (Sri Lanka), Southeast China and East Africa. This was also the period in which the Persian Gulf trading empire declined and transferred to merchants from the Red Sea and the Gulf of Aden with Mediterranean trading connections.

1.6 THE ORIGIN OF BEADS FOUND IN SOUTHERN AFRICA

It is my contention that the Fatimid caliphate at Cairo was the political entity which most directly affected or controlled the external trade relationships of southern Africa during the period AD 900 - 1250. The emergence of the Fatimid caliphate coincided with the appearance of large numbers of glass beads at south African Iron Age sites. The arrival of these beads was probably dominated by, or related to, the commercial dealings of Muslim merchants. I propose to show by means of chemical analysis that some of the beads found in southern Africa were made in Fustat. I will also show that such beads were **not** made in India and that while beads with the same chemical composition occurred in south-east Asia, they were imports. While such proof does not eliminate the possibility of non-Islamic sources for some of the beads from southern African sites, it considerably strengthens the argument that Islamic traders and manufacturers dominated the Indian Ocean trade, of which beads formed such an important part.

....

2



BACKGROUND TO GLASS COMPOSITION AND ANALYSIS

2.1 INTRODUCTION

In this chapter I examine the raw materials involved in the manufacture of glass, their effects on the finished product and how the chemical components may be utilised for analytical purposes.

2.2 GLASS AND ITS PROPERTIES

Glass batch materials.

The major constituents used to manufacture the analysed glasses in this study comprise: silica or sand (SiO_2) = 50-80%; sodium oxide (Na_2O) or potassium oxide (K_2O), or both, as a fluxing or alkali agent to reduce the melting temperature of the silica = 5-20%; and calcium oxide (CaO) from lime = 3-15%. Impurities in the sand together with additives or colourants include iron (Fe_2O_3) = 0.05-3%, copper (Cu) = 0.1-6%, alumina (Al_2O_3) = 0.1-8%, and magnesium (MgO) = 0.1-5%. The fluxing agents could have contained phosphoric oxide, sulphate and chlorite (Turner 1955: 277T-300T). While the quantitative amounts of these major elements are useful indicators for characterising the type or recipe of the glass, they are too imprecise for sourcing purposes (Tables 8.2.1).

Raw materials.

The major elements determined in my own work are silica, sodium, potassium, aluminium, iron, magnesium, calcium, copper, lead, manganese, phosphorus and antimony. They were chosen because they are common indicators of soda-lime-silica and potash-lime-silica glasses, which were the predominant types of early glass. Lead was included as an analyte, because lead-containing glasses were reported in Islamic glass compositions (Table 4.8).

The raw materials, particularly the sand, would have undergone some preliminary screening, washing and burning (fritting) processes to remove extraneous coarse particles, organic matter and impurities. Heavy minerals such as zircon, ilmenite and rutile, which are not dissolved in the glass mixture, give rise to flaws and unsightly spots. The end product would probably not have been as refined as that made by modern mechanised methods and synthetic materials.

Sand

Sand is the cheapest and most readily available of all the raw materials used for glassmaking and the exact amount used can be varied within fairly wide limits without spoiling the glass[1]. Despite extensive analytical studies undertaken in the 1950s, representing thorough and comprehensive analysis on the subject, no studies have shown precisely where the sand used to make ancient glasses was obtained (Turner 1954; Turner 1955; Turner 1956a). In fact, surprisingly few records actually refer to the sources of suitable sand deposits except for Pliny and Strabo; they reported that the sands from the Belus River on the Palestine-Lebanese coast, between Acre and Tyre, and those north west of the ancient harbours of Pozzuali and Naples, were used for glassmaking (Tatton Brown & Andrews 1991:21).

Several items of useful information have been reported on the geology of Egypt; one striking fact is that the sand found alongside limestone bluffs, which run for hundreds of kilometers parallel to and not far from the Nile, from just south of Cairo to Luxor, contains a high calcium (lime) content. The sand from near the Pyramids at Gizeh also had a substantial calcium content (Turner 1955:282T). This phenomenon would have affected the sands from Fustat and Tel el-Amarna, both of which were glassmaking centres. It it not unexpected, therefore, that the chemical composition of glass beads and a glass rod from Tel el-Amarna and Fustat examined in this study have relatively high proportions of calcium (see Chapter 8, Table 8.2.2.1).

Soda (Na_2O, $NaHCO_3$, Na_2CO_3)

Soda is one of the dominant components in glass. This alkali[2] serves as a flux in a glass batch, making the mixture melt down more rapidly and uniformly. High soda glasses may contain as much as 23% Na_2O, but they are prone to weathering. Natron is a well researched impure sodium carbonate and bicarbonate type of alkali found at Wadi Natrûn and El Kab in Egypt. The geological formation below the lakes at Wadi Natrûn is complex. One or more of the lakes contains relatively sweet water, while in some of the others either sodium sulphate, carbonate or chloride is predominant. It is a natural assumption that the alkali from these sources or other lakes containing sodium bicarbonate was used for glassmaking (Turner 1955:283T-299T). Other sources of soda are evaporites from dried seas; salt deposits leached out from soils; and salts derived from the burning of certain plants. The residuary ash from a plant grown in the Syria desert called *Chinane* (locally known as *Keli*) was also exceptionally rich in sodium carbonate.

Potassium oxide (K_2O).

Like sodium compounds, potassium oxide also acts as a flux. If sodium oxide is replaced by potassium oxide, the resultant glass has a greater brilliance and a better colour. It tends to be a much harder and more durable glass possessing a higher melting point than the soda

---

1. Sand should have an optimal particle size for glassmaking. Finely ground quartz pebbles would also have been suitable for melting. Ideally the sand should be angular grained, and be able to pass through a 20-mesh sieve. According to British Standard the majority should be retained by 100-mesh sieve, i.e. 0.1mm-0.5mm (Borax Consolidated Limit ed 1977:9).

2. The term alkali is Arabic in origin, meaning ashes, and was used to described partly vitrified ashes of plants prepared in Egypt and Arabia (Turner 1956a:44T).

glass (Hodkin & Causing 1925:94). Potassium compounds are found in the ashes of wood and land plants and are used to produce many coloured glasses. According to Miles (1948:55), analyses show that there is appreciable K_2O in most of the glasses from Tel el-Amarna and Thebes, while those from Alexandria lack K_2O or only have small amounts: the variation in the ratio of the two alkalis in the published glass analyses suggests that more than one source of alkali was used in Egypt.

Table 2.2.1.
Range of % composition of sodium carbonate from Wadi Natrûn & Keli or ash from the Syrian desert plant called 'Chinane'.

The features of the material are the complexity and variability of composition between the proportions of sodium carbonate, bicarbonate, chloride, hydroxide and sulphate and the exceptionally rich sodium carbonate found in Syrian Keli (or ash) (Turner 1955:285T-287T).

	Ancient Natron from Wadi Natrûn	Modern Natron from Wadi Natrûn	Syrian Keli
Sodium carbonate	15.5-94.0%	22.4-75.0%	75.0%
Sodium bicarbonate	5.0-32.4%	5.0-32.4%	
Sodium chloride	0.5-39.5%	2.2-26.8%	
Sodium sulphate	5.5-27.8%	2.3-29.9%	
Sodium hydroxide			4.0%
Potassium chloride			7.5%
Potassium sulphide			5.0%

Calcium (lime - CaO)

Calcium is added to the glass to act as a stabilizer, which causes the glass to stiffen quickly as it cools. It also improves the resistance of glass to attack by water, making it more durable. Miles (1948:53) noted that many limestones are of a dolomitic variety and contain a variable amount of MgO with the CaO. These are often present in equal proportions. As MgO is a common constituent of Egyptian glasses it is suggested that the composition of the sand may be responsible for its presence in the glass. He also reported that much of the sand on the northern shore of Egypt contains calcium carbonate as an impurity, a factor which could explain a variance that occurs naturally, rather than by the intentional addition of lime to the batch.

Calcium derivatives occur widely in nature as calcium oxide or lime. Calcium carbonate ($CaCO_3$), for example, is found in sea-shells, limestone and chalk. Low lead-soda-lime-silica compositions contain up to 8% CaO; lead glasses usually contain 2.5% (Henderson 1985:271).

Lead oxide (PbO)

Lead oxide usually acts as a glass former and colourant, but many colouring agents give better effects in lead glass than in lime glass (Hodkin & Cousin 1925:103; Brill, Chow and Fukang 1989:11-15). Lead is generally added in the form of red lead (Pb_3O_4) and litharge (white lead). It increases the density and refractive index of the glass. Glass with a high lead content is particularly suitable for optical glass and tableware. Lead is also an important ingredient for opaque glasses. One of the earliest references to the use of lead in glassmaking occurs in ancient chemical texts containing recipes for glazes (Turner 1956a:47T). In Europe, lead was used both in transparent and opaque glass since before the Middle Ages, and in western Russia since the 10th century (Henderson 1985:277).

Manganese (MnO_2).

According to Henderson (1985:283), when manganese oxide is found in glasses at a level of 1% or above, it was added deliberately as a manganese rich compound. The colours produced by manganese are variable, depending on furnace condition and the composition of the glass (i.e. lime or lead glass). Small amounts of manganese in potash glass are used for decolouring the glass, by producing complementary colours.

Zirconium (Zr).

Zirconium is most commonly found associated with silica as zircon ($ZrSiO_4$). Incidentally, zargon is an Arabic word denoting the gold colour of the gemstone, which is also refractory and is mined in Sri Lanka and Burma. Zirconium occurs in titanium minerals, such as ilmenite, and in association with others such as rutile and monazite, which occur as beach sands at Tramancore in India. Hafnium is generally found in conjunction with zirconium. Zirconium-rich alkali varieties of all rocks are mainly characterised by increased sodium content. The Na-varieties of alkali rocks possess considerable zirconium concentrations, whereas K-alkali rocks are markedly poor in zirconium (Vlasov 1966:309).

Titanium (Ti).

Titanium occurs in a number of rock forming silicates such as sphene or titanite ($Ca\ Ti\ SiO_5$) which are abundant in contact metamorphosed limestones (Read 1962:396). The titanium minerals, ilmenite ($FeO\ TiO_2$) and rutile (TiO_2), are mainly exploited as detrital beach sands.

Rare earth elements (REE)

REE in minerals are found in low concentrations widely distributed in the earth's crust, and in high concentrations in specific minerals such as monazite. REE possess distinct individual properties and are found in almost all massive rock formations.

REE, or Lanthanides, consist of a group of naturally occurring elements from lanthanum (atomic number 57) to lutetium (atomic number 71), These include Lanthanum (La), Cerium (Ce), Praseodymium (Pr), Neodymium (Nd), Promethium (Pm), Samarium (Sm), Europium (Eu), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb), and Lutetium (Lu). Promethium (Pm) is a radiogenic element which has long disappeared.

Some properties of the rare earth elements

An in depth study of the rare earth elements, and the geological processes from which sand is derived, goes beyond the limits of this study. However, because the Lanthanides have never been used as sourcing indicators for archaeological glass artefacts found in southern Africa, a brief overview of some characteristics is instructive.

The REE are mostly trivalent elements that decrease gradually in ionic radii from Lanthanum (1.160 Å) to Lutetium (0.977 Å). There are a very few major elements with ionic radii equivalent to those of the REE. Ca^{2+} (Å 1.12), for example and Na^{+} (Å 1.18) have similar radii, and, as such, HREE (heavy rare elements) are quite capable of entering Ca and Na sites in minerals: the ionic radius of Y^{3+} (Å 1.019), is almost equivalent to Er (Å 1.004) and Ho (Å1.015) behaves like the HREE and is often plotted with the REE. Eu^{2+} (ionic radius 1.2 A) has the same radius and charge as Sr^{2+} (Willis 1993). This results in preferential uptake by some minerals of the HREE, relative to light rare earths (LREE), or vice versa.

Eu is present as Eu^{2+} under reducing conditions, and Ce will be oxidized from Ce^{3+} to Ce^{4+} under strongly oxidising conditions, as for example are present in sea water, where Ce^{4+} enters phosphate minerals (Willis *op. cit.*).

The REE are refractory elements (involatile at temperatures up to 1200°C).

One of the earliest quantitative explanations of REE behaviour was published diagrammatically in 1962, illustrating a chondrite normalised REE pattern (Allegre & Minster 1978:2). The values showed the relative abundances of REE found in certain meteorites (chondrites), which are accepted as representative of their overall abundance in the cosmos. When the chondritic rare earth element normalising factors are used to normalise rare earth element data, it gives us an indication of the amount of fractionation relative to primitive abundances.

The lanthanide distribution at the earth's surface is also approximated by the abundances in a composite of North American shales, which are relatively common in sedimentary rocks of post-Archaean age (although absolute concentrations may differ due to different proportions of quartz and clay minerals).

REE analysis has been highly successful in many geochemical tracing studies. REE distribution patterns in rock-forming minerals are very diverse. The REE signature, particularly in sedimentary rocks, is helpful in establishing the source and nature of the original rocks.

Various instrumental techniques are used to obtain elemental information on the REE including optical, infra-red and mass spectroscopy, and radio and nuclear chemistry which permit detection in parts per billion. Willis (1986) improved the X-ray fluorescence technique, although this has limitations in respect of the amounts of material available for analysis and also on the resolution on some of the elements.

2.2.1 Previous Chemical Analyses of Early Glasses

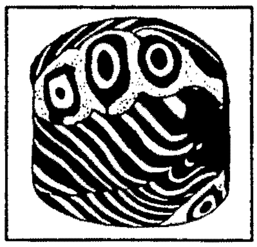
The rationale for selecting particular elements tends to vary between various studies. A review of some of the work shows an emphasis on major elemental analysis for silica, calcium, potassium and sodium, and on particular colourants added intentionally during manufacture, such as cobalt and copper to make blue beads. Brill (1986:1-27), for example, concentrated on the major elemental, and a few trace element components, of the raw materials in sourcing studies. Some researchers, such as Djingova & Kuleff (1992:53-61), question the validity of investigating colouring agents altogether. They preferred to use clear glass for analysis in order to overcome a bias toward colour classification.

Sayre and Smith (1961:1824-1826), whose work predated that of Djingova and Kuleff by over thirty years also elected not to use colour as a denominator to 'avoid undue bias of colour'. They classified ancient glasses from Europe, Western Asia, and Africa from roughly BC 1400 to AD 1100, based on five main compositional categories of the elements in the glass. These were magnesium, potassium, manganese, antimony and lead.

There is no fundamental study to determine the best elemental variables, (irrespective of analytical technique), for the classification and discrimination of glass samples. (Hickman, Harbottle and Sayre, 1983.) It was for this reason that I used trace element analysis as detailed in Chapter 7.

....

3



EARLY GLASSMAKING

Although glass is one of the oldest of man-made materials it remains, even today, one of the most empirical and least understood of technologies (Goffer 1980:137).

3.1 INTRODUCTION

The chance discovery of glassmaking as recorded by the Roman author Pliny in the 1st century AD is probably one of the most popular texts in the history of glass. The narrative described a group of merchants/sailors (predictably Phoenician) who used some of their cargo to support cooking pots over the fire, while camping overnight on a beach near the mouth of the River Belus, Acre (modern Israel). The cargo was lumps or blocks of *nitrum* or natron, which is a natural mixture of sodium carbonate and sodium bicarbonate. The fusion of these with the sand resulted in glass. Notwithstanding a few omissions[1] , and the fact that Pliny wrote some 2500 years after the production of the earliest recorded glass objects, the legend probably contains an element of truth. The two important details of his account confirm that the sand from the Belus was renowned for its quality glassmaking properties and that natron, which is a basic glass forming ingredient, was being transported and used as a trading commodity in the Mediterranean. The shipment of natron was probably *en route* to a primary glass producing centre.

Although the precise origin of glassmaking is not known, current opinion holds that it evolved from pyrotechnologies emanating from Akkadian (Babylonian) craftsmen. Early masters combined chemical formulae and pyrotechnology to produce different types of glass in various colours. *Glass-blowing*, introduced by the Romans in *ca* 1st century AD, is one of the most important innovations in the history of glass production. This process spread rapidly throughout the then civilized world. Until this time, glassmaking techniques were restricted to relatively small sized vessels including beads and pendants[2] that had been *mould-pressed*, *cold cut*, or *core-wound*, indicating that although well-developed glass procedures existed, the versatile properties of molten glass technology had not yet been fully exploited.

[1]. The tale never mentioned that the impurities in the sand, such as shell, would have benificated the glassmaking process as well.

[2]. An Egyptian pendant (BC 1500) was made virtually from a standard ingot of glass. Its granular appearance would suggest that it was cast from grains of glass (Cummings 1980).

There is an important difference between *primary* manufacture, which implies source, as opposed to *secondary* glass-reworking (using raw glass in the form of ingots; *cullet* or scrap i.e. broken bottles; glass cakes; slab or *block* glass), suggesting trade. Archaeological evidence for glassmaking and glass-reworking has been found at sites throughout the Mediterranean, Near East, Europe, Britain, Ireland, Mesopotamia, North, West and southern Africa, India, Southeast Asia and China. Evidence of secondary glass reworking has been found at southern African Late Iron sites in the northern Transvaal, where *Garden Roller* beads were made by the *cire purdue* casting method. The technique of *cire purdue* consists of translating a form modelled in wax or other modelling medium into glass or metal by direct replacement.

Only a few scanty remains of early glass furnaces have ever been recovered, the majority of which have not survived above the foundation level. Therefore, most of the information on ancient glass melting and techniques depends on descriptions and illustrations in manuscripts and ancient texts. For many centuries glass has been called *metal* by its workers. Whatever the reason for this, it is interesting to note that in cuneiform texts glass is often called *stone.*

Glass also occurs naturally as obsidian from volcanic activity, or as tektites which resemble obsidian, but which are derived from meteorite or cometary impact on earth. Tektites are found as small hazel-nut size masses in particular geographical areas, such as Bohemia, Borneo and Java; other sources are Texas, Australia and Tasmania. Obsidian and tektites are dark bottle-green to blackish in colour although various shades of transparent olive green and yellowish-grey have been found. Fulgarite or fused silica is another natural glass produced by the effects of lightning striking desert sand.

3.2 THE ORIGINS OF GLASS

Glassmaking technology is generally associated with early pyrotechnologies such as metals, vitric glazes and faience (Forbes 1957:113; Brill 1963:122; van der Sleen 1967:58; Freestone 1991:37; & Kurinsky 1991: 24-42), and it is conceivable that early metal-smiths were the first to notice or experiment with siliceous slags from their bronze, copper or iron smelting furnaces. The fact that many early glazes and glasses were coloured blue by the addition of copper lends some support to this assumption, although the connection may not be as simple as it appears because the slags only contain small proportions of copper and are much richer in iron than early glazes or glasses (Singh 1989:14).

Turner (1955:285T-90T) suggested that glass or a glassy like substance could have been the result of a residue produced from burning straw in intense heat, such as those associated with pottery firing[3]. Chemical analysis of ash from wheat and straw shows all the elements required for glass, in the correct proportions, as well as showing low magnesia and high potash concentrations. These amounts are similar to some Egyptian, Roman and Indian glass mixtures (Table 3.2.1.).

---

[3]. In 1788, an English glassworks produced glass made of one part of sand and three parts of ash. The ash most favoured was obtained from a neighbouring bakehouse where straw was used for firing the baking ovens (Turner 1955:289T).

Henderson (1988:441) used the occurrence of low amounts of magnesium and high potassium to distinguish between European Bronze Age glasses found at sites in Switzerland, Italy, Ireland and England and earlier glasses thought to be of Near Eastern or Mediterranean origin (high magnesia-soda-lime-silica glass). Henderson suggested that the fall of the Mycenaean civilisation in the 12th century B.C. disrupted the trade supply of suitable alkali sources. Another explanation may simply be that straw ash was used as a flux in the manufacture of the glass!

Table 3.2.1
Average composition of wheat & straw ash, and early glasses.

Chemical composition of plant ash from wheat and barley straw (Turner 1955:289T), and Egyptian, Roman and Indian glass formulae (Goffer 1980:141).

No	Sample	Silica	Lime	Magnesia	Soda	Potash
		(SiO_2)	(CaO)	(MgO)	(Na_2O)	(K_2O)
1	Wheat straw	66.2	6.1	2.5	2.8	11.5
2	Barley straw	53.8	7.5	2.5	4.6	21.2
3	Egyptian Glass	69.7	9.6	1.9	2.6	12.6
4	Roman Glass	62.1	8.6	2.9	4.3	20.4
5	Indian Glass	73.6	3.9	2.4	3.1	13.4

3.2.1 Glass Technology

Glass is a non-crystalline material, categorised as super cooled liquid rather than a solid, which liquefies at a much lower temperature than that required to manufacture it. Cotterill (1985: 182) defines glass as the rigid metastable solid produced by cooling the liquid form rapidly enough to prevent crystallization, the stiffening occurring predominantly at the glass temperature. It is characterized by an arrangement of atoms or molecules which is irregular, and which thus contrasts with crystalline order. According to Kurinsky (1991:43), the art of glassmaking combines two distinct, independently evolving technologies, the development of pneumatically drafted furnaces and the invention of glazes. Technically, faience, glass and vitric ceramic ware are related, in that high temperatures are necessary for their manufacture, similar raw materials are involved and all are vitreous to varying degrees (Henderson 1988:435).

Until relatively recently, it was common for the alkali component of the glass and part of the sand to be preheated and fused before being added to the final ingredients. Thus glass production involved two stages, first the *fritting* of the raw materials, and second the melting. The fritting-process of this initial stage eliminated some of the gaseous products, and assisted the subsequent melting stage. Scrap glass, known as *cullet* is often added to the raw material mix to accelerate fusion.

Glass production involves several factors:

(1) The use of a pneumatically drafted furnace capable of producing firing temperatures in excess of 900°-1000°C.

(2) The use of an alkaline flux to reduce the temperature required for vitrification.
(3) A first firing of the mixture of granulated silicate and raw materials resulting in the production of a frit at a temperature of about 750°C.
(4) A second firing at a higher temperature of about 1000°C. This firing requires sustained temperatures over lengthy periods of time. Complete vitrification can take many days to achieve.
(5) In order to speed up the vitrification process, cullet is added to the batch. Cullet acts as a catalyst in the process of liquefication into an homogeneous mass.

3.2.2 Early Industry

Cuneiform texts from the Royal Library at Nineveh, excavated from Tel Umar near ancient Babylon, in Mesopotamia, recorded chemical formulae and preparation of the raw materials used to make glass (Kurinsky 1991:31-33; Cummings 1980:11). They also mention the use of closed containers or a complex type of furnace (the reverbatory furnace) dating to the seventh century BC; smoky fires[4]; extended periods of heating; and the need for cooling glass while still within the kiln (Singh 1989:218). Instructions for constructing furnaces, fuels, grinding and moulding guidelines and directions for manufacturing coloured and crystal imitations of highly prized gems were also recorded. (Charleston 1978:9). Based on translations of this text, Henderson's (1988a:439) experimental work yielded glass which, by analysis, was directly comparable to high magnesium glass that formed the basis of Near Eastern or Mediterranean glasses.

One of the earliest examples of a substantial glass industry, using simple open hearth furnaces and small shallow crucibles, was found at the site of Tel el-Amarna in Egypt.

Many of the early furnaces of the southern and eastern Mediterranean appear to have been circular structures with the heat source or fire situated at the lowest level. Only a closed kiln design would have been able to retain sufficient heat to fuse the raw materials needed to make glass. Unfortunately, the superstructures of these early kilns have not survived, therefore their design must remain speculative. Probably the melting pots and work area were placed at the middle level, and the annealing or reheating space for the finished glass at the top. In Palestine (Galilee), built-in rectangular melting tanks were installed while in other areas separate clay crucibles were used instead; available evidence shows that early kiln temperatures did not exceed 1050°C or 1100°C (Auth 1991:1142). Later, wood-fired medieval furnaces did not achieve heating temperatures much above 1200°C either (Turner 1954:443T; Sen & Chaudhuri 1985:47).

Often crude and misshapen beads, cut or ground from rough lumps of glass and pressed or cast moulded-ware are examples of early glass technology. Molten glass fashioned on a core or *core-vessels*, popular in Mesopotamia (ca. 2400-1800 BC) and Egypt (ca. 1500 BC) were made by dipping or winding liquefied glass around a pre-shaped body made of a clay and straw mixture or a sand-core on a tapered metal rod (Freestone 1991:38; Mehlman 1982:33; Cummings 1980:19). The encircled mass was rolled or marvered on a flat surface to smooth and homogenize the glass exterior. Finally, after cooling, the core was scraped or burnt out.

---

[4]: These conditions are necessary to maintain a reducing environment required to complete the reduction of copper colourant additives in making opaque red/brick coloured glass (Brill & Cahill 1988:18-19).

The advent of glass-blowing towards the 1st century BC had a considerable impact on glassmaking, resulting in relatively inexpensive and efficient manufacture of glass objects and the introduction of new forms.

Until the invention of glass-blowing, glass beads and vessels could have been made from one of four methods:

(1) cutting from solid blocks of glass;
(2) casting in moulds, either pressed in open moulds;
or casting in two-piece moulds using powdered glass, or by the 'lost wax' or *cire-perdue* casting method;
(3) molten glass applied around a core;
(4) sections of coloured rods fused onto a glass matrix.

Ceramic glazes and enamels, and glass have essentially the same chemical composition (Goffer 1980:136). However, they are used in different ways - glazes and enamels are surface coatings applied to a substrate. Enamels are normally fused to metal surfaces. Glass on the other hand, is fashioned into objects unsupported by a backing or body of material. Glazes on pottery protect the article from chemical attack or render it impervious to liquid, in addition to providing decoration.

3.2.3. Faience

Faience or glass paste (a term often used instead of faience) is a sintered material containing all the raw materials of glass manufacture but which has not been subjected to the necessary high temperature to convert it into true glass. The earliest known European record of faience, consisting mostly of beads, was excavated from archaeological sites in Rumania (Henderson 1988:436) and Mycenae (Wace 1932:9-205) and dates between 1600 BC - 1100 BC. Egyptian faience was, of course, found at sites predating those in Europe. There are various techniques for making faience. Tite & Bimson (1983:69) describe faience as 'objects which have a ground quartz body covered with an alkaline glaze', and have documented three processes.

Freestone (1991:37) suggested that failures in the production of faience resulted in the accidental formation of glass, and that the glassy material related to the slag by-product of metallurgical processes, familiar in the Bronze Age, may well have been the catalyst for glassmaking. Kurinsky (1991:44) however, specifically differentiates between glass manufacture and faience, connecting glass production with the chemical knowledge of Sumerian potters who developed the formulae for vitric glazes, and pneumatically drafted furnaces used by metal smelters.

Interestingly, faience is rarely found in China. According to Brill, Tong and Dohrenwend (1989:11) the earliest known date for faience in China is 11th-10th centuries BC, from which period hundreds of small beads have been found. Even these may have been imported, most likely from somewhere to the west. Cognisance must be taken of the fact that these finds do not corroborate glass manufacture, but more likely reflect the extent of ancient trade routes.

Previous work by Allen, Llewellyn & Schweizer (1973:171) show that there is virtually no evidence for faience in early Islamic Persia, and at Siraf before the 14th century AD. However, Francis (1989:27) argues that there has been an unbroken faience tradition in Persia from at least the time of Alexander the Great.

As no faience artefacts have been found in southern Africa to date, Beck (1931:235) considered its absence significant enough to discount any Mediterranean links.

3.3 PRIMARY GLASS PRODUCTION

The distinction between *primary* glassmaking and *secondary* reworking is an important factor in sourcing studies and pivotal to an understanding of the history of glass production, trade and contact. Glass objects found at an archaeological site do not necessarily indicate that it was a primary producing centre. Nor is slag or siliceous material conclusive evidence of glass production, since similar vitreous slags can come from the manufacture of metal or ceramic artefacts; frit or scum [sometimes referred to as gall] are also similar to slag in appearance. Interpreting the difference is difficult and sometimes misleading. Whitcomb (1983:105), for example, compared the differences perceived by two investigators on glass lumps found at archaeological sites:

> *...(L)amb suggested that raw material, (i.e. lumps of glass) found at this site* [Pengkalan Bulang, Malaysia] *was used for grinding beads, whereas Bass sees similar material in the Serçe Limani wreck as supplies from itinerant glassmakers.*

Some researchers believe that primary glass was made at a number of small factories (Auth 1991:1142); others, such as Brill & Cahill (1988:17), note that among the excavated ancient glass factories known to them 'fewer than a dozen were probably locations where glass was actually made from scratch starting with raw materials' and that most of the excavated evidence that has been preserved appears to be the remains of processes connected with the forming of objects [i.e. secondary working]. They also showed that cullet and glass 'metal' was frequently manufactured in one place and transported over considerable distances before it was formed into objects. Newton (1971:12-13), maintains that only a few glass centres produced and exported glass ingots of specific colours, which were traded over hundreds if not thousands of miles, where they were used for decorating small items such as beads or bangles

Many descriptions of excavated glasshouses unfortunately lack accurate or sufficient data to determine if the technology used was for primary or secondary glass-working. Although a number of crucibles have been recovered from archaeological sites, very little work has been carried out on the receptacles to determine usage.

Charleston's (1978:9) description of the open hearth furnaces used for melting glass at Tel el-Amarna[5], for example, and the small crucibles that were supported in them on refractory drums do not explain whether the glass was made from scratch or whether it was re-worked. Given the nature of the furnace it is unlikely that very high temperatures

5. Tel el-Amarna was the capital of Pharaoh Akhenaton betweem 1379 BC-1368 BC.

could have been achieved. From this explanation one can only assume that the crucibles were used either to make frit, glass of a pasty nature, or to re-heat the glass for secondary working. It could of course have been pressed and moulded into fairly large sizes, but the possibilities of producing *hollow-ware* were very limited (Forbes 1957:122).

Researchers such as Henderson & Ivens (1992:52-64) clearly distinguish between articles that had been used for primary raw material production, and those that were used simply to reheat the glass sufficiently to soften it to form and decorate artefacts. Metal *heating trays* and examples of ceramic crucibles found at Irish Early Christian sites, showed extensive fusion or interaction (wetting) of the raw materials with the clay lining of the crucible. This reaction between the glass and the crucible walls does not occur at the lower temperatures used for secondary reheating practices.

3.3.1 Secondary Re-Working

Secondary re-working facilitated the moving of fragile merchandise from one destination to another, without extra packaging or protection to avoid breakage. The establishment of glass re-working workshops using imported glass ingots would obviate the necessity for an intimate knowledge of glass manufacture. In addition, fuel requirements for secondary working are less than those of initial production[6]. It takes much more heat to melt a glass batch, bring all the materials into solution and remove some of the larger bubbles, than it does to soften it once it has been made.

Brill & Cahill (1988:17) have shown that frequently cullet was manufactured in one place and transported over considerable distances before it was formed into objects. Newton (1971:12-13) however, was more specific, and thought that only specialized coloured glasses made in relatively few centres were exported as ingots, and used for decorating beads or bangles.

Probably one of the most significant and convincing sources of evidence supporting the export of glass cullet for re-working was found on a a 14th century BC shipwreck off the southwest coast of Turkey at Ulu Burun (Sparrow harbour, situated off the southwest coast of Turkey, opposite the island of Rhodes). The Serçe Limani carried large cargoes of glass ingots and *cullet* (Bass 1987:693-732). More than 20 cobalt blue glass ingots, weighing 11kg (25lbs) each and measuring 178mm (7inches) in diameter and thickness, were recovered by marine archaeologists. According to Pulak (1988:35), these glass ingots almost certainly originated in Syria-Palestine. More recently, these finds have been attributed solely to Syrian glass-houses (Scanlon, pers. comm.). The forms of some of the glass cargo, recovered from a medieval shipwreck in the Adriatic, off the Island of Mljet, "conform to common medieval models of the eastern Mediterranean" (Kurinsky 1991:373).

Quantities of glass cullet, often in slab form but also as roughly shaped chunks, have been found at Hellenistic Rhodes (Weinberg 1971:148). Spaer (1984:15) suggests that blue

---

[6]. The most widely used fuel was wood, although in the geographical areas such as Egypt and Mesopotamia, where wood was in relatively short supply, other materials were used including dried dung and the roots of certain plants, including the papyrus plant. But, for the more primary processes such as pottery firing or glassmaking, wood and charcoal had to be imported (Day 1990:206). Two cubic metres of burned solid wood produced one kilogram of primary glass (Harder 1993:272).

wound beads and moulded objects produced in Greece and local (referring to the area known as modern day Israel) workshops during the 14th to 12th centuries BC were made from glass imported from Mesopotamia. Glass has also been found at Karanis.

3.4 GLASSMAKING IN AFRICA

Egypt.

Glass products and glass beads have been manufactured in Egypt for centuries. According to Mehlman (1982:30), Egyptian craftsmen were familiar with glaze techniques and faience prior to BC 3000. Forbes (1957:126-130) reported that glass manufacture suddenly flourished in Egypt from BC 1500 and evidence of glass factories from this period have been found all over the country from Memphis, Tel el-Amarna and Thebes to Elephantine. By BC 1200 the Egyptians had begun to shape glass by pressing it into moulds. The Egyptian industry was firmly rooted in the Delta at or near Alexandria, and reached its height of beauty in the luxury glassware made at Alexandria in the Ptolemaic and early Roman periods BC 300 - AD 100 (Singer, Homyard & Hall 1956:322). From about AD 350 they were also producing glass coin weights in Alexandria.

Mehlman (1982:35) considers that the founding of the Roman empire, and the subsequent spreading of its culture to all the provinces, had a substantial influence on glassmaking - particularly in Egypt and on the Syrian coast: The glass industry throughout this period continued on a large scale and production in each region remained distinctive[7]. The impact of Roman colonization also led to increased glass exports to Italy, and other later colonies, and a movement of migrant craftsmen to the West.

Glass demonstrating Coptic influence and the glass of the early Islamic period were heirs to this long tradition of glassmaking. Although glass furnaces of this era have not been found, the sheer quantity and style of most glass found from this time suggests that a number of small factories produced glass articles for local use. Evidence from other areas around the Mediterranean shows that glass factories could have been quite small and simple (Auth 1991:1142).

Suitable raw materials such as sand and natrum were plentiful in Egypt in the form of natural soda in the oases of the Western Desert, Wadi Natrun, south and west of Lake Mareotis and west of the Delta. As late as AD 900 the Venetians were carrying the *vitreous earth* of Alexandria (as well as sand from the Belus) to Italy to use it in their own glassworks, which remained dependent on imports of Egyptian natron very much longer (Forbes 1957:158).

[7]. Syrian glass-makers were among the first to employ the technique of mould-blowing for domestic wares, a method by which the hot glass was suspended at one end of a blow-pipe and placed inside a hollow wood or clay mould, then blown into shape (Mehlman 1982:35)

North and West Africa.

Kairouan was the main commercial, as well as the most important industrial metropolis in North Africa. Tunis, Sousse, Sfax and Gabes were also important trade centres. The Fatimids controlled Kairouan where glass was manufactured as well as enamelled pottery of high quality (Lewis 1951:163). Textiles became an important industry and were exported to Egypt. Zawila, Çabra, and Bougie were centres for glass manufacturing (Lewis 1951:209). Marçais (1946:180), also reported archaeological evidence of a glass furnace at Zawila (suburb of Mahdiya) and slags at Çabra (next to Kairouan).

Smith (1957:92) comments that most authors on glass history in antiquity have ignored North Africa as a producing area, or at the most they have dismissed the matter summarily as a vague possibility. In his opinion, although the literature is full of references to glass exports from Egypt to North Africa, it is all based on surmise.

Lamb (1970:47) suggested that the bulk of glass found in markets and in archaeological sites in black Africa, with particular reference to West Africa, was imported material. He considered it reasonable to suppose that from very early times, trade in glass *cullet* and glass ingots existed in sub-Saharan Africa, and that of a number of categories of beads found in Ghana, some were locally produced whilst others were not.

In Nigeria, the Yoruba civilization made glass, ceramics and metals: prior to that, radio carbon dates for Ife pottery suggest that terra-cotta figures were made sometime after 900 BC. and that the culture may have continued production after AD 200 (Fagg & Willett 1960:245). In 1910, Leo Frobenious discovered glass making crucibles at Ife with remelted residue of opaque glass which he considered to have been

> *...(t)he centre of the great glass making industry which had spread blue glass segi beads across West Africa* (Fagg & Willett 1960:237).

Glass bead moulds and glass fragments dating to the 8th century have been discovered at Tegdaoust in present day Mauritania (Opper & Opper 1993:37).

South Africa.

Garden Roller beads are the only locally produced glass beads known in southern Africa. The technology involved *secondary* reworking or remelting of small imported glass beads in clay moulds to make larger barrel-shaped ones (van Riet Lowe 1955:12; Davison 1972:60). Practically all the beads termed *Garden Roller* (after the shape of rollers used to surface English lawns) were made from beads in various hues of turquoise blue. Most of the beads used in this study were excavated from K2 and Bambandyanalo (AD 1000-AD 1220).

Van Riet Lowe (1955:12) suggested that small, *seed* beads excavated from K2 or Bambandyanalo provided the raw material for the *Garden Roller* beads. The results of spectrographic analyses are consistent with this theory (Davison 1972:60). Visually, the texture of the glass of many of the beads looks 'sugary', suggesting that either the glass beads or the heating temperatures were insufficient for vitrification.

The only description suggesting their process of manufacture was presented by van Riet Lowe (1955:12).

> *The small beads from which the larger beads were made were crushed and melted down in a suitable crucible. A metal wire was then dipped into the molten glass and withdrawn with a filament of viscous glass adhering to it. This was then wound up until a spindle-shaped mass about 1 inch long and somewhat under 1/2inch in diameter was obtained. The whole was then passed into the mould and the glass at one end detached from the wire which was then retracted so as to bring the other partly solidified end back into the mould. The first end was then reheated in order to attach the glass to the wire when it, in turn was retracted. The wire was then bent over, heated, rotated and finally withdrawn. During the whole of this process the mould and the glass in it were kept at a red heat - at a temperature which just avoided devitrification. An examination of a section of the bead shows how the glass layers have been folded and refolded and the mass of the bead forced out to fill the mould by the effects of retraction at the ends as illustrated in the accompanying text.*

Modern techniques of 'mould-pressed' beads involve two basic methods; those made from one piece of glass pressed into a mould and those made from fusing two glass-filled moulds together (Karklins 1985; Saitowitz 1988:43). The moulds can be re-used many times.

I argue from the outset that van Riet Lowe's suggested method is ill conceived. Firstly, winding glass around a metal wire which has not completely melted into an homogeneous state is not feasible. Secondly, although some parts of the beads portray a wound effect (usually around the ends of the beads), this method would not explain the folded layers of glass. Nor would it account for some the bubbles or holes in the glass, which if wound, would have whirled around the perforation. Microscopic examination of many of the samples shows that the bubbles are oriented parallel to the perforation.

A pottery firing kiln or pit associated with *Garden Roller* bead manufacture and numerous broken moulds have been excavated at K2 (Gardner 1963:7). Some of the moulds have small globules of glass bonded to them, while a few beads still have fragments of pottery adhering to them that had been detached from the moulds.

Gardner (1963:93) noted a complete absence of moulds on Mapungubwe summit. He used this evidence to substantiate the claim that *Garden Roller* beads were made at K2, and when the settlement was overrun they were no longer made but continued to remain objects of value to the newcomers.

An unbroken *one-piece* mould, found by A. Meyer (pers. comm.) at K2, clearly shows that the moulds could only have been used once, thus explaining the high proportion of breakage. The shape of the mould plus the fine consistency of the clay body inside the mould could only have been achieved by the *cire purdue* method of casting. This pyrotechnology has not previously been reported in southern Africa, but it is well known in the Far East, India, Egypt, Near East, West Africa and Peru[8]. Perhaps van Riet Lowe

---

[8]. The process consists of making a wax replica, encasing it in a ceramic mould and heating it over a fire or in a kiln. The heat causes the wax to melt and flow out through a special hole/holes. The wax is

(1955:12) would have modified his comments that 'only the inexpert would go to so much trouble'.

The most likely method for making *Garden Roller* beads would have been either by melting the small beads directly in the clay moulds, or by melting them in a small crucible and pouring the molten glass into the mould. Both of these methods would account for the layering effect. An iron rod or pontil could have been inserted into each end of the mould or plunged directly through it, which resulted in the vertical and horizontal striae described by van Riet Lowe (1955:13). One of the mould ends would have been *plugged* with clay, wax, or grass (Fig. 3.4.1.).

Herbert (1984:89), pointed out that the earliest evidence (IgboUkwu) of *cire purdue* yet known in sub-Saharan Africa was found in the region of West Africa, which happens to be a great distance from North Africa, the Nile Valley and the ancient Near East, where the technique already had a long history by the time trading between North Africa and the Sudan intensified in the wake of the Muslim conquest of the Maghreb. She doubted whether this situation would benefit proponents of a diffusionist theory, although she accepted that diffusion from the north or northeast still seems the the most probable explanation.

3.5 GLASSMAKING IN SOUTHEAST ASIA

India

Although glass is mentioned in early Sanskrit and Buddhist literature and referred to in ancient Indian texts, Sen & Chaudhuri (1985:6) maintain that the origin of glass in India is still surrounded in mystery. Singh (1989:27) considered that the occurence of glass or glass like materials can be traced back to the Harappan period (*ca.* BC 2350 - BC 1750).

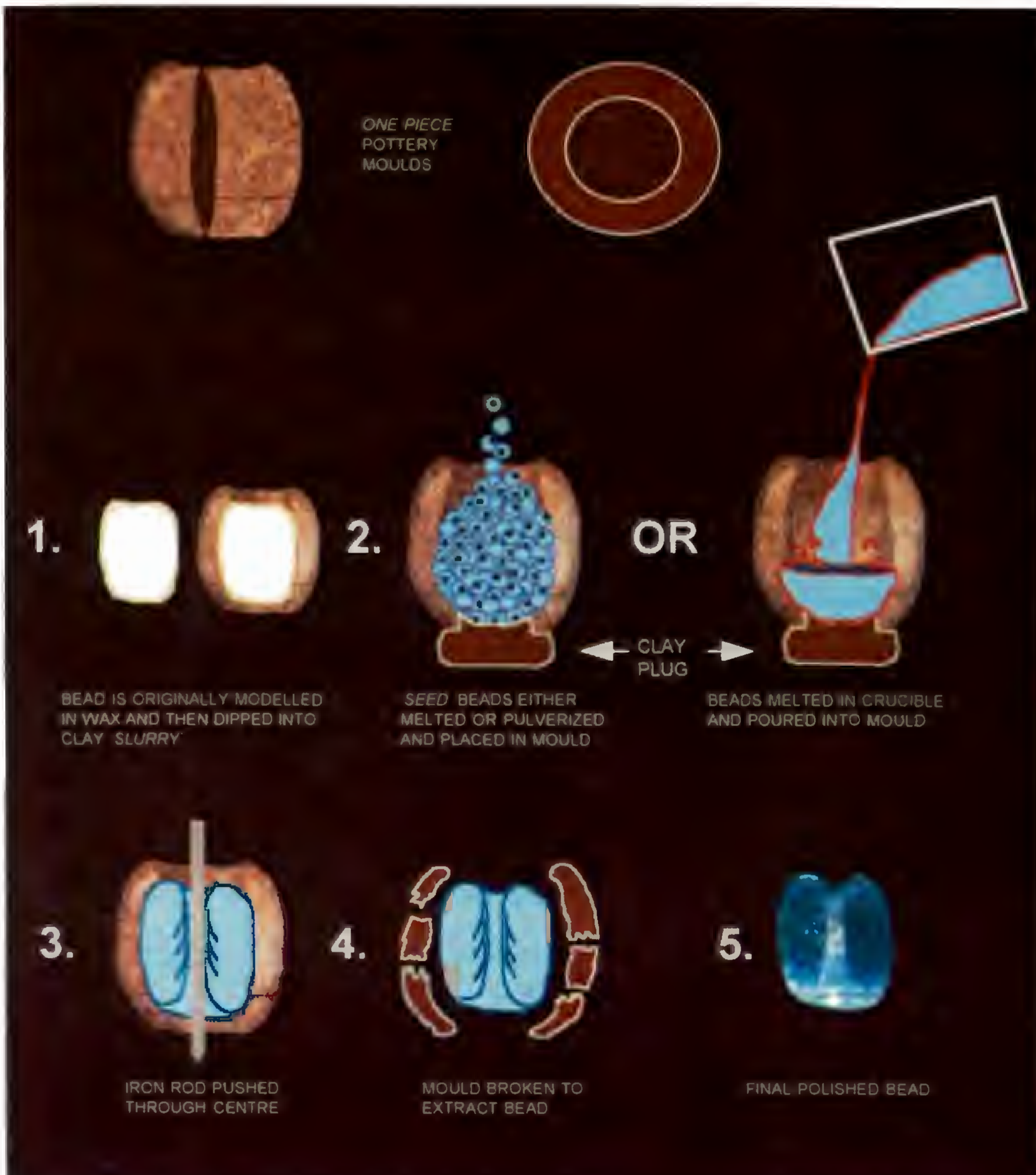
According to Francis (1984:152), the earliest date for the introduction of glass production in India was BC 1000. Dikshit (1969:150) is more conservative in his estimates and placed Indian centres such as Arikemedu, a glassmaking site and well known as an emporium on the eastern coast of India, in the early centuries of the Christian era. Brill (1986:2) believes that, although some of the glasses excavated in India could have been imported from the Near East and Roman World in earlier periods, and from Europe, China and Iran in later periods other earlier glasses were actually made locally. Dikshit (1969:157) was rather of the opinion that finished products like bangles[9] and beads were made from big thick tiles, which were a pre-requisite in medieval and pre-British India (early Indian glass was primarily used for personal ornaments such as beads, bangles and seals). Lal (1958:139) used physical and chemical analyses to examine glass-like material, erroneously identified as fossilized twigs, from Arikamedu. The results confirmed that the material was manufactured glass, attributed to local glass-workers at the site.

---

replaced by a metal or glass. After the form had cooled and hardened the mould is broken, thus, freeing the cast object. The final product is cleaned and polished, either by heat polishing or with abrasives.

[9]. The fact that they were made from tiles is indicative of secondary reworking.

Fig.3.4.1. The *cire purdue* casting method used to make *Garden Roller* beads.



After extensive study of early Indian glass, Singh (1989:219) draws the conclusion that Indian glass technology did not compare favourably with contemporaneous cultures. He attributes the limiting factor of mass produced Indian glassware to the absence of suitable natural alkalis such as natron.

Sen & Chaudhuri (1985:132-135), however, describe Indian sources of raw materials used for making glass, with particular reference to soda-bearing substances called *reh*[10] soils which have been used for making glass from ancient times in Bihar and Uttar Pradesh. *Reh* soils are widespread in the Indo-Gangetic alluvial plains from Bihar through Uttar Pradesh to parts of the Punjab. Salt lakes constitute another important source of sodium salts which are used in many indigenous industries, including glassmaking. Sodium compounds from salt lake deposits yield crystallized compounds of sodium chloride (NaCl), sodium sulphate ($NaSO_4$) and sodium carbonate (Na_2CO_3).

Malaysia

Glass-house waste and glass beads have been found at many Southeast Asian sites particularly in western and eastern Malaysia, and in Thailand (Beck 1930; Harrison 1964 & Lamb 1965). Lamb (1965:36) suggests that melted down batches of imported glass scrap, originating in Egypt, the Middle East or Arabia, were used to make beads found in Southeast Asia. More recently, Jacq-Hergoualc'h (1992:1) still considers a Middle-Eastern source for some of the glass sherds and glass beads from sites in the province of South Kedah[11].

Evans (1928:123) and Francis (1990:1-23) support a local beadmaking industry for the beads found at Sungai Mas, (South Kedah), and Kuala Selinsing (Perak) in the Selinsing River estuary, but do not speculate on imported glass being used to make them.

The distinctly orange colour (Munsell 3.75YR 6/14) *seed* bead is very characteristic of the Southeast Asian collections.

....

10. Collectively these are referred to as *urao*, although some mineralogists have preferred to use the term *trona* for the compound (Sen & Chaudhuri 1985:136-7). According to P. Francis. Jr. (pers. comm), *deshi kach* or soil salts are salts which effloresce on the soil after rains (or alternately are gathered from evaporating pans). This is the basic traditional material used for Indian glass. In the north it is called *reh* and in the south *sondu*. At Purdalpur the reh is gathered and fired in a special furnace for about a week to make frit (they did not need to add sand, as the soil particles they gathered up with it contained sufficient amounts). This was then made into glass. Early descriptions of glassmaking in India describe this process. It was also used sometimes in China.

11. Archaeological excavations along the Bujang River in South Kedah show evidence of entrepôt activity engaged in handling foreign wares such as Arab glasses and Chinese porcelain (Andaya & Andaya 1994:28).

3.6 GLASS BEAD MANUFACTURE

Methods of bead manufacture have been described in innumerable publications (Van der Sleen: 1967; Kidd and Kidd 1970; Karklins 1985; Sprague 1985, Francis 1988; Saitowitz 1988). Basically there are four different procedures for making beads from molten glass, i.e., *drawn*, *wound*, *blown* or *moulded*.
Initially, glass beads were made either by cold working from lumps of glass then by heating, joining and decorating small pieces of glass from rods, or by winding glass threads around a metal rod or wire and fusing the different layers together. In all probability early glass beads were made as subsidiary factory articles or part of cottage industries.

Some of the earliest examples of glass beads are wound, quadrangular, disc-shaped spacer beads (spacer is the name given to any bead having multiple perforations). Over 11000 of these beads were recovered from Nuzi, in north eastern Iraq, dated to the 2nd millennia BC (Spaer 1985:1). The spacers have a decoration of four to seven ribs. Similar spacer beads have been recovered from temples at Beth Shean and Lachish (in modern day Israel). Several wound glass beads and *eye* beads manufactured by the "stratified" or "layered " technique were also found at Nuzi. Some of the beads were still attached to the copper metal rods, approximately 2-3mm in diameter, around which they were wound.

Lamb (1966:85) believes that Arikamedu was a large bead-making site, and that South Indian beadmakers moved to areas in Southeast Asia where they created overseas centres of production. Francis (1991:21-42) suggests that much of the Old World was supplied with *drawn* monochrome beads made at the site from the third century BC, following the same theory that while the bead industry continued at Arikamedu, bead-makers moved from there to other sites in Ceylon, Malaysia, Indonesia, Vietnam and Thailand. Francis has used diagnostic glass 'wasters' associated with the *lada* method of bead-making to connect seven sites where Indo-Pacific beads were made. As each site was abandoned, the bead-makers were forced to move. By the 13th-14th century beadmaking in south and southeast Asia had ceased to exist. However, all the bead-making sites lack a firm archaeological context for *primary* glass production. No glass furnaces have been discovered at Arikamedu so far (Francis 1987:13).

The *lada* technique of making drawn beads

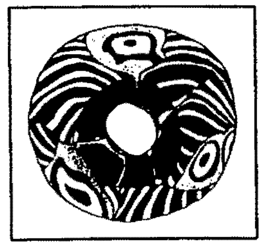
According to Francis (1991:28-36), the *lada* technique is an extant method of manufacturing small *drawn* monochrome beads in India (Papanaidupet, Southeast India). The procedure is fairly labour intensive, involving a number of manufacturing processes and specialised equipment, such as the furnace and the *lada*. The *lada* is a hollow metal tube. Softened glass is rolled and worked around the *lada* to form a large cone shape lump or 'gather' of glass from which a continuous tube of glass can be drawn. An iron rod is pushed through the *lada* to pierce the cone of glass from the base to the apex. The perforated cone is returned to the furnace, still on the lada, and the tip is *drawn* out with an iron hook. This procedure produces characteristic glass wasters in the form of 'knots', curved tubes, flakes of glass and collapsed tubing from the end of the *draw*. After the tubes have been *drawn* they are cut into segments which are reheated to round off the ends.

An alternative method to form the perforation for *drawn* beads is by manipulating the glass into a hollow in a molten lump of glass or *gather* at the end of a glass blowing pipe. The rest of the procedures are basically the same where the glass tube is cut into short portions and rounded off. The glass wasters resulting from these two methods have different attributes.

Harder (1993:272) noted that in ca. 1st century AD South India and Ceylon were in close contact with the Mediterranean and China, and that Mantai was an ancient port of the maritime silk route. He questioned whether the large pieces of prehistoric glass found at different sites in Ceylon were manufactured at the site or imported from elsewhere.

....

4



EARLY ISLAMIC GLASS 8th - 11th CENTURIES

4.1 INTRODUCTION

The glass history and production directly related to this study is that of the *Early* period of Islamic glassmaking from the 8th to the 11th centuries, which coincides with the appearance of glass beads at southern African Iron Age sites.

Glassmaking under Muslim sovereignty evolved from an existing industry, entrenched by former Greek and Roman art and culture. The decline of the Roman Empire and the transfer of political power from Rome to Constantinople (AD 350), however, interrupted the development of late Roman Imperial art and resulted in a general decline in the availability of glass, particularly of artistic and decorative wares, and mass produced glass products[1]. Nevertheless, glassmaking did not come to a complete standstill. Glasshouses that were still operational in the eastern Mediterranean continued production which provided the link in style and form between past classical designs and the subsequent Islamic genre.

Glass production of the succeeding period did not evolve with the same rapidity as did the Muslim conquest. Thus, glass manufactured during the *Early* period shows a great deal of Roman influence in shape and decorative techniques. It is, therefore, difficult to specify features characteristic of Islamic glass before the 8th century.

Islamic glassware, glassworkers or glasshouses had a predilection for one or another style or form. In Syria, for example, the overall type of work produced during the *Early* period was based on Syrian prototypes, such as mould-blown and free-blown vessels for domestic use. Production or the revival of artistic wares was promoted only later by the Abbasid caliphs and their governors. The centres of production in this period were Syria, Egypt, Persia and Mesopotamia[2]. Over time, distinctive styles and specialist technologies emerged, which did distinguish Islamic glass from the previous Roman industry. The techniques of painting in lustre, gilding (gold painting) and enamelling on glass were developed, and, along with marvered, trailed threads in a contrasting colour - either combed or feathered,

[1].The 'dark age' (AD 6th-8th century) of the post-Roman Empire was formerly regarded as a period of reorientation. But see Scanlon 1968 (my refs. P. 186) for an updated analysis consequent on the finding of a lustred glass goblet *et al* in a pit at Fustat in 1965.

[2]. The decorative arts of Persia, in particular, had a profound effect on the glassware produced at these centres.

pinched, incised or in relief carving - were perfected by craftsmen during the *Early* Islamic period; glass and window glass were also used to decorate the interiors of buildings. Unique inscribed glassware confirms the existence of some of this early ware.

In Egypt there was a notable reappearance of earlier glass techniques, such as mosaic ware and deeply incised cut glass. Glassmakers seem to have been preoccupied with surface manipulation; metal tongs were used to impress or *stamp* designs into the glass. High-quality glass products have been excavated from archaeological deposits in Fustat, including distinctive bead types, termed *Fustat Fused Rod Beads*, and glass coin weights. During the *Early* period, Fustat was already a successful cosmopolitan entrepôt and enjoyed a history of glassmaking. The city was a clearing and forwarding centre of glassware from other glasshouses within the Islamic world. The combined skills of Muslim, Coptic (Egyptian Christians) and Jewish glassmakers working in Fustat produced glassware of notable distinction. Egyptian cut glass and rock crystal work reached perfection during the *Early* period under the Fatimids, and vessels made of rock crystal were among the most highly prized possessions of the opulent Muslim courts (Rice 1956:85).

Glass beads[3], bracelets, finger rings, and other *small* items, which probably would not have qualified as masterpieces in their own right, were nevertheless part of Islamic glass-making industry as well. Although beads and bangles were simple body ornaments some of the stylized techniques used to decorate the more elaborate glassware such as mosaic, marvered and trailed, were used on the beads. Three *Fustat Fused Rod Beads* (now referred to as FFR beads in this text) have been used for research purposes in this thesis, as well as other types of beads that were made either for local or export purposes. Fragments of three glass bangles from an Islamic burial in Palestine dated *ca.* AD 800 were also available for analysis.

4.2 ISLAMIC GLASS TRADITIONS

Islamic glass has not enjoyed the popularity of, for example, Islamic ceramics such as lustre ware, notwithstanding its importance. Jenkins (1986:4-6) questions why Islamicists have largely abstained from undertaking scholarly investigation of glass as it remains one of the least-studied media in Islamic art. A number of reasons for this are cited including that

(1) there is very little information inherent in the Islamic glass objects themselves such as a source or inscriptions containing makers' marks that can be historically placed[4];
(2) glassmakers in the Muslim world were mobile and seem to have moved from place to place, which meant that the styles and shapes they created would not necessarily have been at one particular centre and, therefore, could have been made in different countries and continents; and
(3) finished glass products, and probably glass ingots and glazes, were traded from country to country.

[3]. Contemporary Islamic glass beads are used as amulets for protection against the evil eye. In certain parts of Africa, Italy and Spain, glass itself is considered amuletic; certain colours are associated with helping cure specific ailments (Allen 1993:6).
[4]. This is in direct contrast to the Fatimid lustre pottery which was quite frequently signed: signatures do not only identify the artist but also acknowledge that the particular piece was personally valued and recognised (Caiger-Smith 1973:37).

A major problem in identifying or distinguishing *Early* Islamic ware is the similarity, in both shape and execution, to many pieces made by preceding Roman[5] artisans. An appreciation of this relationship is important in understanding Islamic glassmaking more fully.

The fall of the Byzantine provinces of Syria and Egypt to Islamic forces probably resulted in the closure of many leading glasshouses and a general decline and shortage of glass and mass produced glassware. However, glassmaking continued at centres along the Syro-Palestinian coast and, according to Pinder-Wilson (1991:115), it seems that Persia and Mesopotamia contributed most to the resurgence of glass production in the first three centuries of Islam. Lane (1937:61) and Clairmont (1977:35) also credit the revival of the glass industry, after the Muslim conquest of Syria and Egypt, to the Abbasid caliphs and their governors at various glasshouses or glass producing centres in Mesopotamia and Persia (Sasanian Persia, 100 BC- AD 600). It was in these regions that craftsmen began to satisfy the needs of a new consumer market. Recent archaeological excavations in Persia confirmed that there was a flourishing glass industry that continued without interruption into the Islamic period (Tate 1991:114).

Significant numbers of glass fragments have been excavated from Al Mina in North Syria. Lane (1937:64) notes the corrosive properties of the Syrian soil, contrasted with the good preservation qualities in the dry sand of Fostat [*sic*], in which a wealth of glass, showing every kind of technique, was found.

Clairmont (1977:31) does not consider the terms 'Roman' or 'Islamic' satisfactory when analysing the stylistic aspects of glass found from this period. Nor does he see merit in assigning any one particular name, shape, technique or decoration characteristic of Islamic glass before the 8th century. Lane (1937:64) also acknowledges difficulties distinguishing between particular glasses, admitting that it was equally as difficult to classify Roman glass made in Syria and that made in Egypt. He is of the opinion that Syrian glass maintained the world-wide prestige it had won in Roman times, and that the shapes or metal, and the *family resemblance* [Roman] must have outlasted the advent of Arab rule.

Innovative, stylistic techniques and decoration were the essence of Islamic glass. During the early period, craftsmen seem to have been preoccupied with surface manipulation and less inclined to explore polychrome decoration, which was to become the principal feature of later work (Pinder-Wilson 1991:122). By the 10th century, however, Islamic artisans began experimenting with new methods of decoration, and a distinctly Islamic glass style evolved from at least two major glass producing centres within the empire, on a scale which was comparable to the preceding Roman period (Jiayao 1991:6-7).

According to Jenkins (1986:11)

> *Islamic glassmakers inaugurated a period of innovation that brought them increasingly further from Roman Imperial glass and culminated in the superb and quintessentially Islamic lustre-painted and relief-cut vessels.*

---

[5]. The term 'Roman glass' is used here in a general sense to describe objects that were made throughout the empire during the first four centuries of the Christian era. The variety of glass produced during this period can be classified broadly into two major categories, that of utilitarian ware such as bottles, beakers, vases etc. and artistic or luxury glassware associated with body uses and decoration or religious purposes.

Glass has been found at Islamic sites in Spain and in North Africa. It is not known whether they were local products or imports from Egypt or the eastern Mediterranean. Glass finds have been recorded at the ancient Tunisian capital of Kairouan [also spelled Qairawan; Quyrawan] (AD 670 - 1056-57), Bougie and Gabes in Tunisia and Morocco (Fig. 4.2). Archaeological evidence at the site of Çabra (near Kairouan) uncovered some engraved glass objects including goblets and perfume bottles that were similar to the type of glassware found in Egypt during the same period (Marçais 1946:180). According to Smith (1957:117), glass wasters, furnaces and specimens of ribbed vessels and bowls excavated at Sabrah [Çabra], Tunisia, are clear indications of primary glass manufacture in Islamic times

In Egypt, glassmakers specialised in numerous techniques including engraving, incising (*intaglio*), relief surface decoration, glass enamelling, and composite cane ware, known as mosaic or *millefiori*. Mould-blowing was peculiar to Syria while in Egypt, lustre-painted and enamelled glass made in the *Early* period reached a high level of excellence.

Lustre-painting on glass[6]

Lustre-painting is a technique of decoration usually associated with Islamic glassmaking. In 1941 Lamm (1941:23) was very cautious in his assessment of lustre glass and thought that it would be a vain effort to try to make a sharp distinction between Islamic and pre-Islamic ware. While recognising that pre-Islamic examples of lustered glass, based on stylistic grounds, have been found, the number of artefacts in this category was very small. He suggested that it would probably be more profitable to compare lustered glass with lustered pottery made before or after the foundation of Samarra (AD 836-838). The Tulinid dynasty in AD 868 may also be used as a marker for similar distinctions. More recently, Pinder-Wilson (1991:124) and Scanlon (1990:2) have shown that this technique was used on glass in the second half of the 8th century, and credited its discovery to glassmakers in Fustat, perhaps as early as the 6th or 7th centuries, who made a goblet bowl given to the Governor of Egypt in AD 772: There is evidence that lustre-painted glass was also produced in Syria. It appears that lustre-painting ceased to be practised after the 11th century, being replaced by gold painting[7] (Pinder-Wilson 1991:130).

Gold painting and enamelling

It is not known whether gold painting originated in Egypt or Syria (Pinder-Wilson 1991:130). Frequently used together with later enamelled ware, this type of decoration became characteristic of glass made at Raqqah, Aleppo and Damascus in Syria. The great Islamic lampshades, or mosque lamps are the best-known Syrian products. They were also produced in Cairo to obviate transport problems. Probably, Syrian enamellers migrated there. Many lamps were often decorated with abstract patterns and quotations from the Koran and many were exported to decorate Egyptian mosques (Vose 1980:53).

---

6. Lustre-painting decoration consists of painting onto the glass a film of colour made from various combinations of sulphur, silver oxide and copper oxide in a medium of vinegar. The vessel is fired in a reducing kiln after which the painted decoration becomes lustrous when fired (Pinder-Wilson 1991:124; Mehlman 1990:42).

7. The technique should not be confused with that of earlier gilded glass, in which gold leaf was sandwiched between two layers of glass. Enamelling is the application of ground glass mixed with colouring material to a surface and subsequent firing at a low temperature (Pinder-Wilson 1991:130).

Glass carving, cutting and etching

Rock crystal carving and glass cutting[8], including facet cutting and slicing, incised, relief and cameo-cutting all became specialist industries in Islamic glassmaking. The art of glass cutting was revived in the late 8th century and, by the 10th century reached its height in Persia and Mesopotamia (Basra). According to Jenkins (1986:18), when glassmakers in the *Early* period employed the incising (as opposed to engraving) technique, they preferred glass *metal* coloured aubergine purple and various shades of blue compared to the colourless variety utilised by the Romans. Relief-cut vessels were and still are costly rarities which require highly specialised skills. As Pinder-Wilson (1991:119) correctly pointed out it would have been far easier to have produced moulded vessels. It is doubtful whether the end results would have been comparable!

Clairmont (1977:83) believed that from the middle of the 9th century the 'trade' in cut decoration passed from Persia and Mesopotamia to Egyptian glassmakers, who familiarized themselves and perfected the techniques by the time of the *high Fatimid* period (*ca.* 1000-1060). Although the chronology and place of manufacture of both these techniques has been debated,[9] authorities on Islamic art now seem to have reached almost unanimous agreement about the major part of rock crystal carving. The conclusion is that rock crystal work began in the *Early* period *ca.* AD 850, and that, contrary to popular opinion, a substantial production of rock crystals occurred prior to the Fatimid sovereignty in Egypt (Clairmont 1977:81).

An important aspect relating to this enterprise is that rock crystal, supposedly of superior quality, was found and traded from central Kenya from the tenth century (Allen 1993: 55)[10]. Horton (1987:82) also reported on the rock crystal trade by Swahilis from East Africa to Muslim merchants until AD 1050, noting that after this particular time all traces of rock crystal exchange from the coastal sites in the Lamu archipelago vanished. The reason for this could have been that the demand for rock crystal was replaced by imitation colourless glass. Mehlman (1982:42) confirms that many cut glass pieces of glass associated with the Fatimid period were made from clear colourless glass in imitation of rock crystal.

In Mesopotamia, engraving (as opposed to incising) flourished, especially during the Abbasid dynasty (AD 750-1258). Both Baghdad and Basra were highly acclaimed glass

---

[8]. As far as is known, relief cutting was carried out by means of the bow drill which consisted of a fixed spindle to which were attached the appropriate discs - either a fine cutting edge for incised work or a broader edge for grinding: the drill was rotated by the backwards and forwards movement of the bow (Pinder-Wilson 1991:119).

[9]. A general sequence of cut glass vessels has been mapped independently by various scholars on the basis of excavations in the Near East and glasses of known provenance, and a sizeable number of vessels, dating from the 5th-7th centuries confirm production in these geographic areas (Clairmont 1977). Although a large group of carved crystals is referred to in the literature as Fatimid (the description is based on the fact that two pieces were inscribed with the names of two Fatimid caliphs) (Erdman 1951:142) it is not clear whether or not the cut-glass industry in Egypt was developed under the first Fatimid rulers by glassmakers emigrating from Persia and Iraq to Egypt.

[10]. Rock crystal was not found exclusively in Kenya. According to Rice (1956:45) the raw material was imported from the Arabian peninsula, especially Yemen and the Red Sea coast, Madagascar, Laccadive and Maldive islands, Kashmir, Afghanistan and Maghrib centres.

producing centres and excavations at Samarra have unearthed large numbers of fragments of glass including millefiori and mosaic examples based on earlier Alexandrian styles (Mehlman 1982:42 & al-Janabi 1983:312). Four individual moulded glass artefacts, inscribed in Kufic text, were made by the same craftsman in the Abbasid capital of Baghdad as well. The vessels, two of which were created in slightly different clay moulds, confirm one of the only known provenanced inscribed Islamic glasses (Rice 1958:11).

Impressive collections of this selective ware are privately or publicly owned, and are exhibited at institutions such as the Museum of Islamic Art (Cairo), Victoria and Albert Museum (London) the Benaki Museum (Athens), and the Metropolitan Museum of Art (New York).

Trailed ware

This type of decoration was executed by winding a thread of contrasting colour around the piece and subsequently marvering, or pressing the thread into the surface. A comblike tool was then used to create a featherlike design: This technique has a long pre-Islamic history in the Near East; its ultimate origins lie in Dynastic Egyptian core formed vessels (Jenkins 1986:11; British Museum catalogue: Masterpieces of Glass; Louvre publications).

Palestine once renowned for glassmaking, supported an industry ascribed to the *Early* Islamic occupation. In Jerusalem, a specific type of marvered or *trailed*[11] glassware has been found incorporating purple, blue and red glass. According to the evidence, Hasson (1983:109-111) suggests that Islamic Jerusalem was a centre for *trailed* glass production but believes that only the purple colour was produced there, and that *trailed* ware output probably peaked during the 11th and 13th centuries. Hebron has also been recognised as a glass producing centre, although it is not known with any degree of certainty when - or by whom. Some scholars believe that a glass industry began in AD 800, but they offer no concrete evidence to support their theories: The first authentic documentation in the form of letters, diaries, and other literature written mainly by Christian pilgrims dates from the 14th century (Lehrer-Jacobson 1993:12).

Following the Mongol invasion of Persia in 1248 and the founding of the Yuan (Mongol) dynasty in China, glass decorated in the Chinese style began to make an appearance. Chinese Islamic porcelains and glass decorated with Arabic writing have been found in Malaysia as well (Mohd Othman 1981:17-21).

In 1402, the whole of the Middle East was over-run by the Mongol conqueror Tamerlane, and, following his invasion of Persia, Iraq, Armenia, Syria and India the glass of the Islamic world went into decline; this gave Venice the opportunity to expand and take over the markets which had previously been supplied from the East (Brooks n.d.:17).

---

[11]. In this thesis, *trailed* ware refers to glassware that has been decorated with either feather and herringbone patterns, or straight, wavy and oblique lines.

4.3 GLASS MADE AT FUSTAT

Fustat played a dominant role in Egyptian Islamic glass history and was a thriving commercial and industrial centre throughout the ancient world particularly during the Fatimid period. A parallel glass industry was also established in Syria and Palestine. Glassmaking in Fustat was not only confined to the period of Fatimid occupation. Large quantities of late 8th century glassware and rock crystal carvings have been found (Hasson 1983:112; Pinder-Wilson 1987:60-71; Clairmont 1977; Miles 1948:31-69).

The eleventh century is considered to have been the artistic renaissance of Fatimid Egypt (Pinder-Wilson 1973:13). Fustat not only exported to markets throughout the then known world but also imported products from China[12] Persia, Iraq, Anatolia and the Byzantine Islands, Syria & Palestine to the east; Nubia, the Sudan and Ethiopia to the south; the North African littoral, Sicily, southern Italy and Spain (Scanlon 1968:189). According to Pinder-Wilson (*op cit*:15), wares from the glass houses of Syria, Mesopotamia and Persia certainly reached the markets of Fustat, although it is not possible to distinguish in every case, between imported and locally-made glass. Goitein (1967:110) also confirms that both "local" and imported glasses were available at Fustat, and that Chinese porcelain also reached the markets.

The period relevant to this study (AD 900 - AD 1250) includes the height of the Fatimid dominion and Fustat's greatest prosperity and in many respects illustrates the artistic excellence and cosmopolitan character of the city's commercial life. The pre-eminence of the city was recorded by a Persian traveller, Nasir-i-Khusru, in the middle of the 11th century who noted that there were 20,000 shops in Fustat; interestingly, they were all owned by the government (Lewis 1951:206). The same informant also reported on the fine pottery and glassware produced there. Perhaps one of the reasons for the excellent quality and varied specialist techniques of glassmaking in Fustat was an over supply of Syro-Palestinian craftsmen, who fled to Egypt during political unrest in the 11th and 12th centuries (Goitein 1967:51). The Geniza seems to show that the inhabitants of Fustat used glass, even crystal, for utilitarian wares like common drinking cups, tumblers or other household commodities such as primitive lamps made of glass (Goitein 1983:148). Also to be considered is the fact that not only locally-made glass but imported glassware from either Syria, Mesopotamia or Persia was sent to the markets and clearing houses of Fustat.

It is not surprising that the excavations at Fustat revealed large quantities of glass material. The objects included good quality blown glass vessels, window glass, bangles, amulets, beads and dated glass coin weights, and a glass ingot factory (Scanlon 1972:59). The sheer quantity of glass finds leaves no doubt of the existence of a local industry.

---

[12]. The shift of the trade from the Persian Gulf to the Red Sea made a great difference to Islamic entrepôt activities.

4.4 ISLAMIC GLASS BEADS, COIN WEIGHTS & BRACELETS

Egypt

According to Spaer (1989:9), Islamic Egypt is probably the best recorded source of early Islamic beads. Various manufacturing methods were used to make different types of beads. These included wound, drawn *seed* beads and mosaic, segmented, folded and fused rod beads (Francis 1989:15-28). Distinctive decorative techniques used on the beads were dragged and trailed, feathered, festooned, and folded patterns; some of the basic designs comprised geometric, floral, calligraphic, and stylised animal and human figures (Sherr Dubin 1987:95). Examples of fused rod beads, mosaic, trailed and segmented beads were used for analysis in this dissertation.

Fustat Fused Rod beads

Archaeological investigation in Fustat revealed the remains of a glass factory and undisturbed pits below and above a house which contained a particularly distinctive type of glass bead and dated coin weights; some glass "scrap" material used to produce these beads was found amongst the excavated material (Pinder-Wilson & Scanlon 1987:71). These beads, variously referred to as 'fused rod', 'Fustat Beads' and 'Fustat Fused Rod Beads', have been dated between AD 800 - AD 900 (Spaer 1993:4-11; Francis 1993:3-4) and are thought to have been made only during a short time (Section 4.4). Chemical analysis was performed on three FFRB beads. (Fig. 8.1.3.1. a-c)

Although the exact manufacturing procedure is not known, the most likely method was to heat and fuse together individually prepared cylindrical rods around a central perforation (Francis (1989:29). The rods are made in a variety of colours (translucent green glass with opaque white, yellow, "Indian" red and blue) which are fused together to form a large barrel shaped bead. Some have 'eye' decoration.

Segmented beads

Segmented beads are a particularly interesting type of glass bead, known to have been made in Islamic and pre-Islamic times. The exact process of manufacture, however, remains conjectural. In 1989 (Francis 1989:28-29) described *Early* Islamic segmented beads, together with an explanation of how they could have been made. He then drew attention to the fact that examples of segmented beads have been found at Siraf, Nishapur and Fustat, and, are known in Europe, Southeast Asia and beyond. He also pointed out that the most remarkable segmented type of beads are gold-glass, also referred to as gilt-glass or goldfolium.

In more recent publcations, Spaer (1993:5-9) and Francis (1995:7-9) offered additional evidence retrieved from a *ca.* 4th-6th century AD glass bead workshop excavated at Alexandria. Amongst the finds were eight stone moulds made of granite, schist or limestone with grooved and ridged tops. The grooves and ridges are alternately carved out of the stone, and vary in size and shape.

Both Spaer and Francis suggest that the technique involves rolling a hot *drawn* tube [back and forth] over, and into, the grooves of the mould. The ridges in the mould segment the tube while the grooves determine the shape of the beads. After the tube has cooled, it is cut up, either into single or multi-segment beads. The ends of the beads were finished in a variety of means. Sometimes they were ground, lightly polished or just cut and left ragged without any more finish.

Francis (1995: 7) specified two types of segmented beads, one made of a wide tube, V-scored and spaced to make discs, and the other made from medium sized tubes, U-scored and spaced to make short cylinders. He also confirmed V-scored segmented beads made at Fustat, and that similar ones have been found in Sungai Mas, Malaysia.

Three segmented beads excavated from the Iron Age site at Shirbeek, located in the northern Transvaal, have been analysed in this thesis (see chapter 8.1.3.2 & Table 8.2.2.1 #152). Another V-scored segmented bead, belonging to the Van Riet Lowe Collection from Fustat, has also been examined for comparative purposes (Table 8.2.2.1 #20a).

Glass weights

The great majority of known glass weights and stamps are of Egyptian origin although some were also manufactured in Syria during the Umayyad period (Miles 1948:30).

Glass weights or *nummi vitrei* were made for a utilitarian function. According to Miles (1948:67), the use of glass as a material for producing weights and stamps in the eighth century marked a distinct technological advance over their earlier classical counterparts which were made of clay. The use of glass also implies that it was no longer considered a luxury item.

There are several types of weights, although they are usually small, round or oval glass discs produced in a variety of colours and types of glasses. The precision achieved in manufacture is an indication of the skill of the glassmakers. Production became so accurate that by AD 780 their weights agreed within 0.005 grain (Forbes 1957:158). Besides their accuracy, they also had the advantage that they could not be easily cut, and none of the glass could be tampered with unnoticed. They were prepared in large quantities and were relatively cheap to make, so it would have bee been quite feasible to weigh the weights after manufacture and reject those that differed from the standard (Miles 1948:41). The discarded pieces could easily have been remelted as cullet and made again.

Glass weights were produced over a long period and until the 9th century the common sizes ranged up to about 1 kilogram. Thereafter, smaller weights were produced to verify gold coins until *ca.* AD 1250. Approximately ten thousand Islamic coin weights have survived and are to be found in public and private collections worldwide.

Glass weights were used to confirm the veracity of coin money[13] of Islamic commercial merchants, and were central to the economy. They were issued under strict official control

[13]. Three denominations of coins - gold (*dinar*), silver (*dirham*) and copper (*fals*). Another type of weight. known as a ring weight was used specifically for weighing produce such as meat and other commodities (Jenkins 1986:56).

on behalf of the caliph, and stamped and dated with the ruler's, or local governor's names[14]. Kolbas (1983:95-100) has suggested using the different colours and types of weights *minted* or produced from these closely referenced sources as an index for dating other Islamic glass material. Sixteen glass weights were excavated from a shipwreck in the Aegean. Three of them were identified as being of the Fatimid caliph al-Zahir manufactured in 1021/22 or 1024/25 (Bass 1984:64).

In the Fatimid period the range of colours is wide, with blue green predominating: Late Abbasid weights of al-Mutsadi and al-Nasir (AD 1170 - AD 1225), like many of the still later Ayyubid and Mamluk pieces, are made from opaque glass and occur in many colours, including white, cream, yellow, amber, turquoise, etc. (Miles 1948:34-35).

Glass weights have also been used to date marine and terrestrial archaeological sites in the Aegean and West Africa. Three coin weights, all of Fatimid origin, dated 1021/22 or 1024/25 (Bass 1984:64), were recovered from the shipwreck Serçe Limani, providing a *terminus que* date of the site as AD 1025.

Glass bracelets

Pre-Islamic and Islamic closed ring glass bracelets or bangles were popular simple objects of personal adornment manufactured, worn and exported throughout the eastern Mediterranean and beyond. They have been described by Spaer (1988:51), as inexpensive ornaments, neither artistically nor technically outstanding, but not without charm; over time they became the most prevalent type of glass jewellery in all of the Levant and further afield.

Archaeological finds of bangles are usually referred to but seldom published in detail. Spaer (1992:44) attributes this to the fact that archaeologists have only recently become interested in Islamic post-medieval studies, and that earlier assumptions were that burial gifts became rare with the introduction of Islam.

Whitcomb (1983:106) reported an entire range of bracelets from the region of Aden, together with wasters and slag: he thought that the Aden glass centres supplied the east African coast and suggested that the distribution of glass products may be further elaborated by considering glass bracelets. Translucent glass bangles or *rings* have been reported as far afield as Borneo and Malaysia (Harrison 1962:237-238; Lamb 1966:86). Some were also found in an Islamic context at Kaundinyapura, India (Sen & Chadauri 1985:63).

Excavations at the exclusively Islamic site of Khirbet el-Minyeh, on the Sea of Galilee, and other sites have shown that bracelets were often placed in burials, and that some of them have been preserved intact (Spaer 1988; Spaer 1992). Glass bracelets and beads were also reported from Kibbutz Hagoshrim, located in the upper Galilee (Kurinsky 1991:194). Four fragments of glass bracelets found at these site were analysed in this study.

[14]. The impression of inscriptions in glass with iron dies requires much skill and careful timing, for hot glass will rapidly attack an iron surface and will soon obliterate the inscription on a die by forming a scaly oxide coating if the operator is inexperienced or careless (Miles 1948:69).

Although glass bangles are rarely found in coastal or inland sites in eastern or southern Africa, two fragments were recovered from an excavation at the island port of Manda in East Africa. Both pieces are black. One is D-shaped in section, the other is circular - the latter has a ribbed surface: The most likely date for the first specimen is 13th to 14th century (Morrison 1984:176).

4.5. SOME OTHER ARCHAEOLOGICAL SITES WITH ISLAMIC GLASS

The wreck of the Serçe Limani

Perhaps the most spectacular archaeological find of Islamic glass has been the recovery of a cargo from a ship wrecked off Serçe Limani, or Sparrow Harbour, opposite the island of Rhodes (near Bodrum - in ca. AD 1025). The ship was bound north, and dated according to glass coin weights found in the hold. The cargo consisted of many tons of raw glass blocks, ranging in size from tiny chips to large chunks up to 300mm across, and 1 ton of broken brightly-coloured glass fragments (between 1/2 million to 1 million pieces) (Lawton 1984:8). Of an estimated 10,000 glass vessels excavated only 80 remained intact. The broken fragments or cullet is believed to have come from various sources, and was probably collected by dealers going from house to house, as well as factory waste (Bass 1984:65).

The results of chemical analysis carried out at the Corning Museum of Glass on some 80 samples from the Serçe Limani, including vessels and cullet, showed that the majority of the glasses were of a uniform composition and could well have been made at the same factory; only four fragments of emerald-green glass from the wreck have a high lead content (Lawton 1984:11). In addition to its cargo of Islamic glass, other finds include gold coins, Islamic glazed ceramic ware and jewellery of Fatimid origin.

Quseir al-Qadim, Egypt

The site of Quseir (Fig. 4.2.1) was an entrepôt port engaged in the Indian Ocean exchange during two distinct periods: Roman (1st - 2nd centuries) and the Ayyubid-Mamluk (13th and 14th centuries). An interesting range of Islamic glass and Far Eastern ceramics have been excavated from three areas of the site.

The glass assemblage from Quseir has been compared to some of the material from the Serçe Limani, and attributed to Egyptian craftsmen who continued in the Fatimid tradition into the Ayyubid and early Mamluk periods (Whitcomb 19983:105). Much of the glass is believed to have been broken discards from repacking operations. In addition to the Mediterranean parallels, the Quseir glass shows many similarities to glass found at other Red Sea ports such as Aydhab [Aidhab], Aden, and Indian Ocean/Rim entrepôts at Kilwa, Gedi and Pengkalan Bulang, near Penang Island in Malaysia. It must be remembered that while some of the glass at Quseir al-Qadim may have been used at the port, most of the Egyptian glass was intended for export.

Evidence of brick kilns and a glass industry excavated at Sohar in Oman during the 10th century (Williamson 1973:88) may well have been connected to the entrepôt ports of Aqaba, Quseir, Aydhab and Aden.

Glass finds in the vicinity of Aden have been recorded previously. Forneau (1955:56), reported a whole series of objects found at Sheik Othman, near Aden, in the immediate area of an ancient glass-factory site. Ordinary glass, coloured glass, fragments of glass enamelled phials, bracelets, rods and beads were recovered.

West Africa, Tegdaoust

Excavations at archaeological sites in West Africa, including Ghana (Kumbi Saleh) and Tegdaoust (Awdaghust), show an increase in semi-luxury or luxury goods. Glassware in the form of phials, vases, cups, goblets and glass weights were found at Awdaghust. All the glass weights were of Fatimid origin, and some were dated to the tenth century (Devisse 1992:199-200): an imported glass goblet was also recovered, but it is not clear whether it was made at Ifrika (Tunisia) or Egypt.

Glass beads and fragments of glassmaking crucibles with traces of bluish *metal* have been recovered from sites in Nigeria such as Ita Yemoo, Orun Oba Ado and especially Olokun Grove (Shaw 1978:146; Willet 1960:242). Whether the glass itself was made locally or came from another source has not been established. Willet believes that Ife's famed bead industry was based not on local manufacturing but rather on reworking imported European and Islamic glass beads (Quarcoopome 1993:121).

East Africa, Kilwa

Different fragmentary types of glassware and glass beads have been found at many entrepôt ports along the East Coast of Africa including Kilwa, Shanga and Manda (Horton 1987:298). At Kilwa and Manda a large assortment of beakers, cut glass phials, flasks, and bowl types plus significant numbers of both *drawn* and *wound* beads were recovered. Chittick (1974:394) was mindful of the fragmentary nature of the material, and cautious about comparing their resemblance with some of the material found at Fustat, as suggested by R. Pinder-Wilson, then of the British Museum. One unusual complete open bowl was compared with a piece from Syria, attributed to the 13th century. Chittick (*op. cit.*:238) also acknowledged the likelihood that some of the glass found at Kilwa could have been made at Aden[15].

At Manda, large assemblages of especially high quality glass-ware were excavated. The material is comparable to other glass-ware from widely dispersed sites during the 9th to the 13th centuries. There is a wide variety of recognisable shapes and types, the majority of which are similar to some found at Siraf. Other parallels have also been drawn to a few types from excavations further south on the East African coast, Nubia, Egypt, the eastern Mediterranean and Persia (Morrison 1984:159-180)[16].

According to George Abungu (pers. comm.), glass trade beads have been found at inland sites along the Tana River as well.

---

[15]. Sherds of early Chinese blue-and-white porcelains recovered from coastal sites in East Africa, particularly Kilwa, were also found at the medieval port of Aydhab on the Red Sea, no doubt on its way overland to the Nile, to be shipped downstream to Fustat (Carswell 1976:122).

[16]. Morrison does not actually mention the fact that most of the material she classified from Manda was compared with glass-ware from the predominantly Islamic glass producing centres, such as Siraf as well as in the Gulf region, Egypt, the eastern Mediterranean, Mesopotamia and Persia.

4.6 CHEMICAL COMPOSITON OF SOME ISLAMIC GLASSES

Sayre & Smith (1961:1824-182626) categorised two major groupings of Islamic glass: (Table 4.6.1)

(i) **Early Islamic glass (8th-10th centuries)** - typical soda-lime glass with a low content of antimony and lead. Contains characteristically high percentages of magnesium (between 3.6%-6.5% or an average of 4.9%), and 0.94%-2.2% (or an average of 1.45%) potassium (Tables 3.2.1 & 8.2.2.1 #'s 20_-27). This group is represented by finds at Fostat (*sic*), Nishapur, Susa, Kish and Raqqa. They also suggested that pre-Islamic glasses made in the eastern Mediterranean (between the 1st and 7th centuries AD) contained high magnesium and potassium, implying that Islamic glass was a continuation of an earlier glass tradition. According to Forbes (1957:159), high calcium and magnesium are indicative of a dolomitic source.

(ii) **Islamic lead glass (8th-10th centuries)** has been distinguished by high proportions of lead varying from 40% - 33% (average 36%). Sayre *et al* (1961:1824) show six samples, all from different sources, with remarkably similar lead composition (Table 3.2.1-(iv)). The glass contained considerably more lead and less alkali and lime than other high lead glasses (Table 8.2.2.1).

In his work on Chinese lead glasses Brill (1991:28) acknowledges that

> *...(I)n the West,* [West of China] *the earliest presently known uses of lead in a base composition was in emerald green Islamic cameo glasses of the 10-11th centuries and in certain Eastern European glasses, most often in the form of beads.*

He also notes that lead oxide was used extensively in colourants, namely yellow opaqueness as Pb_2SbO_7 and $PbSnO_3$ and in red opaques. This information is directly related to my major elemental analysis, (chapter 8.2.2.1.#'s151 & 151a), where two opaque yellow beads from a burial at Mapungubwe contained a high proportion of lead (50%) and antimony (reported as Sb_2O_5). Another bead from Gedong in eastern Malysia (transparent blue green) also has a high content of lead and antimony. They both contain low amounts of sodium and calcium.

Table 4.6.1
Chemical analyses of Islamic glasses

		(i)		(ii)	(iii)	(iv)	(vi)
		Fostat (sic)		Arabic Glass weight Egypt AD 800	Early Islamic AD 800-1000 n=66	Islamic Lead n=6	Cairo AD 50
	blue	green	green				
SiO_2	71.2	70.5	49.4	71.4			68.73
Al_2O_2	1.0	0.8	14.5	4.75			1.69
Fe_2O_3	1.4	1.9	8.6	2.02			0.47
P_2O_5	0.3	0.6	1.2				
CaO	8.1	7.8	18.7	2.74			8.62
MgO	3.2	1.2	1.4	0.81	4.9	0.33	4.15
Na_20	11.4	16.1	2.4	16.98			12.54
PbO	ND	ND	ND		0.0088	36.0	2.87
K_2O	2.1	tr	3.5	0.27	1.45	0.026	
MnO	1.2	1.1	1.3	0.3	0.47	0.022	0.74
CuO				0.1			
CoO							
SO_2				0.12			
Sb_2O_5					0.021	0.081	
LI						0.28	

Sources of analyses

(i) A. Lucas (In Turner, 1956T:172)

(ii) FR Matson (In Singer *et al*, 1956:313)

(iii-iv) Mean concentrations of oxides that best characterise ancient glass (Sayre *et al*, 1961:1824)

(vi) Miles (1948:63)

....

Chemical analysis of lustre glass fragments from Fustat, carried out by Brill revealed two chemically distinguishable types of glass composition (Pinder-Wilson & Scanlon 1973:15). The variation was attributed to the use of natron and plant ash as alkalis. Brill also suggests that the differences may serve to distinguish between locally made glass and imported wares. Miles (1948:55) also acknowledges the use of more than one source of alkali in Egyptian glasses, such as seaweed plant ash and natron from Wadi Natrun.

4.7 ISLAMIC GLASS & GLASS BEADS FOUND AT SOUTHERN AFRICAN IRON AGE SITES

The chemical analysis reported in this thesis provides the first firm evidence for the manufacturing source(s) of glass beads found at South African Iron Age sites. However, some finds described in archaeological reports strongly suggest an Islamic origin and require comment. They involve specifically a few *wound* decorated beads from Great Zimbabwe and a fragment from Mapungubwe.

The original artefacts are not available for analysis, but a watercolour painting of the fragment found at Mapungubwe [probably done by Beck's wife - who did all the illustrations for his work] and a description has been published (Beck 1937:103-113). The bead is a *wound* glass bead with dragged trails on a dark matrix and is vaguely reminiscent of early Islamic manufacture. Bent (1969:205) photographed and described some black beads with white encircling lines which he found at Renders Ridge Ruins in Zimbabwe. MacIver (1906:82), submitted seven green glass beads the size of a pea, also found in Renders Ruin, to the British Museum for scrutiny. The report on the beads was that:

> *...(t)hey might well have been made in Egypt or elsewhere in the Mediterranean.*

Other beads found at sites in the Limpopo valley and the eastern Transvaal suggest an early Islamic provenance. Segmented beads found at Shirbeek and tubular beads with unusual triangular cross sections found at Shikumbu and Mahlangeni in the eastern Transvaal are analysed in this work.. Beads similar to this were common at Aoudaghost *(sic)*, and some of them were made in Fustat (P. Francis Jr. pers. comm.).

Juta (1956:10), also reported tubular beads with unusual cross sections that were found on a small sand dune near Lorenço Marques [Maputo], Moçambique. He thought that the beads resembled some of those found at Zimbabwe, Mapungubwe and related sites, and were associated with Rongo or Thonga pottery. They were described as:

> *Small, red, transparent, three-and four sided glass beads painted with gilt, now badly weathered. The sides are all irregular.*

At Great Zimbabwe, Caton-Thompson (1931:186) recorded plain, enamelled and engraved glass fragments, authenticated by the British Museum as Arabic. Roger Summers (1969:197-198) also found pieces of a Syrian glass vessel with painted red, white and blue rosette decoration at Great Zimbabwe, and reported that R. N. Hall and D. R. MacIver had found fragments of 14th century Persian faience bowls at Renders Ruins. The faience was dated and authenticated by the British Museum as well. These finds contradict Beck's assertion that no faience was found at Great Zimbabwe (Beck 1931:235).

Table 4.7.1
Chronology of early Roman, Byzantine & Islamic glass finds AD 100- AD 1400

Place	*Date - AD*	*References*
ROMAN EMPIRE	1st C	Freestone (In: Bowman (1991:40)
BYZANTIUM	*ca.* 337	Kurinsky (1991:365)
COPTIC	*ca.* 200-1100	Auth (1991:1142)
ISLAM	*ca.* 708 -1494	Kolbas (1983:100)
TUNISIA	ca. 750-	Marçais 1946:180
	ca. 750	Smith (1957:117)
EGYPT	800	Sayre et al, 1961:1824
FUSTAT	*ca.* 800	Pinder-Wilson & Scanlon (1987:71)
	9-10th C	Spaer 1993:5-11
	9-10th C	Francis 1993:3-4
	850	Clairmont (1977:81)
SYRIA		
DAMASCUS	661-750	Melman (1982:41)
Al Mina	800-900	Lane (1937:64).
MESOPOTAMIA		
BAGHDAD & BASRA	*ca.* 800	Mehlman (1982:41)
SAMARRA	833-883	Lane (1937:61)
MALAYSIA	*ca.*9thC	Beck (1931:236)
KILWA	800-1000	Chittick (1974)
]TEGDAOUST	900	Devisse (1992:201)
KHIRBET EL MINYAH (Palestine)	750	Spaer (1992:45)
HEBRON	1300	Leher-Jacobson (1983:12)
JERUSALEM	ca. 1000 -1200	Hasson (1983:109-111)
TURKEY	*ca.* 1025	Lawton (1984:11) Serçe Limani
QUSEIR, ADEN & AYDHAB	*ca.* 1200-1300	Whitcomb (1983:101)
DAMASCUS	*ca.* 1250-1400	Mehlman (1982:30)
SYRIA	14TH C	Freestone (In: Bowman 1991:40)
MALAYSIA	1400	Mohd Othman (1981:21)
WEST AFRICA		
SOUTHERN AFRICA		

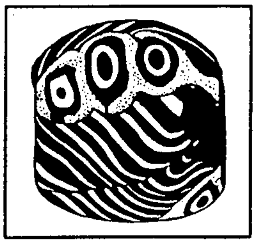
The glass of the Islamic world was widely distributed and traded not only within Muslim countries but also throughout the Mediterranean area, Scandinavia and Russia, East Africa, the shores of the Indian Ocean and even China. While Islamic glass has been greatly admired for many centuries, formal studies worldwide have been overshadowed by the popular appeal of Islamic ceramics, particularly the lustre wares[17]. Unfortunately, this has resulted, until relatively recently, in a lack of information and many inconsistencies particularly with regard to the *Early* period. However, archaeological investigations, have done much towards remedying the situation, and excavations at the sites of Fustat, Samarra, Siraf, Quseir al Quadim and the cargo of the Serçe Limani shipwreck have produced supportive evidence. Studies of glass beads have also made noteworthy contributions to our knowledge of Islamic glass in this period.

Having now delineated a history of Islamic glass from the *Early* period, I continue by examining Islamic world trade and contact in Africa, with the intention of demonstrating for the first time that glass beads made in Islamic Egypt were transported as trading items to southern Africa.

....

[17]. Caiger-Smith (1973:26) attributes the beginnings of polychrome lustre pottery (perfected by Islamic potters) to glassmakers in Fustat who used silver and copper stains on glass in the eighth century if not earlier.

5



ISLAMIC WORLD TRADE AND CONTACT IN AFRICA

The most powerful imported influence on the indigenous African culture has been Islam (Donley-Reid 1990:47).

5.1 INTRODUCTION

During the course of the 7th century, all the Near Eastern countries, Palestine, Egypt and other regions of North Africa were conquered by Arab armies under the influence of Islam, and in AD 634, Damascus (Syria) was established as the new Islamic capital under the Umayyad dynasty With the advent of the succeeding Abbasid dynasty (AD 750-1258), Baghdad became its capital in Mesopotamia. Abbassid rulers firmly established a single and self contained entity.

The flight of the prophet Muhammad from Mecca, marked the beginning of Islamic history.

632-661	The Four Orthodox or Rightly Guided Caliphs.
661-750	The Umayyad Caliphs
749-1031	The Abbasid Caliphs
909-1171	The Fatimids
819-1005	The Samanids
977-1186	Ghaznavids
1038-1194	The Saljuqs
1077-1307	The Rum Saljuqs
1256-1353	The Il-Khaqnids (Mongols)
1226-1502	The Golden Horde (Mongols)

In this chapter I examine some of the wider issues related to circum-maritime and overland trade of the Mediterranean, North, West, East and southern Africa and the sea-routes of the Indian Ocean, under early and medieval Islamic influence. This was a period in economic history, with the exception of some Italian ports such as Genoa, Florence, Venice and Pisa, when the West tended to remain passive from expansive industrial pursuits. However, as a result of the development and expansion of trading networks orchestrated through Muslim channels, coastlines became commonly linked and separated cultures were modified. Land trade routes made contact with sea-routes. Caravans transferred their goods from camels to Arab *Dhows* and Swahili *Mtepe*. The monsoon winds and sea currents were of paramount importance in determining trading patterns, and East Africa was a key participant. Relationships of coexistence and mutual exchange were involved in transporting trade goods among which, no doubt, glass beads played a significant role.

The full extent of this history goes well beyond the scope of this thesis. It is not possible, however, to exclude the broader issues associated with external politics and economics which influenced the prehistory of southern Africa. Therefore, it is my intention to present an overview of some of the global events I believe were ultimately connected to the infrastructures which resulted in the distribution of glass beads into southern African Iron Age communities. The extent of these issues are complex and are only beginning to be accounted for in the broader picture of southern African prehistory.

An upsurge of trade occurred with the rise of Islam. There is also an increase in documentary evidence from then on. By the 9th century Islamic commercial connections stretched from the Atlantic to the Indian Ocean Rim encompassing all the Middle East except Asia Minor. Islam brought together many cultural traditions including, Roman, Greek, Egyptian, Persian and Tartar. Expansionist policies concentrated initially on procuring and converting towns and people, and controlling old and new trade routes especially the gold routes across Africa from Ghana to Egypt, and on silver coming from the Iberian peninsula. Once these were secured the Muslims were able to expand their interests across North Africa, East Africa, India, Southeast Asia and China. In most conquered provinces Muslims established or created main garrison bases which formed an essential role in administration. Arabic was the common language. Besides commercial and military enterprise Islam played a major role in promoting literature, the arts and culture. Specialised traditions evolved from different parts of the Islamic world.

The trade routes within the Muslim world were characterised by overlapping long-and-short distance itineraries. A great diversity of goods was handled by merchants in the Mediterranean trade (*ca.* AD 1000-1100): Goods were usually ordered and shipped in round numbers although this did not necessarily mean that they were all produced by a single manufacturer (Goitein 1967:210).

The Indian Ocean became the vehicle of a world trade, connecting the water-ways of Mesopotamia and the Persian Gulf with Baghdad, the centre of the Islamic Empire. Merchants in Baghdad obtained silks and porcelains of China, and luxury goods including the spices and aromatics of India and tin from Malaysia. All these wares found their way from Islamic countries to Europe, then deprived of all direct traffic with those countries: A portion of this sea trade did not pass through the Persian Gulf. Instead merchandise was brought to Aden and the Red Sea ports of Jedda and Aydhab.

The African overland trade was divided into an eastern and a western area, although on both sides the chief import was gold. In western Africa Muslim merchants from Morocco, Algeria, and Tunisia travelled south and passed generally through Tegdaoust to Ghana and Nigeria.

In the East the commercial decline, following the demise of the Tang dynasty in China (AD 906) left a vacuum in trade in the Persian Gulf. This resulted in a shift of trade to merchants from the Red Sea and the Gulf of Aden with Mediterranean trading connections. It was during this period that the Fatimids took control of the Mediterranea Persian Gulf-trade route, through Baghdad, to the Red Sea, so linking it to the Far East.

5.2 TRADE ROUTES AND THE SPREAD OF ISLAMIC COMMERCIAL ACTIVITIES

5.2.1. Africa

Spencer Trimingham (1949:249) suggested that the success of Islamic trade was because the Arab adapted his social life to that of the African. The Muslims concentrated initially on securing the main gold and slave routes across Africa, from Ghana to Egypt, and on the silver which was brought from the Iberian peninsula. For that they were prepared to take risks and if necessary fight, but only to keep trade routes open, not for the sake of mere conquest or domination (Coupland 1965:30).

North Africa.

Islam spread rapidly through North Africa. In 647 AD Tunisia was occupied and by the 8th century AD Morocco and Spain were as well.

During the 10th and first half of the eleventh centuries, Tunisia and Sicily formed the hub of Mediterranean trade, selling goods from the East to the West via Egypt, and *vice versa*. At the same time there were ships that operated directly between Alexandria, Bijaya (Bougie) in present day-Algeria, and the ports of the Atlantic and Mediterranean coasts of Spain, such as Seville and Almeria (Goitein 1967:212). Al-Mahdiyya was the capital (Fig 5.2.1.1.).

The coming of Islam to North Africa brought about the rapid development of the Sahara commerce based on camel transport (Connah 1987:99). Large, regular camel caravans interlaced previously established trade routes. The takeover of the Saharan trade was essential in order to protect the established supply of gold, ivory and slaves. Evidence to show how rapidly Islam spread is demonstrated by an Islamicised burial in the Wadi Mammanet, radio carbon dated to the early 7th century AD (Close 1988:166).

Gold was the essence in the tran-Saharan trade, and yet little reliable information reached Arab geographers and historians about the exact location and nature of the goldfields. It was frequently associated with legends and myths (Levzion 191973:153; Devisse 1992:195), which seems to have been a cunning ploy devised to keep foreign traders away from the sources.

During the first half of the 11th century the Geniza letters contained information showing that a constant flow of gold and silver coins from Tunisia was used to pay for the merchandise from Egypt, Syria and the Orient. However, payments by *sealed purses* and the simultaneous use of different currencies no longer proved sufficient for the volume of trading taking place. By the middle of the 11th century a form of medieval money order, similar to the modern cheque, was in use (Goitein 1967:241).

Correspondence sent from Fustat to Baghdad, North Africa and Spain, as well as Italy and France, confirms the large volume of trade between these countries, irrespective of political barriers. A consignment of beads (Kharaz), in amounts of tens of thousands of pieces, was bought in Fustat by two Muslim merchants from Barqua in eastern Libya (Goitein 1983:296).

Trans-Saharan trade & West Africa

Important north-south and east-west trade routes were already well established before the great cities of the Ghana Empire reached their zenith *ca.* AD 700 - AD 1000 (Opper & Opper 1993:37). Trade networks across the Sahara linked Ghana with the markets of the east, where luxury commercial goods left by caravan from Sijilmasa[1], terminating at the trading towns in southern Mauritania, Ghana and Nigeria. The Sijilmasa caravan passed through Kairouan [sic *Qayrawan*] on its way to Egypt (Goitein 1967:212). Other trading routes linked Tripoli via Fezzan to Timbuktu and Lake Chad, and another crossed the Libyan desert from the Nile valley via the oasis of Khaza (Hiskett 1984:13). A number of categories of glass trade beads used in this trade have been described by Lamb (1970:247-250).

Muslim travellers and geographers such as al-Fazan (AD 750 & AD 799), and Al-Hamdani (AD 942), confirm the wealth of Islamic trade in West Africa (Horton 1987:77; Hiskett 1984:19). The geographer Ibn Hauqal (*ca.* AD 975), for example, claimed that he saw in Awdaghost [*sic*] an I.O.U. for an amount of 42 000 dinars, made out to a merchant in Sijilmasa in southern Morocco (Kramers 1931:101)[2]. According to Hiskett (1984:59), the volume of trade was even bigger when the straight road connection existed between the western regions through the Libyan desert from the Nile valley (Hiskett 1984:59). This particular route was abandoned in the 9th century AD on account of its insecurity.

Gold, ivory and ebony were exchanged for salt, copper, glass beads, hides, dates and textiles. In AD 1068 the king of Ghana was reported to have owned a group of houses on the river which were;

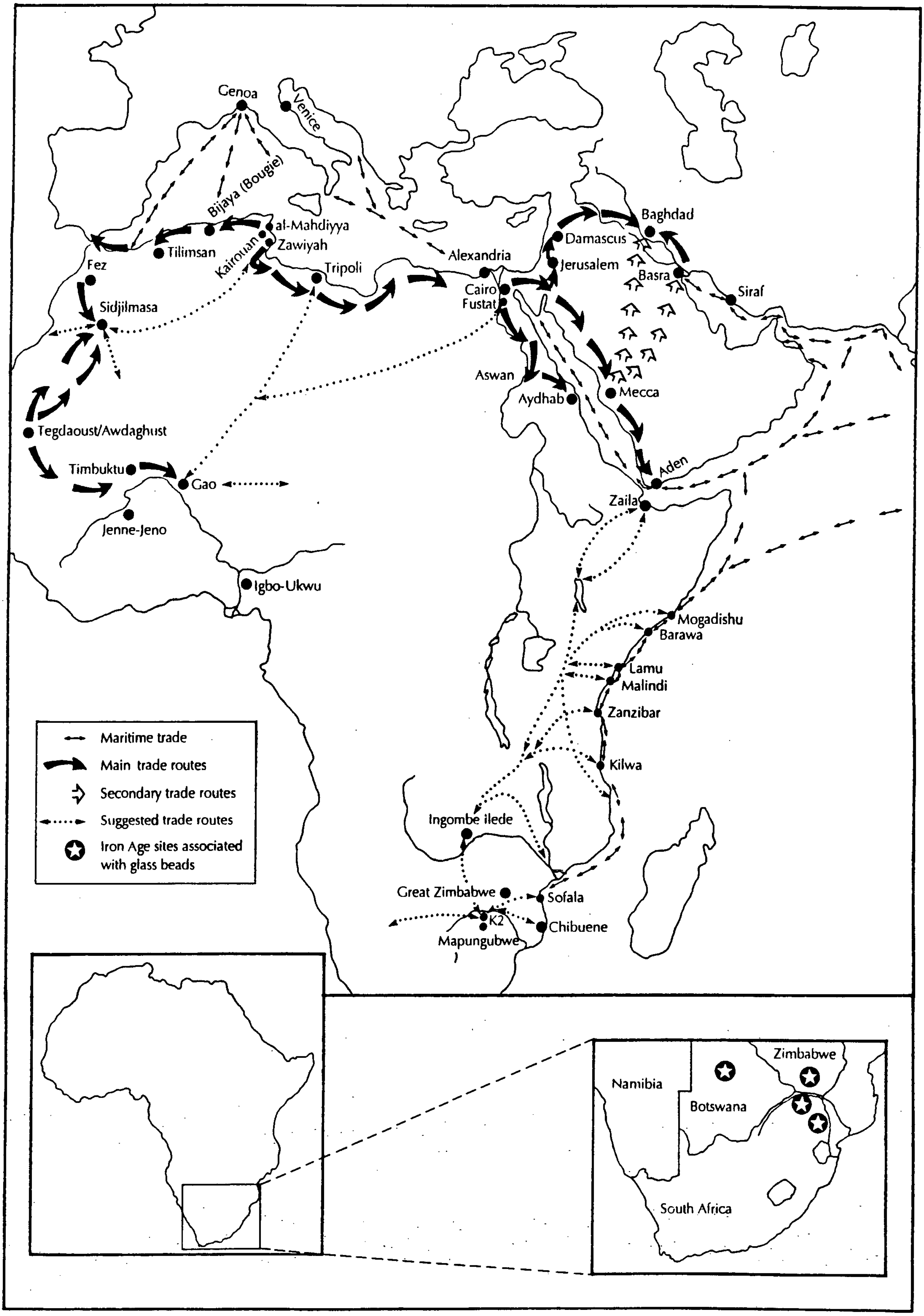
> *...(o)rnamented with designs and sunblinds of glass beads* (Spencer Trimingham 1962:56).

The growth of the south western Sahara was largely dependant on the development of the local salt industries and their ability to supply a surplus, which was readily converted into other forms of wealth. The spread of Islam continued along trade routes and an important centre of learning was established at Timbuktu, by a group of merchants and scholars associated with the salt trade (McDougall 1985:1-31; McDougall 1986:46; Bovill 1968:84-84).

[1]. The Sijilmasa caravan, named for its Moroccan desert port of departure, also served as a terminal for the Saharan traffic (Goitein 1967:212).

[2]. The modern word 'cheque' is derived from the Arabic word *sakk* (Kramers 1931:103).

Fig. 5.2.1.1 Maritime and overland trade routes *ca* AD 900 - 1250



Egypt.

In AD 639 Byzantine-ruled Egypt, weakened by religious differences, fell to the invading Muslims. Fustat was the original Arab capital of Egypt, founded in AD 642 around the Roman-Byzantine fortified town of Babylon in what is now Old Cairo. It was founded as the seat of a military garrison for Arab troops in conquered Egypt, as well as a base for future campaigns against the enemy (Kubiak 1987:11).

Besides its importance as an administrative and commercial centre, Fustat was the centre of the artistic renaissance of Islam which characterised the eleventh century (Pinder-Wilson & Scanlon 1973:13). It played a dominant role in Egyptian Islamic history and was renowned as a thriving commercial and industrial centre throughout the ancient world particularly during the Fatimid period.

The original city of Fustat began as an encampment surrounded by a defensive channel, slightly to the north of the Byzantine fortress of Babylon. From its modest beginnings in *ca.* AD 640, dwellings of mud brick and baked brick houses replaced tents and this narrow-laned complex grew to become the centre of commerce and industry in Islamic Egypt.

In AD 750 the newly established Abbasid Caliphate (AD 749-1258) dynasty established its administrative and military headquarters in a separate suburb, which was gradually drawn into the city's perimeter. The population of Fustat expanded and more suburbs were added to service each new political power. The final and probably most important phase of Fustat's history began when the Fatimid dynasty gained control of Egypt. Fustat, as it is called today, was the capital of Islamic Egypt until the beginning of the Fatimid caliphate in AD 969.

Al-Qahira.

In AD 969 the Fatimids built a walled royal quarter, al-Qahirah, from which the name Cairo is derived. Cairo, built to the northeast of Fustat, became the new capital city and the administrative and religious nucleus of the Fatimid caliphate. It was reported to be the largest and most important metropolis of the Muslim East. From the beginning, Fatimid governments realized the importance of trade both for the prosperity of Egypt and for the extension of Fatimid influence, and devoted great efforts to advance its scope.

Fatimid Egypt marked a period of expansion and prosperity. According to Lewis (1970:190), the first century of Fatimid rule represented the high watermark of medieval Egypt in many ways. Egypt possessed a rich system of waterways, and it is perhaps correct to say that its economic ascendance over its neighbours is owed partly to this advantage (Goitein 1967:133 & 295 & Hassan 1990:556).

5.2.2. Indian Ocean

The transformation of the socio-economic structure in the Indian Ocean during the 7th to 10th centuries AD was due to Arab expansion on the one side, and Chinese expansion on the other: economic success was achieved with the aid of skills possessed by the people of the ancient Near East (Chaudhuri 1985:36).

With the rise of Islam, the western shores of the Indian Ocean were under Muslim control. Stability in the region was assured by the existence of two large empires. The Muslim world in AD 660 extended from the western Mediterranean (Spain AD 711), to al-Sind and the T'ang Dynasty (618 - 907) ruled China as a united empire (Hourani 1963:61).

By conquest and through the expansion of trading networks the Arabs had restored unity to the area previously controlled by the ancient Persian Empire. This meant that both the Red Sea and the Persian Gulf could be used as trade routes. This resulted in increased commerce between Mesopotamia and Egypt; between the Gulf and India and China and between the Gulf and East Africa, where the ancient routes were also revived.

Tampoe (1989:122) described the Indian Ocean trade of the Middle Ages as a series of complex, interlinked local trading patterns stretching from the Red Sea to China, with coastal entrepôts acting as interchange ports for an immense diversity of goods. Silk, porcelain, cotton and indigo were some of the major export commodities. The navigation of the Indian Ocean in the direction of South East Asia and China were mainly undertaken by either Hindu ships or those from the Red Sea and the Persian Gulf.

Sea-borne trade with the Arabs and Hindus of the Malay Archipelago had been ongoing since the 8th century. According to Hornell (1941:251), colonising Indians emigrated to Java, Sumatra and Cambodia during the first seven centuries AD. Later, Muslim traders from Melaka and Sumatra introduced Islam to the trading ports along the north coast of Java, which served the trade route for the spices in the Moluccas (Lubis 1987:58).

Siraf, situated on the Iranian coast of the Persian Gulf became increasingly important during the early expansion of Islamic trade. Siraf traded directly with China via Canton and Shanghai, and became an essential link in trade between Zanzibar on the east coast of Africa, and as far south as Sofala and Madagascar. Another factor which may have affected the fortunes of Siraf was the uprising of the Zanj slaves and the subsequent sacking of Basra in AD 868. This action must have severely disrupted normal transshipments of goods through Iraq between AD 868 and AD 883 (Chaudhuri 1985:48).

Merchants from the Islamic Middle East established their trading posts along the coast of South India and Ceylon. The site of Mantai, situated a short distance north-east of the causeway across the Straits, between India and Ceylon, is a short distance inland from the sea, which could have once been linked by a short canal: Mantai became an important entrepôt for goods exchanged between the eastern and western portions of the Indian Ocean and the mixture of material found at the site suggests that it was one of the great emporiums of the early medieval period, comparable in importance to Siraf on the Persian Gulf (Carswell 1976:124). Exports included worked ivory, bone, horn, coral and tortoiseshell; terra-cotta figurines; copper and iron ornaments and implements; and products from a large bead industry in green and blue glass, paste, malachite and marble, together with gems of agate, garnet, amethyst, quartz, carnelian, and blue sapphires (Tampoe 1989:109).

Al-Mas'udi mentioned traders from Oman and Siraf visiting the Maldive Islands in AD 916, and al-Biruni in AD 1030. By the 12th century the entire population of the Maldives was converted to Islam (Carswell 1978:139). Several factors lent the Maldives importance for shipping, such as a stop-over for water and provisions from the Far East voyages bound for the Red Sea and East Africa, and also because they were populated by their co-religionists, unlike the ports of India and Ceylon. Travellers to the islands in the 9th and 10th centuries AD noted that cowries were collected by the islanders using rafts made from coconut leaves, to which the living shells attached themselves; other writers described fishing by islanders wading into the sea (Johnson 1970:18).

The Maldivians were chief suppliers of cowries used as small currency[3]. The West African cowrie trade used *Cypraea moneta* from the Maldives, in a sophisticated form of currency capable of adapting to the particular needs of West African trade (Johnson 1970:17). None of this variety of cowrie appears to have been recorded so far from the Iron Age assemblages in this work.

During this period an intermediate entrepôt, Bambhore, in Pakistan, added lapis lazuli, musk and indigo from the interior to the list of trade goods travelling around the Indian Ocean. Bambhore, like Siraf, was situated on an inhospitable coast which could not have supported cities without the surplus wealth generated by maritime trade.

Many of the early Islamic emporia, including Siraf, (severely damaged by an earthquake in AD 977), Mantai and Bambhore, were supplanted by new ports, in the late 10th century, especially after the Fatimid conquest of Tunisia (c. AD 906) and assumption of the caliphate in Egypt in AD 969. With this shift of power, trade routes were transferred to the Red Sea and Mediterranean regions. Negapatum, on the eastern tip of India, became a major port and it is not unreasonable to suppose that the beadmakers of Mantai transferred their attention and contributed to this port becoming a major glass bead making centre. It was to Negapatum that the Portuguese traders came in order to secure beads for the lucrative East African ivory and gold trade.

5.2.3. China

Chinese expansion under the T'ang dynasty (AD 681-907) created new consumer demands which were met by a resurgence in trade using ancient trade routes over land and sea. The overland routes traditionally took trade commodities such as horses, glass, precious stones, ostrich eggs, aromatic herbs, coral, jade, mail armour, ivories, and entertainers to China with return goods of Chinese silks, worked jade and lacquer, silk paintings and ceramics (Tampoe 1989:100). It is interesting to note that notwithstanding an extensive inland communications network ceramics were not, under normal circumstances, transported overland for any great distances and we should possibly look more closely at sea transport facilities when assessing ceramic finds (Tampoe 1989:45).

[3]. The Maldives supplied coir rope and turtle shells to India where they were made into boxes and caskets ornamented with gold and silver, bracelets and other ornaments (Carswell 1978:140).

In connection with the Muslim trade relations with China, Velgus (1993:104) quoted sources of merchants, dated approximately to AD 851 who made the journey from Siraf to China during that time. In addition, Fripp (1941:13) reported that a foreign community of Arabs and Persians existed in Canton by the 9th century, and an *'Inspector of Maritime Trade'* had been appointed in China. Velgus, also commented on the fact that *'Chinese ships'* were referred to in these stories and that al-Mas'udi (died in AD 956) also mentioned ships of the Chinese that visited Oman, Siraf, Ubulla and Basra.

The overriding debate continues as to whether the so-called Chinese ships were built in China and if they were owned by the Chinese or sailed under their command, and whether in fact they visited the Persian Gulf and then presumably Africa at all before the 9th century. The question appears to be based a great deal on interpretation. Opponents of the *'early'* hypothesis such as Hourani (1963) believed that Chinese ships did not visit the Persian Gulf even by the middle of the 9th century, and that if they had indeed done so, this probably would have been reflected by Arab writers. In support of this argument he noted that even though Arab geographers and writers mentioned *'Chinese ships'* the context indicated that the ships were of western countries.

Although it is evident that ships (of whatever nationality) sailed between the Persian Gulf and China and *vice versa*, the probability is that they were not Chinese ships. Vegus concluded (1993:109) that Chinese ships themselves did not visit the Persian Gulf before the 12-13th centuries. It is possible that some of the fleet may also have made the journey down the East coast of Africa as far south as Sofala and Madagascar.

5.3 THE FATIMIDS

The success of the Fatimid caliphate depended largely on government support of trade and on the generally favourable situation created by the increasing needs of an economically developing Europe, with Egypt and Syria serving as distribution centres and suppliers.

Fatimid economic policy concentrated primarily on industrial and commercial growth focussed on banking and trade. Bank head offices were established with branches in other cities and an elaborate system of cheques and letters of credit evolved[4]. The increased volume of merchant shipping linked the Muslim coastal ports of the Mediterranean with one another and with the Christian ports of the north. Egyptian fleets controlled the eastern Mediterranean, and in Europe, Egyptian ships sailed to Spain and Sicily and close relations were established with the Italian city-states, especially Amalfi and Pisa (Krueger 1933:417-437) (Fig.5.2.1.1). The important transit trade between Europe, India and the East accelerated this development, and resulted in the gradual extension of the sovereignty and prosperity of Egypt. The navigation of the Indian Ocean in the direction of South east Asia and China was mainly undertaken by either Hindu ships or those from the Red Sea and the Persian gulf (Chaudhuri 1985:49).

The pre-Fatimid trade had been marginal and confined mostly to neighbouring Muslim countries. Inside Egypt the Fatimids promoted Egyptian agriculture and industry and developed an important export trade of local goods. The wide network of commercial

[4]. These concepts were brought back to Europe by the Crusaders and became widely accepted.

relations, especially with Europe and India, were two areas where previous Egyptian contact had been minimal.

Harbours and entrepôt ports in Egypt and Syria served as distribution centres and suppliers of world trade. In the East, the Fatimids gradually extended their sovereignty over the ports and outlets of the Red Sea, developed a great sea port at Aydhab, for the trade with India and Southeast Asia, and tried to win power or at least gain influence on the shores of the Indian Ocean (Lewis 1970:191).

Cairo and Alexandria took on new roles as centres of trade whilst the rise of Italy as a sea power meant direct trade between Genoa, Pisa and the Levant, where they obtained goods coming from India and the Far East.

From AD 969, the royal quarter of old Cairo, al-Qahirah, became the capital of Islamic rule under the Fatimid caliphate and great changes were instituted. Egyptian agriculture and industry was promoted and an important export trade of local goods was developed. Overseas, they expanded commercial relations with Europe and India, where in particular, previous Egyptian contact had been minimal.

The peak of the Fatimid period in Egypt was the reign of the Caliph Mustansir (AD 1036-1094), under whom the Fatimid Empire included the whole of North Africa, Sicily, Egypt, Syria and western Arabia (Lewis 1958:112).

Muslim contact in Egypt south of Aswan was engaged mainly in slaving and exploiting the mines on the eastern bank of the Nile. In exchange Egypt exported grain and cereals grown on the Nile delta as well as luxury goods including beads (Spencer Trimingham 1949:63).

The middle Nile Christian kingdoms of Nubia (Sudan) resisted Islamic influence and retained their independence for over 800 years. They were still able to participate in the gold, iron, copper, silver, slaves, textiles and pottery trade throughout the region into Arabia and Persia. According to Connah (1987:63), glass and stone beads in this traffic became so common that they may have been used as a medium of exchange. However, by the end of the 14th century AD, , Nubia also succumbed to Islamic pressures.

In the centuries that Islam advanced, important overland routes led out of the Islamic Empire, first those to India and China, southern and central Russia, and then the African trade-roads (Kramers 1931:99). Aden was a main port for the entire Indian Ocean trade to India and China. From the Red Sea, traders were active to Abyssinia and Zanzibar (Lewis 1951:208).

Gold and silver formed the basis of the Muslim monetary system, and minting was the exclusive privilege of the acknowledged authority or caliph. From the 10th century the Fatimids introduced the gold standard into their monetary system and undertook coinage on a scale uprecedented in the Muslim west. According to Devisse (1992:197) the Fatimids minted independent gold coins [*dinars* with shi'ite inscriptions] in competition with the previously accepted Abbasid gold, which was intended to demonstrate the power and glory of their authority. His interpretation underlined gold as a prime resource commodity which he considered was of unprecedented importance for the history of African economic relations.

One of the earliest sources of gold in Egypt was from Wadi 'Allaqi, south of Egypt and towards the end of the eighth century the gold of the Sudan was already known: the area was referred to as '*the land of gold*' (Levzion 1973:127). The traditional view is that the source of most of the gold for the Fatimid mints came from West Africa, although evidence exists that in *ca.* 1000, supplies of gold from West Africa were diverted (Devisse 1992:199). While this source is not disputed, Horton (1987:76) suggests that a variety of evidence exists to show that East Africa was equally as important, presenting a case for exploring alternative sources elsewhere particularly in southern Africa.

5.4 EAST AFRICA

The earliest settlements

Many characteristic elements, such as a startling diversity of languages, monsoon winds, suitable currents, *dhows* and *Mtepes* distinguish the East Coast of Africa as an integrated meeting place of many cultures. Trade and shipping have a long history, particularly in the northern section, which was well known to early Persian and Indian traders as well as receiving occasional visits from Greek and other Mediterranean merchants. According to the Arabic writings of Al-Yaqubi, the port of [*sic*] Zeila, Zaila or Zayla (previously British Somaliland - now Eritrea) had ancient contact with Arab and Persians merchants, exchanging ivory, hides, skins, precious gums, ambergris for cloth, dates, iron weapons, chinaware and pottery (Lewis 1958:218). Allen (1993:32) also supported ancient pre-Islamic trade connections from the Horn ports, such as Aden, with the East Coast. He suggested the existence of an long overland trade-route starting from Zayla or the Gulf of Aden (or both) right down into central Kenya (Fig. 5.2.1.1).

Detailed accounts and archaeological material collected from Zaila and Saada-ud-din Island, by Captain H. B. Gilliland and Major and Mrs Glover (British Somaliland, East Africa Command), were sent to van Riet Lowe at the Archaeological Survey for identification. The material came mainly from the top 20cm of soil around the D.C.'s residence at Zeila and in middens at Saada-ud-din. The artefacts, some of which have been referred to in Chapter 1.2.1, consisted of Islamic medieval domestic glassware, Chinese celadon, glass bangles and beads. 'Modern' glass beads were also included in the collections, and it is surprising to note that there were

> ...*(n)o trade goods such as the small glass beads which the Arabs used for barter down the East African coast and into the interior* (Transvaal Archives, 1945)[5].

Although direct evidence or reports on slaving are very limited, some documents do show that slaves from East Africa were used to cultivate the large scale irrigated sugar cane plantations and the date palm forests in Mesopotamia: Cohn (1959:76), for example, reported that the trade between Ethiopia (*Himyeratic*) and South Arabia (*Sabean*) developed specifically from a traffic in slaves. He was also of the opinion that trade with

---

[5]. Transvaal Archives. SAB.ASW. Vols 32-33. B11/5.

south east Africa came much later. According to Coupland (1965:34), enslavement was practised from the earliest days by the Africans themselves. Exports from the east coast would probably have been shipped from any one of the east African ports, such as Zaila, either to Aden or the Red Sea ports of Jedda, Aydhyab and Quseir, or entrepôt ports in southern Arabia and the Persian Gulf (Fig 5.2.1.1).

Muslim geographer Al-Mas'udi (ca.915/916) and traveller Ibn Battuta gave eye witness accounts of their visits to East Africa in 1331 (Allen 1993:27). Trimingham (1949:274) however, doubted the reliability of Ibn Battuta's accounts and questioned whether or not he travelled even further south than Mogadishu. Although it is unlikely that the problem associated with indirect historical records will ever be resolved (Chittick 1982:47-61), Ibn Battuta's descriptions of Zeila, Mogadishu, Mombassa, and Kilwa Kisiwani are nevertheless compelling. He noted details of distances between Zeila and Aden as a four day sail, and from Zeila to Mogadishu as a two month march across the desert. By sea it would have taken fifteen nights. In Mogadishu, Ibn Battuta recorded that it was the custom for each visiting merchant to be allocated a host merchant who conducted trade on his behalf[6]; after several days at Mogadishu he travelled to Mombassa and Kilwa, where a merchant told him that Sofala was half a month's march away, and, that Sofala was the place where powdered gold was brought from a location a month's march away (Freeman-Grenville 1962:27-31).

Although the information could have been collected from Arab seafarers, who visited both Canton and the East African coast, a detailed description of an East African coastal settlement appeared in a Chinese source of ca. AD 1225 (Allen 1993:21). The source is of interest for many reasons in that it described unusual details of the inhabitants of the settlement, their mode of dress, daily food, bird trapping, funerary customs, and what was extracted from whales which were washed up on the beaches.

Islam in East Africa

Muslim influences spread southward along the east coast of Africa and by the eighth century AD early Islamic trading settlements were founded along the coast of present Kenya. According to Killick (1987), by the ninth century these proto-Swahili traders had extended their seaborne commerce to southern Mozambique. Horton (1987:290) recorded over 400 sites that were occupied well before the Portuguese arrived in 1498, many of which contain some kind of stone building in the form of mosques, houses and tombs and Tana pottery.. A few are of sufficient size and importance to be described as towns.

As the trade grew in volume so did its effect on the political development throughout Africa (Levtzion 1973:10). By the eleventh century many Muslim heterodox communities existed in East Africa and trade became an important component in its development. Datoo (1975:2-5) referred to this period as the Middle Iron Age and noted that East Africa was, for purposes of trade, only the western shore of the Indian Ocean. This implied that the coast was oriented outwards rather than inwards, seawards rather than landwards, with few connections with what is now considered to be its natural hinterland. More recently, academic researchers have questioned the extent of the influence of Islam on the indigenous coastal populations. According to Abungu and Mutoro (1990:694-704) and Connah

---

6. This method of trading obviously ensured exclusivity, and meant that great control was exercised over imports and exports.

(1987:151), for example, new archaeological evidence suggests that the development of the coastal culture owed far more to its African origins than to any external influences, however contributory these were. The question is whether the East African coast was just the edge of the Islamic world or the centre of an indigenous African development of substantial significance.

Developments at settlements along the coast such as Shanga, Manda Mogadishu, Pemba, Mafia and Kilwa were usually restricted to the coastal strip which Connah (1987:151), describes as a 10km long narrow 2400km coastline from the Somali Republic to northern Mozambique. It was along this coast that the distinctive culture, often referred to as the 'Swahili[7] culture' eventually developed. This culture was in many ways urban, mercantile and literate, with borrowed words from Arabic and a number of other languages. Donley-Reid (1990:48) has criticised the tendency towards an Eurocentric interpretation of the archaeology from Swahili sites and the lack of anthropological work related to Islamic analogies.

Timber was one of the main exports from East Africa, which no doubt contributed to the urban growth and commercial success of the coastal entrepôts as well as the widespread development of the Gulf region. Tampoe (1989:104) and Whitehouse (1977:883) emphasize the importance of the East African mangrove imports, equating it to a

> *...(g)iant timber yard built by foreigners for the express purpose of supplying poles to southern Arabia and the Persian Gulf.*

The 'Swahili'

Excavations in the Lamu archipelago, located 2 degrees south of the equator in Kenya, at the island sites of Manda (from which a large quantity of glass beads were recovered), Pate, and Shanga confirm the existence of long established trade between the Persian Gulf and East Africa (Horton 1987:298).

Allen (1993), Horton (1987) and Connah (1987) dispute previous theories that the Swahili were descendants of either Muslim refugees or Arab colonists intermarrying with the local Bantu farmers, and argue that they were African in origin and that their settlements were indigenous. They also opposed theories that Swahili settlements were established to collect supplies for the export trade (Tampoe 1989:111).

Excavations of Swahili sites have yielded both local Tana ware, imported ceramics, glassware and glass beads. In some instances some of these artefacts that have been used to correlate occupation dates of the sites suggest a number of possible trading connections. Allen (1993:25, 30, and 187) acknowledged Fatimid connections with the east coast of Africa in the form of raw materials, building technology and several Fatimid gold dinars that were identified within an East African context. Donley-Reid (1990:50) has stressed the importance of Chinese porcelain brought via India and Persia to the East coast and its role in the Swahili culture even to this day. Abungu (1992:100) confirms that beads in East Africa have special significance, as they are components of everyday dress (especially

---

7. Connah (1987:151), is of the opinion that the term 'Swahili' should not be used in contexts earlier than the last few centuries.

amongst the pastoralists) as well as indicators of age, marital status, and social rank in society.

The resources of the eastern seaboard, such as timber, ivory, sandalwood, tortoise shell, rhinoceros horn, gold and copper meant that an active export commodity trade could have been developed. It is only natural to expect that this trade led to the active development of settlements in conjunction with outside influences. It is quite possible that over-development caused pressure on essential resources, such as water. For example, water in the Lamu Archipelago is drawn from wells, which if overdrawn or sunk too deep, become brackish and unusable (Connah 1987:157). External influences, such as the diminishing ivory trade between East Africa and China via Siraf in the late 9th century AD could have had adverse effects on many early settlements on the East African coast.

Current archaeological excavation of coast-interior sites in Kenya may well provide clues to alternate trading routes, which used inland river transport and then cut through to the coast, in addition to coastal hopping, which is the more popular concept of coastal trade (Fig. 5.2.1.1).

While accepting the many arguments regarding settlement activity along the east African coast this does not detract from the fact that the power and economic base which facilitated the trading ports must have been directed through Islamic entrepreneurial control. Although practically no written sources exist regarding the nature of the trade into the hinterland, East Africa, during this period, surely provided the forum for Islamic control of the trade in glass beads which are so evident at southern African Iron Age settlements. Future scientific sourcing studies of beads found at inland sites could provide information on the external and regional contact trade which linked southern Africa to the rest of the Islamic world.

....

5.5 SOUTHERN AFRICA

Few, if any would dispute that the presence of Arab contact along the East Coast of Africa was the departure from which the external trade of southern Africa operated. However, little is known about the mechanisms which connected the whole endeavour which must have involved a complexity of social and commercial interaction. It is not even known how the merchandise reached the interior nor is the extent of the southern coastal access (if any) known. Many writers, including Hall (1987:74) and Killick (1987), who broadly connected inland sites with the coast, have accepted the mechanism as Chibuene based on the archaeological finds from there (Sinclair, 1982:150-164).

Not only is there insufficient evidence to support this theory but also other factors have not been considered, such as the hazardous shipping lane between southern Africa and Madagascar, tsetse fly infested areas and the difficult overland route from the coast. If the conjecture is that navigable river transport was used then it is not even known if the Limpopo River was navigable. Although documentary evidence in this regard is sparse, perhaps other avenues of enquiry should be considered. The trade routes and commercial links during this early period could well have been overland and inland down from Zambia and the Zimbabwe plateau rather than along the south east coast.

What were the mechanics behind the trade which resulted in the unprecedented growth of cities or states in the sub-continent such as Mapungubwe or Great Zimbabwe? Whether the polities of Mapungubwe and Great Zimbabwe were those of states is a matter of definition and the subject for continuing argument (Hall 1987:88-90). They certainly exhibited a centralisation of authority on a much larger scale than that of a village or chiefdom. The archaeological evidence for trade at Mapungubwe and Great Zimbabwe is considerable

The more important subject of this argument is why these large-scale political structures emerged. The answer to this question undoubtedly has several elements, of which external trade is an important aspect. Huffman (1982) has argued that Mapungubwe rose to prominence because the Limpopo basin was the first area of southern Africa to become part of the trade networks of the Indian Ocean. The trading items, which would probably have been the most sought after, would have been gold to mint Fatimid dinars, possibly ivory and other raw materials. Datoo (1975:7) suggested that the presence of known gold deposits was the crucial factor in determining why the interior of southern Africa had been tapped in one area but not in another.

Gold

According to Chittick (1974:238), trade must have been by barter, or by payment in gold. Summers (1987:84) estimated that the total Zimbabwe gold production over a period of 800 years was 20 million ounces (568181 kgs). The gold trade must therefore have constituted a major proportion of the trade conducted by the Swahili. Although important, the gold trade on the East Coast appears to have been only a fraction of that in West Africa. Despite Summers' estimates, the records show that during the first 18 months of Portuguese occupation at Sofala only 44 kilograms of gold were exported (Liesegang 1972:152). This vast discrepancy may mean that either Summers has exaggerated gold production or that the Arabs, who had exploited the coast for hundreds of years prior, had established another route in order to protect this lucrative commodity for themselves.

Balsan (1970:240), asserts that the founders of the Monomotapa dynasty, the *Makalanga* Bantu, perfected the workings and sale of gold to Arab traders from the coast. Exploring possible trade routes, Balsan traced several alternative passages from Zimbabwe to Sofala. The most direct of these routes is about 400 kilometres and so is well within Ibn Battuta's 'months march' between Yufi and Sofala.

Many early references indicate Sofala as a land or country. Prior to the 11th century AD there was no recorded settlement called Sofala, but the word *sufala* means 'shoal' and Arab sailors may have marked that part of the coast due to the navigational difficulties experienced in the Mozambique channel (Spencer Trimingham 1949:121). If there was a Sofala settlement it is most likely that it has disappeared beneath the sea due to erosion, as is happening to the Portuguese fort established in the 16th century (Liesegang 1972:148) some thirty kilometres south of Beira. In 140 years, the coastline at this point has lost a strip approximately half a kilometre wide due to sea encroachment, between a survey conducted in 1833 by Captain Owen and excavations by Dickinson in 1969 (Dickinson 1974:85). Sherds of African pottery, Chinese blue and white porcelain, Islamic brown burnished ware and glass beads were recovered from the site at Sofala. Of the beads recovered from this site, 61% were 'Indian red'; 18% dark blue and smaller quantities of turquoise, light blue, light green, yellow, black and white. One isolated red on white bichrome was found on the main beach.

Oral tradition suggests that an earlier Sofala that had existed at the mouth of the Sabi river, silted up and was moved 100 kilometres north. Subsequent excavations at the Sabi river mouth revealed evidence of settlement and glass beads, African pottery and spindle whorls were found. At this site, 70% of the beads recovered were yellow; 12% green; 11% 'Indian' red and small proportions were black, sky blue and white (Dickinson 1974:90).

Ivory

Archaeological evidence suggests that ivory was obtained across large areas of eastern and southern Africa, with trade routes penetrating as far inland as the Kalahari Desert: long distance trade networks were clearly operating along the coast with local boats carrying the products to the northern entrepôts of the Lamu archipelago (Denbow & Wilmsen 1986:317). Indian Ocean trade items (including glass beads) are associated with the midden deposits of worked ivory at Schroda and K2.

When the Portuguese landed on the East coast during their voyages of discovery, they found it difficlut to trade with the native population who would not exchange their gold and ivory for the European-manufactured beads that the Portuguese had brought with them. There was obviously a big difference between beads that they traded on the West coast and those required for the East coast trade. In fact, the Portuguese were obliged to bring beads from India (Negapatam) for use in barter exchanges. Portuguese writers described these beads as *barros miudos,* which is said to mean earthenware beads. I interpret these beads as being 'Indian' red glass beads, which are coloured with cuprous oxide and look very similar to red tiles. This indicates that trade between India and the East coast had been ongoing for a long period of time and that an established system of exchange had been formalised.

Van der Sleen (1958:212) makes a personal observation that drawn 'Indian' red beads are found on many sites in East Africa (Zanzibar, Kilwa, and others) as well as sites in Java, Sumatra and Vohemar, Madagascar. In fact, the Portuguese went on to conquer and take over the factory at Negapatum in order to protect their supply. Naturally, Islamic sources were not specifically available to them.

I have noted the background to the production of *'Early'* Islamic glass and examined the possible routes by which this glass, in the form of beads, reached the peoples of the East Coast of Africa and south-central Africa in general, noting also that the European-produced beads offered in due course by the Portuguese were rejected in favour of the types already available.

I now examine the archaeological context of the beads relevant to this study.

....

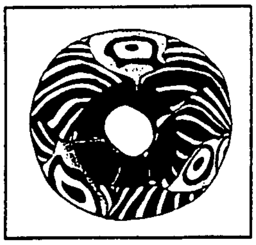
Table 5.5.1
Summary of events associated with Islamic commercial expansion

Date AD	Event	Notes of interest
681-907	T'ang Dynasty	Ruled China as a united Empire. Creates new consumer demands
600	Rise of Islam	Muslim leaders realise importance of northern and eastern desert caravan routes for gold.
600-900	Indian Ocean trade expands due to Muslim trade in the west and Chinese in the east.	
639	Egypt falls to Islam.	
647	Tunisia occupied by the Muslims.	
652	Treaty of Dongola	Ensures trade in gold & slaves from south of Aswan.
650-750	Breakdown in Mediterranean unity. Separates East & West.	
660	Muslim world extended from Spain to al-Sind.	
666	Uqba ibn Nafi travelled through the Fezzan as far as Gafsa.	
700	Islamic burial recorded at Wadi Mammanet western Sahara.	
ca.700	Morocco and Spain occupied by Muslims	Islam rapidly spread along established trade routes.
700-1000	Jewish negotiators kept open avenues of trade Merchants able to raise money for Muslim armies.	
700-1000	Agate bead industry established in Cambay, India	Used a diamond splinter to drill hole
700	Shanga on East African coast first occupied	Indigenous African site.
750 A D	Kanbalu Islamised.	Whereabouts uncertain.
750-799	al-Fazan writes of Sudanic state of Ghana as being source of gold.	
755	Control of Chinese trade passed to urban administrators.	Increased trade.
708-1494	Egypt manufactures glass weights	Weights used to check accuracy of coins.
868	Zanj revolt	Basra taken.
883	Zanj revolt crushed seriously affected. trade in the region.	
ca.800	Community of Arabs and Persians formed in China.	
860	Chinese texts describe Gulf and Somali coast Later references include Zanzibar and Madagascar.	
860	Alexandria ruined as trading centre.	Population falls from 600 000 to under 100 000.
900	Raddamites merchants travelled to China	Luxury goods introduced to Europe.
906	Demise of T'ang dynasty	Decline in trade with China.
916	Al-Masudi visits northern East Africa.	
969	Eastward movement of power from Tunisia to Egypt	Fatimids take control.
969-1171	Geniza papers written	Extensive records of trade & business of the time. Resembles a free trade area.

Table 5.5.1 (continued)
Summary of events associated with Islamic commercial expansion

Date AD	Event	Notes of interest
970	African East Coast rock crystal & ivory traded in Mediterranean.	
909	Fatimids take over Tunisia	Became rulers of Kairouan & al-Mahdiyya.
969-1171	Fatimid Caliphate founded Cairo in Egypt	Trade and industry flourished. Shift trade routes to Red Sea and Mediterranean regions.
Late 900s	Commercial decline on East coast of Africa	Collapse of many early settlements.
906	Demise of T'ang dynasty	Decline in trade with China.
960-1368	Supposed Chinese shipbuilding.	
1000-1100	Geniza papers. Extensive records of trade and business of the time. Resembles a free trade area.	
977	Siraf damaged by earthquake affected trade from/to the Persian Gulf.	
961	Al-Biruni visits Ceylon.	
969-1250	Rule of Fatimid and Ayyubid caliphs	Entire region flourished.
1030	Mas'udi vists Ceylon.	
ca.1030	Regular mail service	Couriers utilized regular caravan routes.
1100-1166	Al ldrisi states that Zanj have no ships	ldentifies Sayuna as capital of Sofala
1150	al-ldrisi, Muslim geographer visits Ceylon.	
1127-1279	Song period in China. China became a maritime nation.	
1159	Mogadishu replaces Kanbalu in importance	Sofala trade.
1200	Chinese shipwrecks indicate ocean going capabilities of V-bottomed craft.	
1291	Genoese traders attempt to find sea passage to the east.	
1273-1331	Description of land of Sofala	Identifies capital as Seruna.
1291	Genoese traders perish at sea	Attempt to find sea passage to the east.
ca.1300	Nubia succumbs to Islamic pressures after more than 800 years independence.	
1331-1343	Ibn Battuta travels to East Africa, Ceylon & Maldives	Sofala identified as source of gold.
1400	Records of Chinese visits to Zanzibar	Annual trade.
ca.1400	Christian explorers set out to find routes to the Indies.	
1414	Chinese fleet off East Africa.	
1415	Giraffe presented to Chines Emperor from Malindi.	
1498	Portuguese land in East Africa.	
1505	Sacking of Mombasa	Start of Portuguese rule.
1593-96	Portuguese build Fort Jesus, Mombasa.	
1696	Siege of Fort Jesus by Arabs.	
1729	End of Portuguese rule in East Africa North of Cape Delgado	

6



ARCHAEOLOGICAL CONTEXT OF THE BEADS

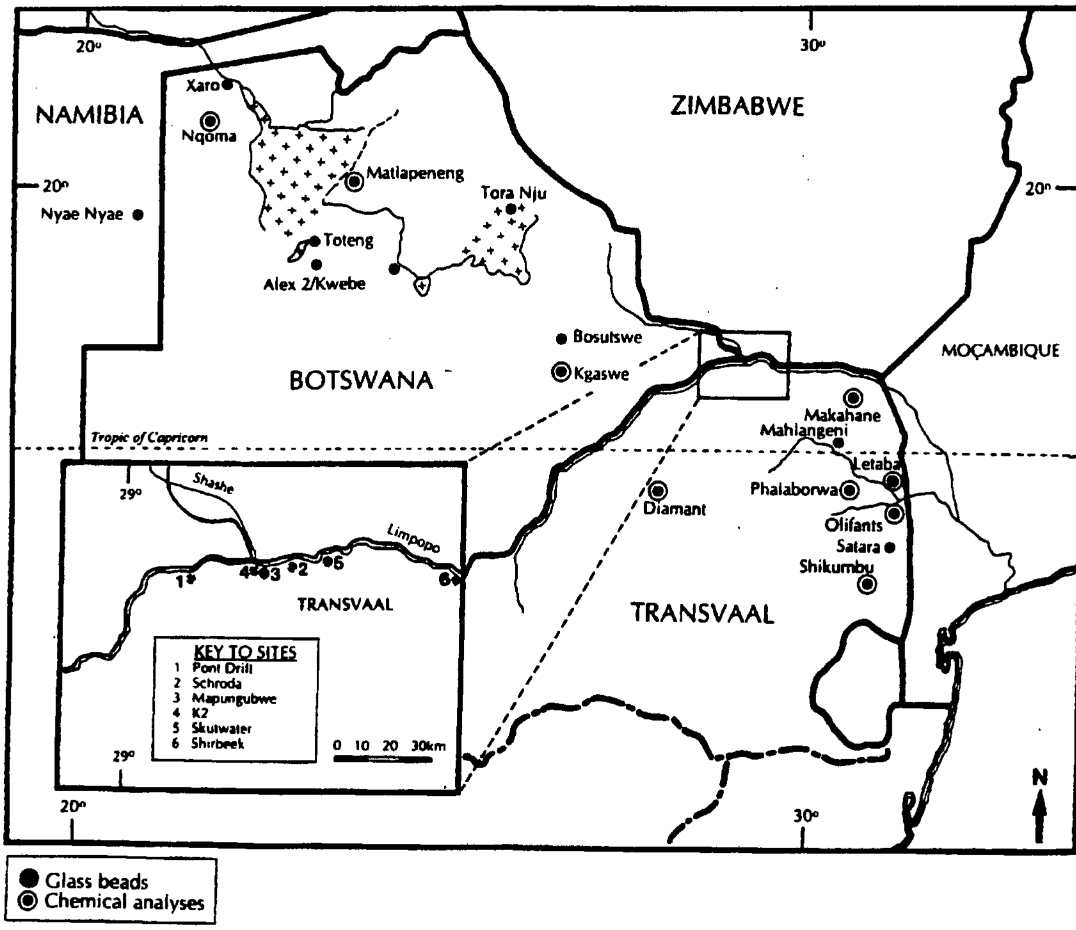
6.1 INTRODUCTION

Glass bead assemblages have been excavated from major Iron Age sites in the northern and eastern Transvaal and Botswana for the period *ca.* AD 900-1250. Similar beads and other glass artefacts have been found at coeval archaeological sites from potential source areas in Egypt, Palestine, Syria and Southeast Asia. Many of these finds were associated with trade in the Mediterranean, Red Sea, Indian Ocean and the South China Sea. The archaeology includes coastal and inland sites, and entrepôt ports. In southern Africa these include sites between the mouth of the Zambezi and Limpopo Rivers such as Chibuene (Sinclair 1982:150-164) and Manyikeni (Morais 1984:113-128). Except for some of the Southeast Asian sites, most of the archaeological evidence from which the following summaries have been drawn has been published before. This study focuses mainly on the glass bead component of them all.

The sites in the northern Transvaal are located along the southern bank of the Limpopo River, near the confluence of the Shashi River. These include Schroda (AD 800-900), Pont Drift (AD 800-900), Bambandyanalo and K2 (AD 1000-1220), Mapungubwe (AD 1220-1270) and Skutwater (AD 1150-1250).

The settlements were comparatively large in Iron Age terms and were populated during a limited period of *ca.* 200 years: In many instances, examples of dry stone walling still exist (Fouché 1937; Hanisch 1980). The Mapungubwe archaeological complex is situated on the farm Greefswald, approximately 70 kilometres west of Messina, and forms part of the Vhembe/Dongola National Park. Two discrete though related sites, Bamabandyanalo and Mapungubwe, were discovered nearby. During the various excavations at Bambandyanalo, the terms K1 and K2 were used to describe specific deposits at the site, such as the enormous central midden. Thereafter, the term K2 became interchangeable with that of the site of Bambandyanalo. Throughout this work the term K2 will be used to refer to this site.

Fig. 6.1.1.
Location of Iron Age sites in southern Africa where glass beads were excavated.



Mapungubwe was built about one kilometre to the northeast of K2 and is characterised by a hilltop settlement in addition to the low-lying, naturally sloping areas surrounding it. The top of the hill is referred to as Mapungubwe Hill (Mapungubwe Kop, MK or Summit) and the Southern Terrace (MST). Collectively the site is referred to as Mapungubwe. It is strategically situated where the Limpopo River forms the northern boundary between the Republic of South Africa and Zimbabwe, and the Shashi River between Botswana and Zimbabwe (Fig.6.1.1). However, these boundaries are relatively recent historical and political demarcations which did not exist a thousand years ago.

Some linguistic and traditional characteristics of Shona, Venda and Sotho speaking inhabitants living in the vicinity endorse earlier movements into the northern Transvaal from the north and the west: Mapungubwe reached the peak of its power in *ca.* AD 1220-1270 (Fouché 1937; Gardner 1963; van Riet Lowe 1955; (Meyer, pers. comm.).

Most of the artefacts found at these settlements are associated with societies who owned or traded domesticated stock, and farmers who used iron implements for sowing a variety of crops including a type of bean (*Vigna unguiculata*), sorghum (*Sorguhum bicolor)* and millet (*Pennisetum typhoides)*. Above all, they used metal smelting techniques, produced ceramics and accumulated surplus of wealth to participate in long distance trade. Evidence of ivory working, glass bead moulds and other remains suggests craft specialization activities at some of the sites.

A large variety of luxury goods such as gold beads and ornaments, cowrie shells, glass and ostrich egg shell beads (OES), soap stone beads and pendants were found, particularly among the human burials at Mapungubwe. Artefacts made from non-indigenous materials were also discovered. These could have been obtained either by way of long distance or inter-site exchange systems, or acquired as bride wealth. Glass beads were the most numerous indicators of external long distance trade, although other items such as Chinese porcelain were also recovered. The bead collections from earlier Iron Age sites in the eastern Transvaal, such as those in the Kruger National Park and at Phalaborwa, number from fewer than ten beads to a hundred. The bead assemblages from the northern Transvaal, particularly Mapungubwe, amount to tens of thousands[1].

Beads and other glass artefacts used for analysis were obtained from various sites inside as well as outside southern Africa. The van Riet Lowe Collection, the Wellington Museum, Peter Francis Jr. and numerous others, provided invaluable comparative material. The material from Southeast Asia examined for this thesis was excavated from Arikamedu in India and sites associated with entrepôt ports in Thailand, the Malay Peninsula and the Indonesian Archipelago, dating from, between *ca.* 5th to the 14th centuries (Fig.6.7.1.). Many of the samples were either from coeval sites, known glassmaking sites or those that could certainly have been connected to the commercial ties of early Muslim enterprise. The southern African component includes all the beads recovered from major Iron Age sites in the Limpopo Basin, eastern Transvaal, and Botswana.

[1]. Although cognizance has been taken of the retrieval methods and volume of excavated material the numbers for earlier sites are comparatively low.

SOUTH AFRICA

Schroda	(AD 800-900 - northern Transvaal). Excavated by E. Hanisch Curated by the National Culture History and Open-air Museum, Pretoria.
Pont Drift	(AD 800-900 - northern Transvaal). Excavated by E. Hanisch Curated by the National Culture History and Open-air Museum, Pretoria.
K2	(AD 1000-1220 - northern Transvaal). Excavated since the 1930. Curated by the University of Pretoria.
Bambandyanalo	(AD 1000-1220 - northern Transvaal). Excavated since the 1930. Curated by the University of Pretoria.
Mapungubwe	(AD 1220-1270 - northern Transvaal). Excavated since the 1930. Curated by the University of Pretoria.
Skutwater	(AD 1150-1250 - northern Transvaal). Excavated by J. van Ewyk. Curated by the National Culture History and Open-air Museum, Pretoria.
Allied sites	Shirbeek, Singalele & Parma - northern Transvaal. Curated by the University of Pretoria..

Letaba, Shikumbu, Mahlengheni,. (*ca.* AD 900-1250 - eastern Transvaal).
Olifants Rivier, Phalaborwa Excavated by E. Meyer, J. C. Pistorius & N. J. van der Merwe.
Curated by the University of Pretoria and the University of Cape Town.

BOTSWANA

Nqoma	(*ca.* AD 850-1080 - Botswana). Excavated by E. Wilmsen & J. Denbow. University of Texas.
Matlapaneng	(*ca.* AD 680-980 - Botswana). Excavated by E. Wilmsen & J. Denbow. University of Texas.
Kgaswe	(*ca.* AD 990-1090 - Botswana). Excavated by E. Wilmsen & J. Denbow. University of Texas.
Bosutswe	(*ca.* AD 700-1200 - Botswana). Excavated by E. Wilmsen & J. Denbow. University of Texas.
Toutswe	(*ca.* AD 960-1500 - Botswana). Excavated by E. Wilmsen & J. Denbow. University of Texas.
Tora Nju	(*ca.* AD 1390 Zimbabwe Phase). Botswana. Excavated by E. Wilmsen & J. Denbow. University of Texas.
Toutswe	(*ca.* AD 960-1500 - Botswana. Excavated by E. Wilmsen & J. Denbow. University of Texas.

From the potential source areas, specimens of glass, glass beads or waste have been compared with material from sites in Egypt, the Near East and Southeast Asia including:

EGYPT

Tel el-Amarna[2]	(BC 1375 - 1358 - Egypt). Excavated by C. L. Wooley. Curated by the Wellington Museum.
Fustat	(AD 642-1168 - Egypt). Van Riet Lowe Collection. Curated by the University of the Witwatersrand.
Fustat	(AD 642-1168 - Egypt). Excavated by G. Scanlon. Curated by the American University at Cairo.

PALESTINE

Khirbet el-Minyeh	(*ca.* AD 850 - Palestine). Excavated by A. E. Mader, A. M. Schneider & O. Puttrich-Reignard. Curated by the Israel Museum.
Hebron[3]	(*ca.* AD 1750-1800 - Palestine). Van Riet Lowe Collection. Curated by the University of the Witwatersrand.

SYRIA

Ba'al-Bakk	(ca. AD 969 - Syria). Van Riet Lowe Collection. Curated by the University of the Witwatersrand.

SOUTHEAST ASIA

Arikamedu	(BC 2nd millennium to medieval - India. Excavated by V. Begley. Universities of Pennsylvania & University of Madras.
Purdalpur	(modern). Peter Francis Jr.
Ceylon	Ceylon (Sri Lanka). Van Riet Lowe Collection. Curated by the University of the Witwatersrand.
Gedong, Bukit Sandong	eastern Malaysia. Excavated by E. Kauri. Curated by the Sarawak Museum.
Bongkissam	Eastern Malaysia. Curated by the Sarawak Museum.
Sungai Mas	(*ca.* AD 900-1100 - Western Malaysia). Curated by the Merbok Museum.
Pulau Kelumpang	(*ca.* AD 800-900 - Kuala Selinsing). Western Malaysia.
Gunang Wingo	Java. Indonesia. Excavated by Goenadi.
Kambang Unglen	Palembang -Indonesia. Excavated by P. Y. Manguin
Klong Thom	(*ca.* AD 800-1100 - South Thailand. Excavated by A & T Srisuchat. Center for Bead Research
Takuapa	(*ca.* 700-900 - Thailand. Excavated by A & T Srisuchat. Center for Bead Research

---

2. The archaeological collection of artefacts from Tel el-Amarna, Egypt (BC 1375-1358) was presented to the Huguenot University College, by Miss E. Armistead of Wolverhampton, England. It is now housed in the Wellington Museum. The artefacts were presented to Miss Armistead by C. Leonard Wooley, of the British Museum, in appreciation for her participation in the 1930-1931 excavation. Tel el-Amarna is thought to have been one of the earliest known glassmaking complexes in Egypt. The collection is unique in South Africa. Although the glass specimens (mostly glass rods) used for analysis in this thesis predate all the other the material, the reason for incorporating it is described in chapter 7.6.1.

3. Conversely this material is much more modern. The same reasoning outlined in chapter 7.6.1 applies.

6.2 OTHER TYPES OF NON-GLASS BEADS FOUND AT SOUTHERN AFRICAN SITES

Beads made from ostrich egg shell (OES - *Struthio camelus*), Achatina shell, (*Achatina* sp.) and glass were the most numerous found at all the southern African sites, as well as cowrie shells (*Cypraea annulus)*. Although relatively rare, other skilfully fabricated beads made from local materials such as quartz, soapstone, (serpentine), pottery and bone (Fig. 6.2.1. a.- g.) and metal (copper, iron and gold) have been discovered. Many of the skeletons at K2 buried with glass, OES, Achatina shell. Gold beads were mostly found buried with skeletons at Mapungubwe. Gardner (1963:34) described the Achatina beads as being beautifully made of the finest nacre and must, on account of their extreme delicacy, have been very difficult to drill.

A number of cowries were associated with a *Beast Burial* at K2. They were also found at Mapungubwe but were not nearly as common.

Cypraea annulus and *Cypraea moneta* are both Indian Ocean species, the former from the East African coast and islands, especially Zanzibar, and the latter from the Maldive Islands (Johnson 1970:17). *Cypraea annulus* is similar to *Cypraea moneta*, only slightly larger. Cowries were used as currency as well as decorative, ritual or magical purposes throughout many indigenous communities in Africa.

Some species of cowrie shells (*Cypraea annulus)*, that live only in the estuaries of the Indian Ocean, are well known as a means of ornamenting clothing in southern Africa and have been found as far inland as the Okavango in Botswana (Wilmsen 1989:68). According Voigt (1983:121) cowries were

(a)... very common marine species at K2 most of which had their dorsal surface cut away suggesting that they were attached to clothing, or to objects such as baskets.

Metal beads include those made from iron, copper and gold. Gold beads of various shapes and sizes have been found at other sites in the Transvaal and Zimbabwe, such as Thulamela (Küsel 1992:66; Summers 1969; Harger 1941:138). Thousands of gold beads were found buried with adult and juvenile skeletons on top of Mapungubwe Hill, but rarely from elsewhere at the site (Steyn 1994; Schofield 1958:215). Besides beads, other gold funerary items were made from beaten sheets of gold tacked onto small, shaped wooden cores. Huffman (1992:325), suggests that these grave goods are the earliest evidence for gold used as a status symbol by indigenous people, and therefore provide the first indication that gold had acquired a local intrinsic value. Burials of skeletons adorned with both gold and glass beads have also been found at Ingombe Ilede in Zambia (Hall 1987:98).

Soapstone beads are not often reported in the archaeological literature, particularly of South Africa. It was very exciting, therefore, to find four finely tooled soapstone beads and a pendant at Mapungubwe which had not been previously recorded, and report on an exquisitely sculptured soapstone pendant excavated by Wilmsen and Denbow at Tora Nju in Botswana (Fig.6.2.1. e.). One other soapstone bead was found at Schroda (Hanisch 1980).

It is very likely that these beads came from one of the many factory sites discovered by Harger (1941:129-142) in the area between Zwartruggens and Zeerust in the northern Transvaal, where large quantities of soapstone cylinder and small short beads and pendants were manufactured. The pendant found in Botswana is very reminiscent of soapstone phallic objects and amulets found in the Great Zimbabwe and Chiwona Kopje ruins (Caton-Thompson 1931).

Apart from the six carnelian (red chalcedony) beads found at Great Zimbabwe[4], no other semi-precious stone beads have been reported from any Iron Age sites dating from between AD 900 - AD 1250. This is somewhat surprising in light of the 'Indian connection' as promulgated, because stone bead manufacture, especially carnelian, was an extremely important export industry at Cambay, in India (Arkell 1936; Gwinnett & Gorelick 1986). If the early glass beads had been imported from India it is most probable that gem-stone beads should have accompanied them. It was not until a much later date that semi-precious stone beads were introduced into South Africa by the Portuguese, attested to by the hundreds found in shipwrecks along the South African coast (Bell-Cross 1987:20-32).

Although *Garden Roller* beads are found at other sites, particularly along the Limpopo River and Zimbabwe the majority of them in this study come from K2. Hanisch (1980:283) reported sixteen *Garden Rollers* from Pont Drift noting that the layers in which they were found corresponded with the discovery of large numbers of small turquoise beads. Pottery moulds, used to manufacture these beads, have been found at K2 and Schroda (Meyer, pers. comm.; Hanisch 1980:178) suggesting local production. One mould fragment was buried with a juvenile human skeleton (Steyn 1994:78). Two broken beads were also recorded from Bosutswe in Botswana. Practically all of the *Garden Rollers* are made in various hues of turquoise glass.

Substantial numbers of triangular beads were found at Shikumbu and Mahlangeni in the eastern Transvaal. These beads are also referred to as tubular beads with unusual cross sections or Type Ic; similar beads were made at Fustat (Francis, pers. comm.).

---

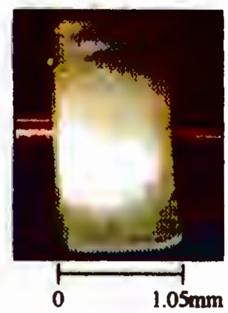
[4]. These beads are now housed in the South African Museum, Cape Town.

Fig.6.2.1.a-g. Bone, pottery, and soapstone beads.

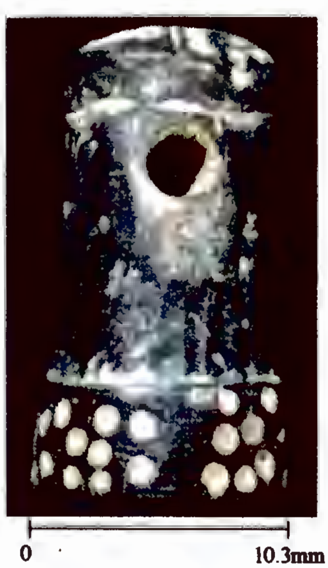
a. Bone bead from Schroda TSR $^{1}/_{1}$:Block:2A (1980)

b. Bone pendant from Mapungubwe Blok C2:Snoer Nr. $^{74}/_{54}$(1954)

c. Pottery bead necklace from K2 RN2 C7 (1976)

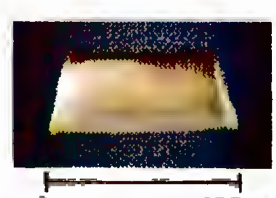


d. Soapstone bead from Mapungubwe MST E2 : Snoer nr $^{76}/_{54}$ (1954)



e. Soapstone pendant from Tora Nju

f. Soapstone bead from Mapungubwe B8(d)Spit $^{34''}/_{42''}$ (1968-1970)



g. Soapstone bead from Mapungubwe E2:Block : $^{B70}/_{10}$ (1968-1970)

6.3 SOUTHERN AFRICA

6.3.1 The Northern Transvaal

Schroda.

The farm Schroda is situated approximately 75 kilometres west of Messina on the Limpopo River (29°26'45"E, 22°11'0"S). The site covers a large surface area (nearly 500m long by 300m wide) on top of a rocky plateau overlooking the Limpopo River (Hanisch 1980:58). According to Hanisch (1981:39) the overall quantities of cultural remains that were found, compared to the large total amount of soil excavated, were very few. Some of the finds, including skeletons, two of which were buried with grave goods, consisted of grid stones, clay figurines, ivory, bone and glass trade beads. Achatina beads were the most abundant and constituted nearly three quarters of all the beads found on site. Some of the ivory items are thought to have been manufactured for trading purposes either on a local scale, from village to village, or with external contacts with Arab traders (Hanisch 1981:53).

In 1937, Fouché (1937:22) recorded that although much of the walling had fallen down, but two pieces of sandstone wall, measuring about 50 yards long by about 3 feet thick, were still standing on the farm.

Two human skeletons with glass beads were excavated at Schroda. One of them was a child, buried with glass beads underneath the chin (Hanisch 1980:114-115).

When Hanisch described the Schroda beads in 1980, more than three quarters of them were so heavily patinated that he could not identify their colour. Once the deposit had been removed however, using preservation techniques described in chapter 7 (7.2.1), it became possible, with relatively few exceptions, to determine the colours of the whole collection. The re-evaluated results are presented in the Appendix. Turquoise beads were the most common colour found at Schroda. Hanisch (1980:282) reported that white beads were found at Schroda. This has since been corrected (Ch.8.2.2). There were no 'Indian' red beads.

Pont Drift.

The farm Pont Drift is located on the Limpopo River 95 kilometres west of Messina. The site (co-ordinates 29°08'30"E, 22°13'45"S) lies in a raised valley on top of a long high sandstone ridge, running parallel with the Limpopo (Hanisch 1980:227).

Clay figurines, potsherds, metal ornaments, and glass beads including 16 *Garden Roller* beads were recovered. The number of beads found in the deeper levels was relatively low. As with Schroda, turquoise beads were the most common. The *Garden Roller* beads were excavated from a layer in which a high proportion of small turquoise *seed* beads were found. According to Hanisch (1980:282), the glass beads from Pont Drift were basically the same as those from Schroda.

Hanisch (1980:342) also suggested that the trade at Pont Drift was probably local, except for possible contact with the East coast, and that more items appear to have been imported on to the site than were manufactured or collected for export.

K2 and Mapungubwe.

Greefswald is the name of a farm in the northern Transvaal on which the two different yet associated sites were discovered, namely K2 and Mapungubwe.

K2 forms the eastern boundary of the site and is located approximately 1 kilomtre due south of Mapungubwe. It lies in an open valley bounded on one side by a hill called Bambandyanalo. One of the middens located on the floor of this valley was covered with deposit measuring 6m in places (Fig. 6.3.1.1). According to Fagan (1964:339), the first occupants of Mapungubwe Hill were the people who occupied K2 in its latest stages.

Archaeological evidence shows that these sites were densely populated for a relatively limited period of time, *ca.* 200 years. Some dry-stone walls are present at K2.

An impressive variety of crafts in the form of decorated bone, ivory and worked ivory arm bands were found during the course of excavation at K2 (Voight 1981:30-31).

Glass beads are more rare in the lower levels of K2 and Mapungubwe which indicates either a change in trading activities or wealth (Tables 6.3.1.2.).

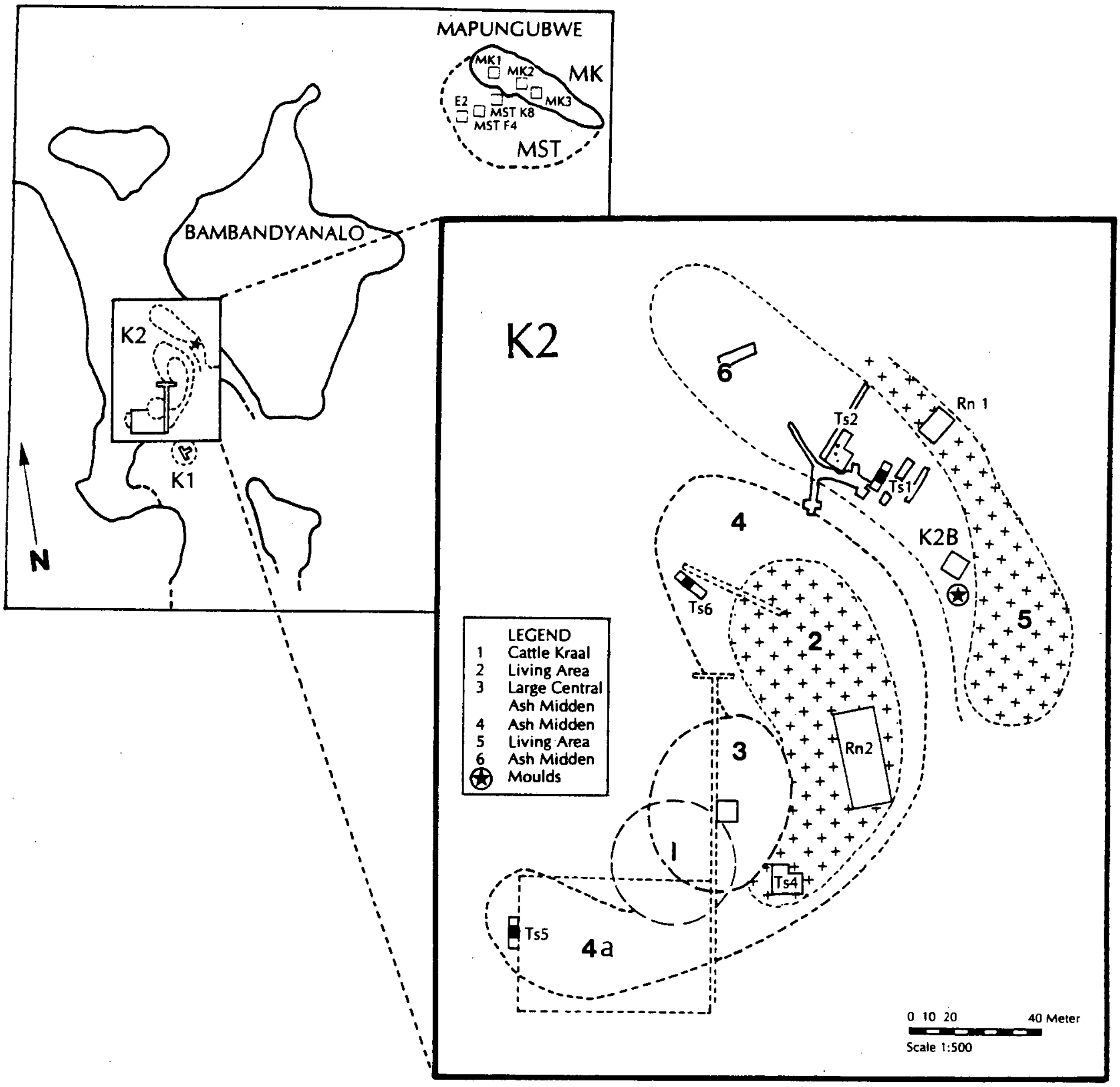
By AD 1075 the site of K2 had been abandoned in favour of Mapungubwe, which offered far more living space. This shift in location is marked by an increase of K2 material in the Mapungubwe deposit (Van Ewyck 1987:158).

Mapungubwe

Mapungubwe is a hilltop fortress, which, according to Fouché (1937:33), was bare before the occupation of the site. It is estimated that the soil cap on the summit, plus the remnants of subsequent hut platforms, built and rebuilt over time, weighed at least 20,000 tons (Hall 1987:77). The soil would have been carried to the top of the hill from the valley below. As natural access to the summit is very limited it is not inconceivable that some type of pulley system could have been set up. Huffman is convinced that Mapungubwe was the first capital of the ancient kingdom of Great Zimbabwe, and that the leaders and their followers including the king's wives, some of his soldiers, musicians and praisers lived on top of the hill (Steyn 1994:5). He also believes that Mapungubwe rose to prominence because the Limpopo basin was the first area of southern Africa to become part of the trade networks of the Indian Ocean (Huffman 1982).

The unstratified midden deposit surrounding the entire foot of the hill (Southern Terrace - MST) contains occupational refuse similar to that found on the summit (gold, imported glass beads, ivory and bone awls, masses of potsherds, iron and copper weapons, jewellery, pottery animal figurines and animal bones) which were washed down or windblown from the top (van Riet Lowe 1936:283). Remains of dry-stone retaining walls, hut floors and granary foundations were clearly traceable.

Fig. 6.3.1.1 Greefswald. The site of K2 (Redrawn from Eloff 1979 & Steyn 1994).



NOTE

Most of the adult and juvenile skeletons were found in the large ash midden area #4a.

Tables 6.3.1.2
Distribution of glass beads excavated at K2 (Eloff & Meyer)

K2 E & M (1971-1973	K2 Layer 1	K2 Layer 2	K2 Layer 3	K2 Layer 4	K2 Layer 5	K2 Layer 6	K2 Layer 7	K2 Layer 8	K2 Layer 9	K2 Layer 10	K2 Layer 11	K2 Layer 12	K2 Layer 13	K2 Layer 14	K2 Layer 15	K2 Layer 16	K2 Layer 17	K2 Layer 19	K2 Layer 20	TOTAL
WHITE	1		2																	3
GREY	1																			1
BLACK	10	8				1					1									20
TURQUOISE	338	405	169	86	46	57	88	43	78	75	32	17	14	79	23	15	7	18	1	1591
CELEDON	47	27	39	10	4	2	1			2	1									133
GREEN	29	12	14	2	2	1	1	2	3	2	2	1		2						73
INDIAN RED	100	68	23	8	15	15	5		4					2				1		241
YELLOW	50	10	9	1	5	3		1		1	3	1	1	4						89
MARIGOLD		1		1		1														3
BRIGHT NAVY																				
BLUE	1	2																		3
PINK																				
MAUVE					1			1												2
OSTRICH EGG SHELL					1															1
MISC	14	14	5	4	4	5	1	5	2	1	1				1					57
Total number of besads	591	547	261	112	78	85	96	52	87	81	40	19	15	87	24	15	7	19	1	2217

K2

E & M (1972)	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	K2	
Layer:	T.T	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	TOTAL
WHITE																	0
GREY		1		1													2
BLACK		7	4	1			1					1					14
TURQUOISE		155	227	73	6	35	46	85	24	92	65	32	13	79	23	15	970
CELEDON		4		3		1											8
GREEN		11	3			1		1	1	3	1	2		2			25
INDIAN RED		31	28	9		6	3			6				2			85
YELLOW		2	4			1	1				1	1		4			14
MARIGOLD							1										1
BRIGHT NAVY																	0
BLUE		1															1
PINK																	0
MAUVE						1											1
OSTRICH EGG SHELL						1											1
GARDEN ROLLER		13	4	1		10	4	6	8	8	11	1		6	1		73
MISCELLANEOUS									1								1
UNIDENTIFIABLE																	0
Total number of beads:	0	225	270	88	6	56	56	92	34	109	78	37	13	93	24	15	1196

Unknown provenance:8

K2

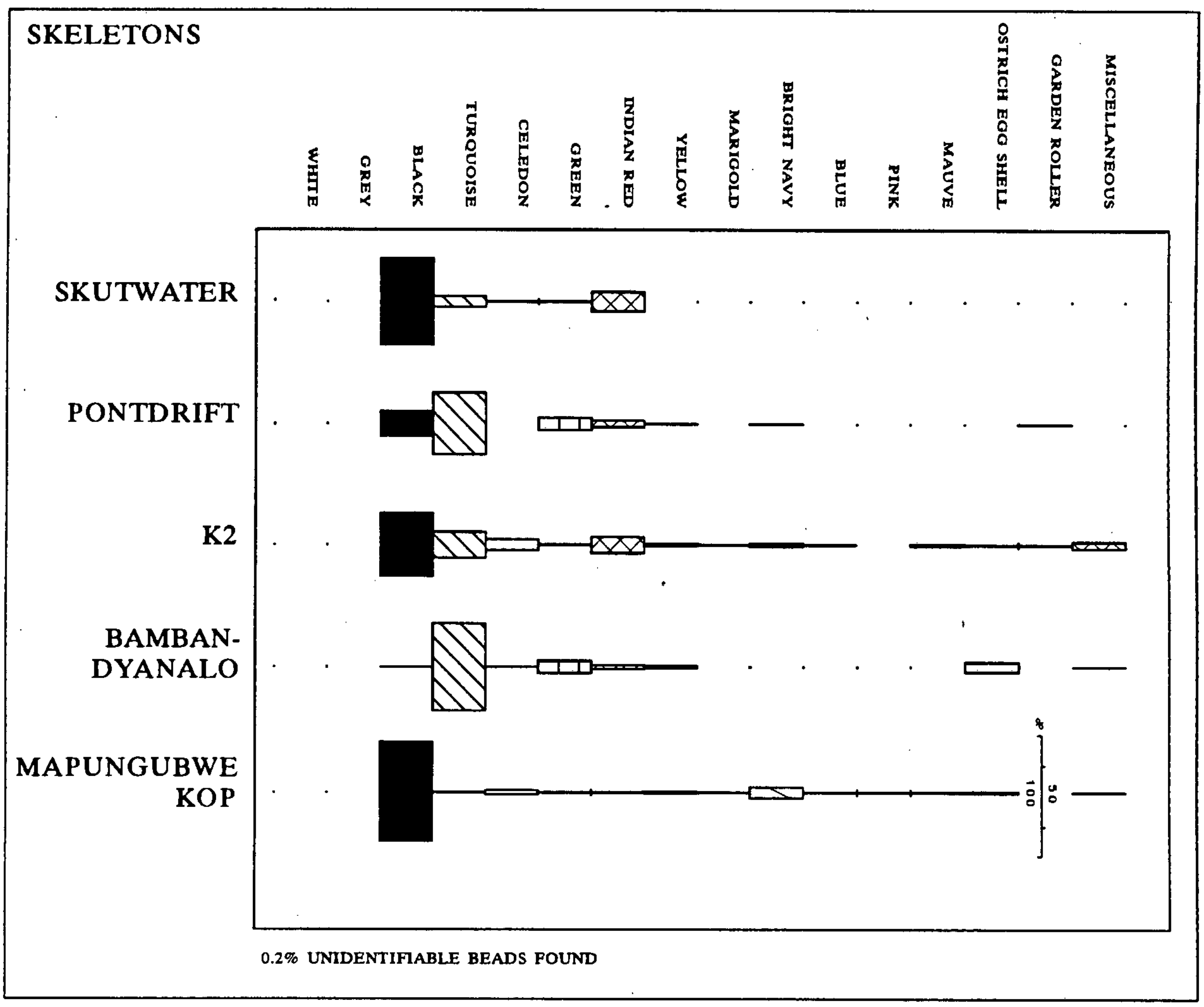
E & M (1976)	K2	K2	K2	K2	K2	K2	K2	K2	
Layer:	T.T	1	2	3	4	5	6	7	TOTAL
WHITE									
GREY		1	1						2
BLACK	1	1	1						3
TURQUOISE	2	117	62	35	18	5		7	246
CELEDON	1	15	4	5	1	1			27
GREEN		10	2	2	1				15
INDIAN RED	1	69	33		3				106
YELLOW		42	2			1		1	46
MARIGOLD									
BRIGHT NAVY									
BLUE			2						2
PINK									
MAUVE									
OSTRICH EGG SHELL									
GARDEN ROLLER		2	3	2	3				10
MISCELLANEOUS			3					1	4
UNIDENTIFIABLE									
Total number of beads:	5	257	113	44	26	7		9	461

Unknown provenance:65

K2 Meyer (1991) Layer:	K2 T.T	K2 1	K2 2	K2 3	K2 4	K2 5	K2 6	K2 7	K2 8	K2 9	K2 10	K2 11	K2 13	K2 14	K2 15	K2 Skltn	TOTAL
WHITE				1													1
GREY																	0
BLACK		2	2														4
TURQUOISE		135	118	87	63	5	11	3	19		10		1			478	930
CELEDON		59	33	18	9	2	2	1			2	1				50	177
GREEN		15	9	13	1	1	1				1					45	86
INDIAN RED		55	10	16	5	9	12	5								587	699
YELLOW		6	4	10	1	3	2		1			2	1				30
MARIGOLD					1												1
BRIGHT NAVY																	0
BLUE																1	1
PINK																	0
MAUVE									1								1
OSTRICH EGG SHELL																	0
GARDEN ROLLER		10	9	2		2										1	24
MISCELLANEOUS				1													1
UNIDENTIFIABLE		4	2	2	4												12
Total number of beads:	0	286	187	150	84	22	28	9	21	0	13	3	2	0	0	1162	1967

K2 Meyer (1993) Layer:	K2 1	K2 2	K2 3	K2 4	K2 5	TOTAL
WHITE						
GREY						
BLACK	3	1				4
TURQUOISE	67	63	16	25	2	173
CELEDON	1	4		2		7
GREEN	6	6	1			13
INDIAN RED	14	10	2	2		28
YELLOW		2				2
MARIGOLD						
BRIGHT NAVY						
BLUE						
PINK						
MAUVE						
OSTRICH EGG SHELL						
GARDEN ROLLER	1	6		1		8
MISCELLANEOUS			1			1
UNIDENTIFIABLE						
Total number of beads:	92	92	20	30	2	236

Fig. 6.3.1.2.
Glass beads from skeletons in the northern Transvaal including K2 and Mapungubwe.



Mapungubwe Hill, is one of several impressive sand-stone formations that rise independently and almost perpendicularly to a height of approximately 100 metres from a valley that feeds the Limpopo River (in the northern Transvaal). The sequence of occupation established for the three sites at Greefswald was based on the occurrence of two pottery types (Van Ewyk 1987:14).

The site has been excavated and reported on by archaeologists and colleagues of the University of Pretoria at various times since the 1930s (Fouché 1937; van Riet Lowe 1936 & 1955; Gardner 1963; Eloff 1979; Eloff and Meyer 1981; Meyer 1980; Voight 1983 and Steyn 1994). Preliminary archaeological investigation at Mapungubwe began in 1933, under the supervision of Leo Fouché working with three students from the University of Pretoria. They commenced with a series of test trenches dug on the Hill, the Southern Terrace, and K2. In 1934, the Reverend Neville Jones (a Rhodesian archaeologist of the time) John Schofield, and a field assistant P. W. van Tonder, expanded the investigations on top of the Hill, the 'Southern Terrace' and K2. This expedition included work on the summit; the occupied area at the foot of the western ascent; and K2. Van Tonder continued working at Mapungubwe and made some valuable discoveries such as the 'Grave Area' on top of Mupungubwe Hill or summit.

In 1935, Clarence van Riet Lowe was appointed the director of the 'Greeefswald' excavation, and Captain Guy A. Gardner was assigned 'field director' assisted by Van Tonder. Together they worked at K2 and Mapungubwe Hill until the war halted proceedings in 1940. Towards the end of 1937 the first reports on excavations at Mapungubwe were published on the findings from February 1933 to June 1935. They were edited by Fouché on behalf of the Archaeological Committee of the University of Pretoria (Fouché 1937).

During 1953 to 1954, systematic excavations in this area were carried out by Coertze, H. F Sentiker and students. A permanent grid was marked off on the *Southern Terrace*.

Small scale excavations were conducted on the Southern Terrace by Eloff (1979) assisted by students from the University of Pretoria. From 1971 to 1979, further work was carried out at K2, Mapungubwe Hill, and the Southern Terrace by J. Eloff and A. Meyer, concentrating their efforts mainly on interpreting the stratigraphy within a cultural sequence (Steyn 1994:14). Periodic small-scale investigations have continued since then with particular attention focused on recovering hut floors at K2, documenting the evidence and curating the sites. In 1993, a casual skeleton was discovered in a pot at K2 (Meyer, pers. comm.). Archaeological research at Mapungubwe continues with staff and student members of the University of Pretoria.

Table. 6.3.1.3.
Distribution of glass beads found at Mapungubwe (Eloff & Meyer).

MAPUNGUBWE SOUTHERN TERRACE E & M (1971-1973)	MAPST	MAPST	MAPST	MAPST	MAPST	MAPST	MAPST	MAPST	MAPST	MAPST	MAPST	
Layer:	1	2	3	4	5	6	7	8	11	12	17	TOTAL
WHITE												
GREY	41						1					42
BLACK	208	416	116	31	27	8	5	1				812
TURQUOISE	26	8	11	1	1		11					58
CELEDON	32	80	27	1	3	1						144
GREEN		12	6									18
INDIAN RED	58	85	34	27	18	9	17	2	1	1	1	253
YELLOW	8	10	9		2							29
MARIGOLD	10	5	4	1								20
BRIGHT NAVY	9	14	1		1							25
BLUE	1	1	10									12
PINK												0
MAUVE	1											1
OSTRICH EGG SHELL	1											1
GARDEN ROLLER												0
MISCELLANEOUS			2									2
UNIDENTIFIABLE					1		1					2
Total number of beads:	395	631	220	61	52	18	34	3	1	1	1	1417

Unknown provenance: 11

MAPUNGUBWE KOP E & M (1971-1973)	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	MAPK	
Layer:	1	2	3	4	5	6	7	8	9	10	11	15	TOTAL
WHITE	2												2
GREY										2			2
BLACK	514	545	237	263	74	235	167	110	70	42	3	57	2317
TURQUOISE	6	2	11	7	1	4	7	3	1	14	10		66
CELEDON	84	70	20	32	8	32	56	30	6	9	3		350
GREEN	26	6	3	7	4	6	2	1	2	3			60
INDIAN RED	68	57	63	48	14	34	39	34	31	113	99	1	601
YELLOW	17	13	14	5	4	6	4	1	4	4	1		73
MARIGOLD	4	3	2	3									12
BRIGHT NAVY	15	8	4	6		4						4	41
BLUE	1	9	2	3		15	12	2	3	3			50
PINK													0
MAUVE	1					2							3
OSTRICH EGG SHELL				1	1	2			2				6
GARDEN ROLLER		1								2			3
MISCELLANEOUS			2	1			1						4
UNIDENTIFIABLE				1			2						3
Total number of beads:	738	714	358	376	106	340	288	181	119	192	116	62	3593

The cemetery or *Grave Area* at Mapungubwe lies within a well defined area on the lower western slope[5]. Recent work by Maryna Steyn (1994) on individual grave descriptions for skeletons from K2 and Mapungubwe, provides an interesting 'shroud' and insight to burial practices prevalent at the time. For example, juveniles under the age of five were buried with 75% of blue green beads. Steyn reported on twenty seven or twenty eight skeletons from Mapungubwe, of which only eight were buried with glass beads (Steyn 1995:47). This data has been enlarged by classifying additional numbers of beads belonging to Mapungubwe skeleton beads which were submitted to this laboratory (Fig. 6.8.1). The combined results provide the most comprehensive inventory of K2 and Mapungubwe glass bead grave goods.

Skutwater.

The site known as Skutwater (TSW1/1) is located on the farm Skutwater (22°21'S - 30°02'E), approximately 65 kilometres west of Messina. The site comprises a large, more or less circular mound of cultural debris, which rises to a height of 1.75m above a relatively flat, sandy plain.

Potsherds, fragments of ceramic animal figurines, ostrich egg shell, bone and glass beads were amongst the cultural artefacts occurring in varying frequency throughout the excavation. Only the glass beads were submitted for analysis. Van Ewyk (1987:60), compared his collection of beads with those from K2 and Mapungubwe. He concluded that the only difference between them was one of colour, as the shape and size were fairly constant. Van Ewyk used the same typology with some exceptions regarding subdivisions and variations of colour. A misleading colour choice - orange - was used to describe some of the beads at the Greefswald sites and at Skutwater; I have reclassified them as light and dark marigold (Munsell No's 2.5Y 6/10 & 7.5YR 6/10). Beads termed as 'orange' (Munsell 3.75YR 6/14) are especially characteristic at sites in Southeast Asia. These should not be confused with the southern African sites, where no orange beads have been found.

Human burials with glass beads were excavated at Skutwater. One of them still had the remains of a piece of beaded work around the pelvic area. Many ethnographers and art historians argue that glass beadwork *per se* was introduced into South African culture only after permanent European contact. The archaeological evidence shows, however, that glass beadwork existed at Skutwater some 400 years before (Van Ewyk 1987:91).

According to Van Ewyk (1987:114) Skutwater represents a single period of occupation with a definite inter-relationship with K2, Mapungubwe Terrace and Mapungubwe Hill.

---

[5]. In almost every instance the body was interred in a flexed position on its side with no regard for orientation. The women were found with masses of metal anklets and bangles made of wire, mostly iron, wound round fibre or sinew. In two case the bodies were buried with considerable masses of gold finely wrought and moulded gold-foil or plating. The plating was secured to small sculptures, such as the well know Mapungubwe rhinoceros, with pure gold tacks: Where the body was not flexed and lying on its side, usually on the right side, the manner of burial seems to have been in a sitting or squatting position (Van Riet Lowe 1936:286) .

Table. 6.3.1.4.
Glass beads from Skutwater.

SKUTWATER	SKUT Layer 1	SKUT Layer 2	SKUT Layer 3	SKUT Layer 4	SKUT Layer 5	SKUT Layer 6	SKUT Layer 7	SKUT Layer 8	SKUT Layer 9	SKUT Skeletons	TOTAL
WHITE									1		1
GREY											0
BLACK	260	118	101	53	18	13	7	7	27	928	1532
TURQUOISE	16	6	6	4		2	1	16	18	131	200
CELEDON	47	29	14	6	5	2	4	1	1	1	110
GREEN	19	12	9	7	2	1	1	1	2	6	60
INDIAN RED	25	25	28	33	3	6	16	1	1	248	386
YELLOW	19	2	2	3	1	3	3				33
MARIGOLD											0
BRIGHT NAVY	5	1	1		2						9
BLUE											0
PINK											0
MAUVE											0
OSTRICH EGG SHELL									1		1
GARDEN ROLLER											0
MISCELLANEOUS											0
UNIDENTIFIABLE											0
Total number of beads:	391	193	161	106	31	27	32	26	51	1314	2332

Makahane

Makahane is located on the northern Transvaal boundary of Venda and the Kruger National Park: The centre of the settlement is situated on top of an east-west oriented hill covered in extensive residual deposit (Huffman and Hanisch 1987:106; Küsel 1992:66). It was first investigated by Eloff and De Waal (1965). A green *wound* bead similar to one found at Mapungubwe was excavated by Küsel (pers. comm.) (see Chapter 8.1.3.2. n-o; Tables 8.2.2.1 & 8.3.1.1.).

6.3.2 Allied Sites

Beyond the boundaries of Greefswald other important sites were discovered. At the end of September 1934, Jones, Schofield and Fouché discovered the 'allied' sites including Singalele, Parma, Maryland, Verdun, Haddon, Islet and Shirbeek. At Haddon, situated 77 kilometres north-east of Mapungubwe, glass beads and very fine pottery were found. The 'allied' sites were classified and described into four groups, according to different methods of stone wall building.

Shirbeek is believed to have been an old Venda settlement. Three segmented beads in various colours were discovered here. (See Fig. 8.1.3.1.(p) p. 130)

6.3.3 North Eastern Transvaal

The north-eastern Transvaal sites consist mainly of open settlements on flat land or low terraced slopes at the bases of small hills (Van der Merwe & Scully 1971; Chatterton, Collett & Swan 1979; Meyer & Pistorius 1984).

Phalaborwa

Phalaborwa and the surrounding area is associated with rich deposits of iron and copper along trade routes that criss-cross the Lowveld of the North-eastern Transvaal. It is located within the dry and harsh Transvaal Lowveld where living conditions were considered unhealthy for man and domestic stock until the turn of the 19th century. Notwithstanding this inhospitable environment, iron and copper ores were mined and worked at Phalaborwa dating from, between *ca.* AD 800 - AD 1300 (Pistorius 1995:45).

Settlement at these sites consisted of villages built at the bases of small hills and settlements erected on low terraced slopes. Two small habitation sites were investigated at Kgopolwe (SPK I, II & III) Nagome Hill (MN 3, 4, 5 & 6) and KAL (MK) (van der Merwe & Scully 1971:178-196). In addition to excavating these settlements, extensive surface collections were made from a number of other sites, including Nagome. Chemical analysis was carried out on beads from Kgopolwe (SPK III) and Nagome (MN3).

The ceramic sequences of pottery found at these sites have been classified by Evers (1987:87-106) and fall into three stylistic groups, Kgopolwe, Moloka and Letaba. Kgopolwe and Moloka are regarded as being similar, and represent the third phase of the Transvaal Western Stream Iron Age immigrants dated from, between AD 100 - AD 1300.

6.4 BOTSWANA.

Numerous Early and Late Iron age sites have been found in the Ngamiland District of northwestern Botswana and eastern Botswana, where agropastoral excavations, dating from, between AD 700 and AD 1000, have been carried out since 1975 (Wilmsen 1989; Denbow and Wilmsen 1986:1509-1515). The largest site is Nqoma, situated on a plateau in the Tsodilo Hill about 40 kilometres west of the Okavango River system. At Nqoma, the glass beads were excavated from a house floor together with marine shells, smithing tuyeres, carbonised grain and pottery radiocarbon dated to *ca.* AD 950, and from the main midden dated *ca.* AD 980 and *ca.* AD 770. Nqoma is considered to have been occupied for several decades as the residence of royalty or an elite upper class and an important trade centre as early as the 9th century AD (Wilmsen, pers. comm.). Matlapaneng, on the southeastern Okavango, is also an extensive site dated from, between the late seventh and tenth centuries.

The cowrie and conus shells found at some of the sites in Botswana suggest trade connections, either with the cowrie shell commerce of West Africa, or with the Indian Ocean. Glass, ostrich egg shell beads, iron, worked ivory and pottery were some of the artefacts recovered.

A total of 771 glass trade beads and one soapstone pendant (previously mentioned) were excavated from some of the sites in Botswana. This number represented beads from both earlier levels in the Iron Age sequence and much more modern ones (Chapter 8.1.c). Xaro on the Okavango, and Nyae Nyae, for example, had beads associated with the Portuguese Atlantic trade of the 16th century (Wilmsen 1989: Saitowitz, van der Merwe & Kaufmann 1994). Besides these, other glass beads were found at Alex/Kwebe, Bosutswe, Kgaswe, Matlapaneng, Nqoma, Rakops, Tora Nju and Toteng. Beads made from different materials, such as metal and ostrich eggshell, were also found. Slate and agate beads were manufactured at Bosutswe (Weedman 1993:40-48).

6.5 EGYPT

Fustat (Fig. 6.5.1).

The first large-scale excavation of Fustat was commenced in 1912 by the Museum of Arab Art in Cairo, directed by Ali Bahgat. During a period of 12 years, about twelve hectares of an important portion of the town were systematically unearthed and a number of large soundings in other parts of the site were made (Kubiak 1988:30). Thousands of artefacts were recovered from this area for the museum. In subsequent years many other, although much smaller, excavations were undertaken in various parts of the site (Fig.6.5.2).

From 1964 to 1981 large-scale scientific excavations were carried out by the American Research Center in Egypt under the direction of George Scanlon (American University at Cairo) and others, including W. Kubiak and trained archaeological workmen. Successive expeditions were joined for short periods by many experts in different fields, including R. W. Pinder-Wilson, Deputy Keeper of Oriental Antiquities at the British Museum, who worked on the glass finds, and B. Gyllenvärd, Director of the Far Eastern Museum of Stockholm, who concentrated on the Chinese ceramics. Preliminary reports of nine seasons of field work, and other ancillary specialist publications, have resulted.

By 1971, 2500 square metres of Fustat-B were uncovered, contiguous to the parts excavated in 1965-1968. One of the characteristics of the eastern part of Fustat, at least in the sections so far investigated, is that, wherever possible, foundation walls were laid directly on bedrock (Kubiak 1988:30; Kubiak & Scanlon 1979:103).

Fig. 6.5.1. General situation of Fustat and other sites in Egypt
(Redrawn from Kubiak 1988:174).

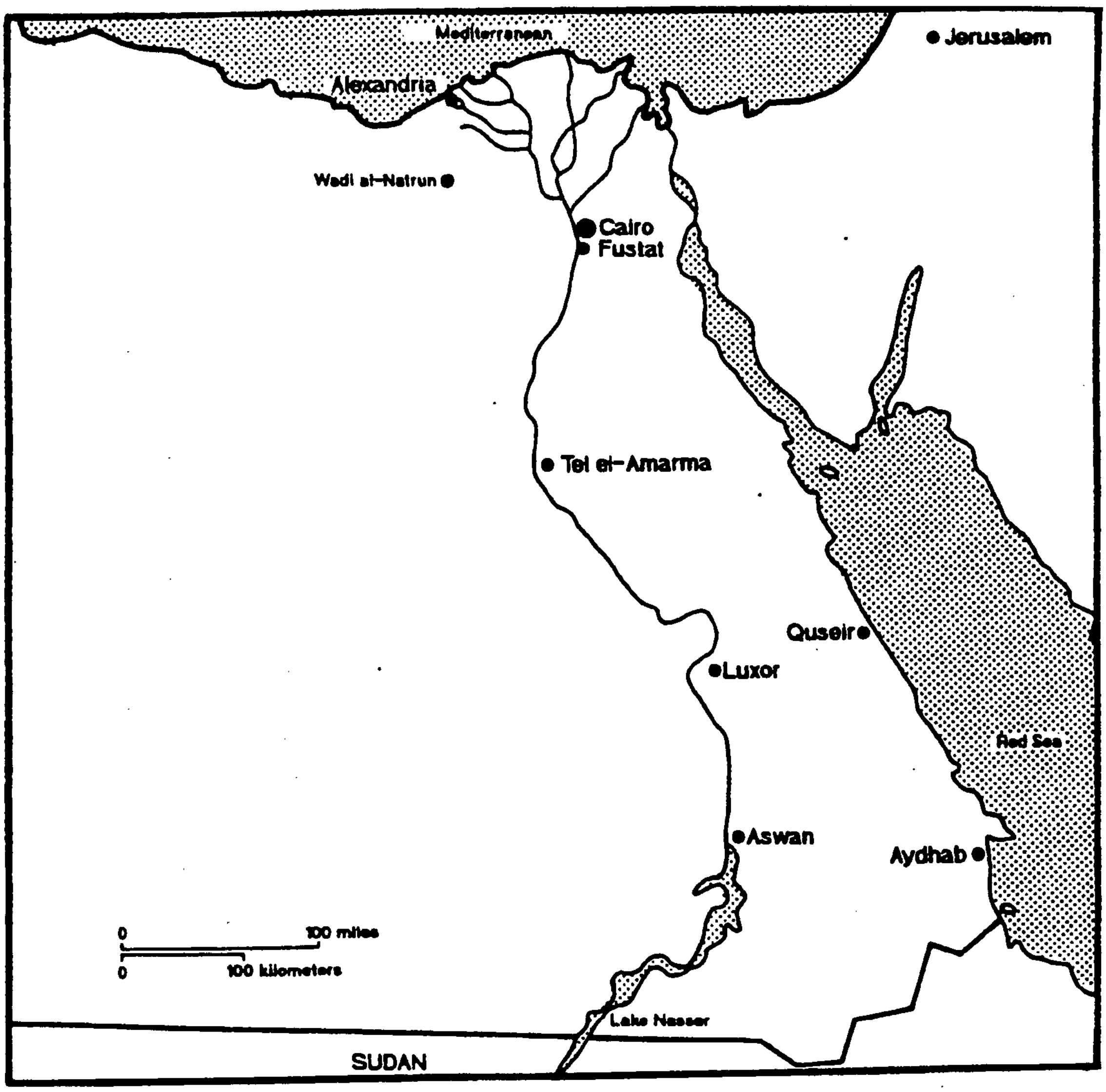
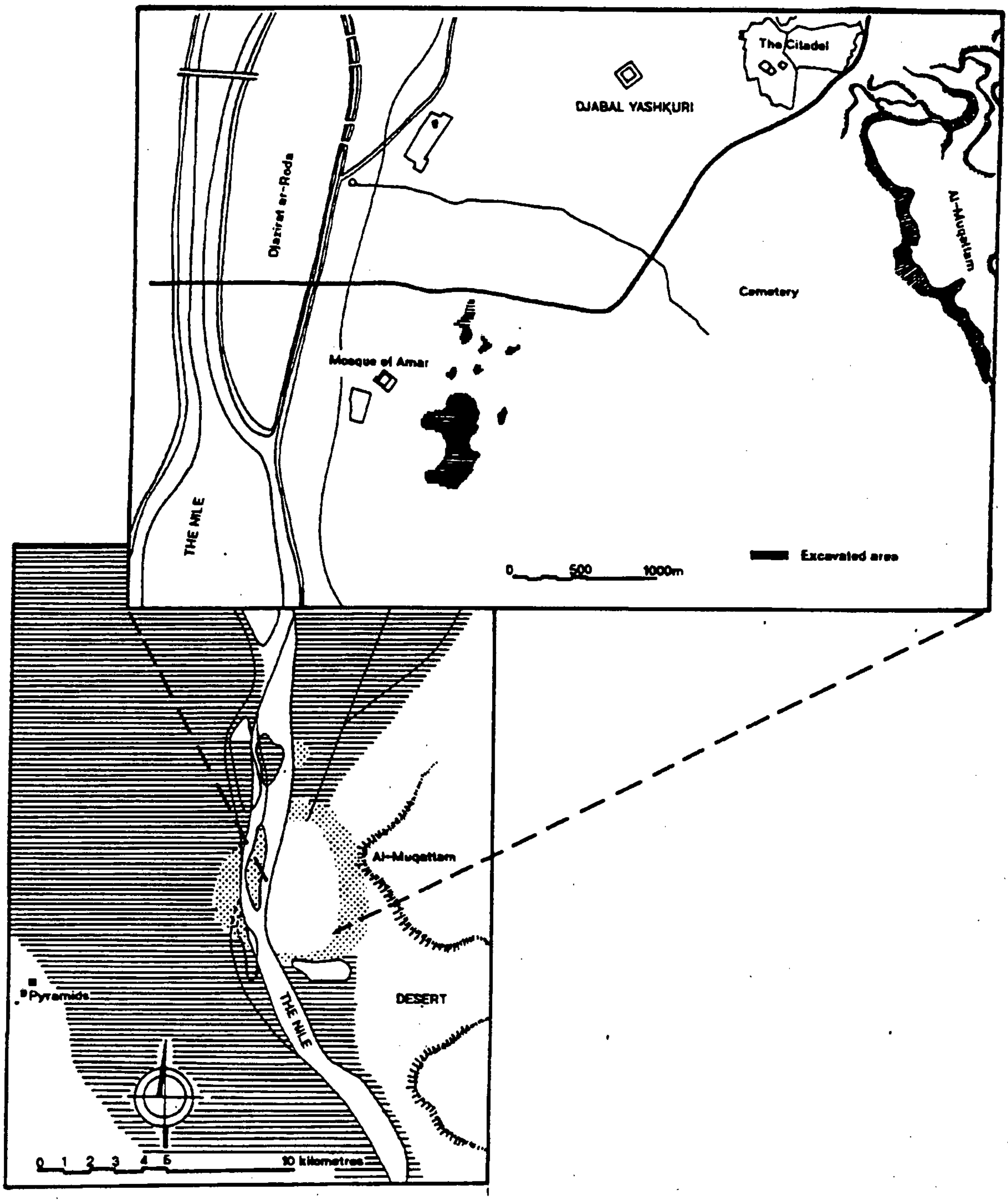


Fig. 6.5.2
The Site of Fustat

(Redrawn from Kubiak 1988 & Casanova 1919



In 1965, the remains of a glass ingot producing factory were discovered. According to Scanlon, (pers. comm.), the kiln associated with this factory was definitely Fatimid. The ingots, made in different turquoise, green honey-brown and manganese colours, were probably ground down and reused to make vitreous glazes. Other kilns were also found in later excavations. However, these were differently structured. They were found laid among the debris of the city deserted in 1169.

Streets, housing complexes, such as the Proletarian Quarter, widely scattered remains of masonry, canals, aqueducts, undisturbed pits, baths and a large and intricate sanitation system were exposed under some very high mounds (Scanlon 1976:69-89). Many of the houses were bigger than others, with paved and unpaved floors. According to Scanlon (1990:4), a 12th century Sumatran coin, the only one of its type found in a controlled excavation this far west, and Fatimid manufactured imitation Chinese lacquer allows us to assume that trade between China and Egypt involved more that ceramics and textiles. A fragment of the earliest known resist-dye textile (possibly the oldest, surviving patterned cotton in the world) was also excavated. These and many others artefacts, individually and in sum made Fustat:

> *...(t)he most important entrepôt of the dar al-Islam* (Scanlon 1990:5)

6.6 PALESTINE AND SYRIA

Khirbet el-Minya

Khirbet el-Minya is located on the shore of the Sea of Galilee, about 14 kilometres north of Tiberias and immediately south of the rocky promontory known as Tell el 'Oreimeh (ancient Kinneret). In 1932, excavations were begun by A. E. Mader and continued under his directorship for a further five seasons until 1939. Excavation at the site revealed two major occupational periods. The earlier period at Minya contained a palace and a mosque, a throne room, and a group of five rooms with mosaic floors. An inscription which mentioned the name of al-Walid (AD 705-715) dated the construction to the Umayyad period (Grabar 1977:876).
In 1959 the site was excavated again by O. Grabar and J. Perot, on behalf of the Horace H. Rackham Fund for Research, University of Michigan. The results of this excavation showed a second major occupation of Khirbet el-Minya in Mameluk time, when it became an important stop-over on the caravan route from Egypt to Syria. According to Grabar (1977:876), it was probably the chateau of a princely landowner.

The glass bracelet fragments used in this study were excavated from the Umayyad occupation of Minya, dated to the first half of the eighth century AD (courtesy of M. Spaer, Israel Museum).

6.7 SOUTHEAST ASIA

Many of the archaeological sites in Southeast Asia are situated along rivers, mangrove forests or estuary harbours close to the sea. The rivers flow straight into the ocean or into bigger rivers. Entrepôt ports played a leading role in the international trade of the Malay Peninsula and the Indonesian Archipelago. This type of commercial activity was widespread in a small section of the north-west coast of Malaysia, in south Kedah next to Penang Island, from the 5th to the 14th century AD. According to Jacq-Hergoualc'h (1992:1), these ports prospered for a few decades or a few centuries, and then disappeared, superseded by other, often neighbouring harbours. One of the characteristic features of coastal ports was their instability, brought about by intense siltation. The coast and river beds are alluvial and therefore keep on advancing into the sea or are washed away, a phenomenon which still exists today.

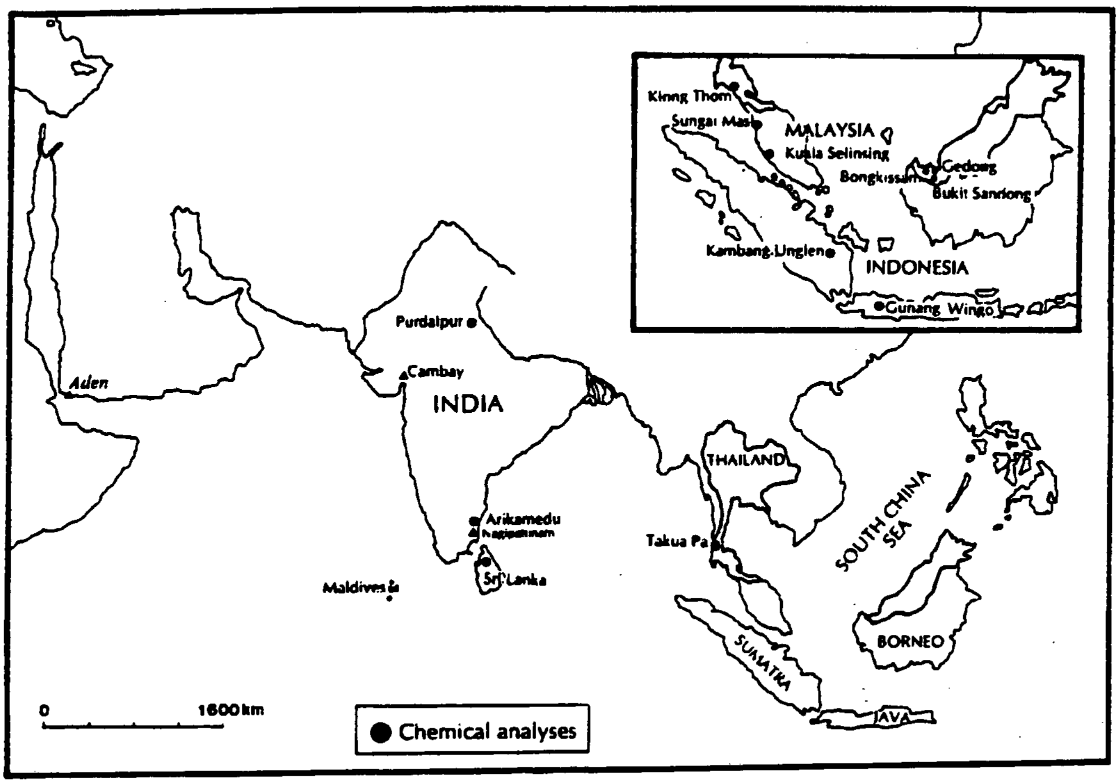
Elsewhere in western Malaysia, such as Kuala Selinsing, situated off the coast of Perak in a mangrove thicket, a number of *canoe* burials, and large shell middens were excavated. Glass beads formed part of the grave furniture and were brought to the surface by the action of burrowing crabs and hydraulic forces (Lamb 1966:82). Other burials have been recovered from megalithic sites where cists and 'slab-built' graves made from granite slabs were found. Some of the graves were made from a single slab while others were covered with several slabs. Grave goods included potsherds with incised and cord-marked decoration, fragments of bronze bowls, decorated stone, iron implements, and bone tools (Evans 1928:121-132; Evans 1929:175-176; 1932:79-133). Slab-built graves are also found in Java.

The pre-European glass bead collections from India and Southeast Asia are predominantly simple monochrome *seed* beads. Polychrome glass beads rarely exceeded 1% of the total of glass beads; and non-glass beads such as metal, stone or fossil resin, shell or vegetable material were never more than 10% of the total (Lamb 1966:86). In certain categories of archaeological sites beads are extremely abundant. For example, at Oc-eo in the extreme south of South Vietnam, over 8 000 beads were collected, and at Pengkalan Bujang in Malaysia over 4 000 glass beads were found (Lamb 1966:80).

The glass material from the Southeast Asian sites analysed for this study came from known sites, but unfortunately only a few dates are presently available. Although glass objects have been excavated from Indian sites dating from the 1st millennium BC through the mediaeval period and into the 19th century, archaeologists often seem to regard these finds as imports from the Near East and Roman world in earlier periods (Brill 1986:2). While it is likely that some of the glass was imported, the possibility does exist that glass was independently produced.

Fig.6.7.1.

Archaeological sites in Southeast Asia where glass artefacts were found.



Peter Francis Jr., who donated most of the Southeast Asian material, is of the opinion that the sites of Arikamedu (India), Kuala Selinsing and Sungai Mas (western Malaysia), Kambang Unglen (Palembang, Indonesia), Klong Thom and Takuapa (Thailand) were beadmaking sites. However, this does not rule out that imported glass in the form of ingots or cullet could also have been used to make the beads, in a secondary process.

Sites in eastern Malaysia where glass beads were found include Bongkissam, situated in the Sarawak River delta, 40kms north (and very slightly to the west) of the capital Kuching. Bukit Sandong is 150kms South-East of Kuching, very near the Indonesian border (Francis, pers. comm.).

Arikamedu

Arikamedu in India, is situated on the bank of a river formed into a lagoon, barred by a sand-bar from the Bay of Bengal on the Coromandel coast of India (11^{O}55'; 79^{O}50') (Fig. 6.7.2). Extensive areas of the site were excavated by Sir Mortimer Wheeler in 1945, by Jean-Marie Casals between 1947 and 1950, and more recently by Vimala Begley (1983:460-481). The site of Arikamedu is a natural harbour, situated on the Ariyankuppam River, approximately 3 kilometres south of Pondicherry. Begley's (*op. cit.*) reassessment of the evidence from the two earlier excavations suggests that the ancient settlement of Arikamedu was first established *ca.* BC 250 and lasted until AD 200, which is a much longer period than Wheeler supposed. Nevertheless, it has evidence for continuous trade with the Mediterranean over an extended period of time.

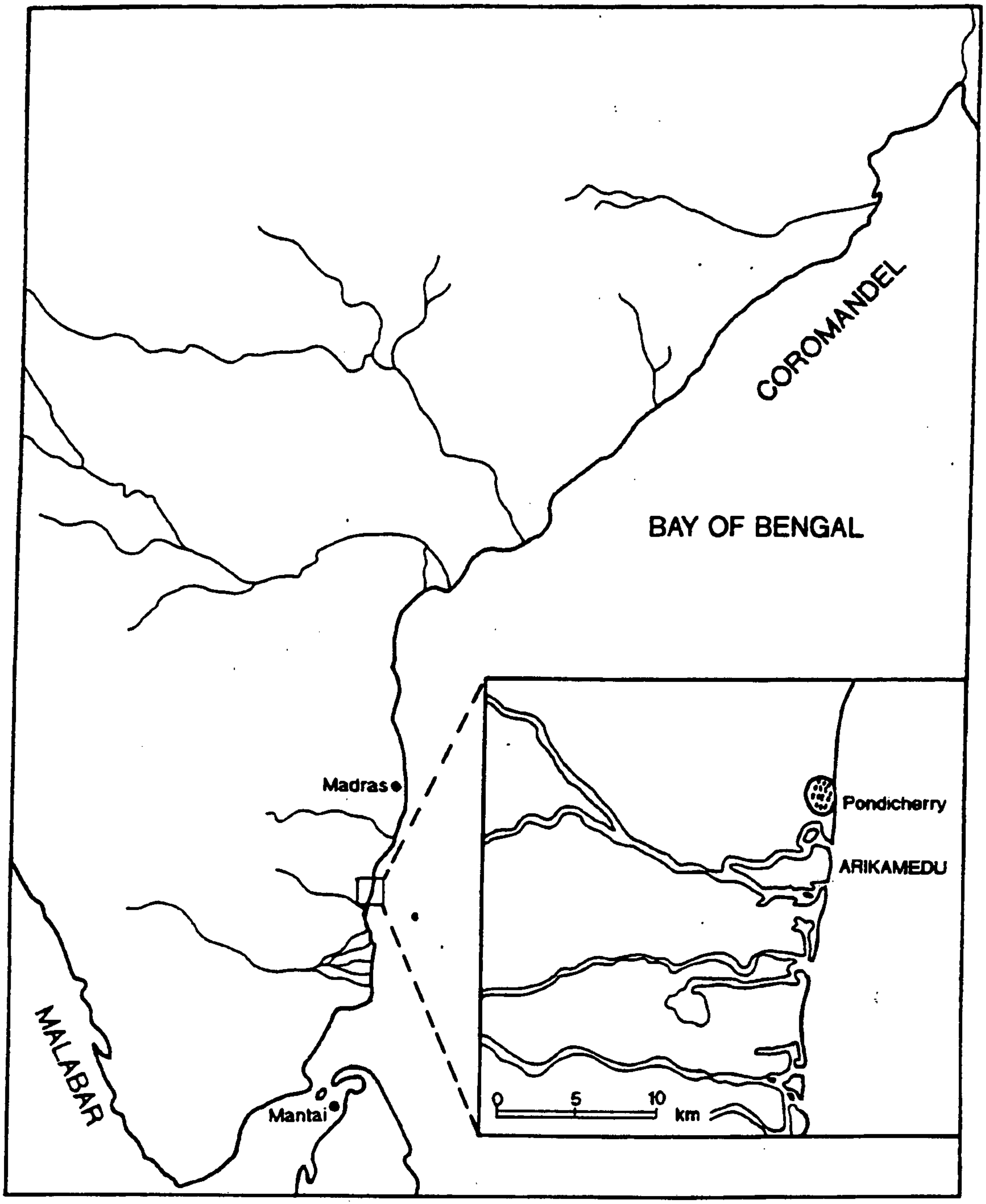
Although large sections of the site have been destroyed for rice plantations, archaeological evidence of an oblong building, identified as a warehouse, was exposed in the southern sector. In the northern area structural remains revealed drains or conduits and substantial pavements, and cisterns or vats used for dyeing muslin (Gosh 1990:23).

According to Lamb (1966:84):

The surface of the Arikamedu site still abounds with the debris of the ancient bead industry. One can pick up chips of carnelian and crystal. From the surface evidence at Arikamedu there can be no doubt that this was an important centre of bead manufacture.

In fact, most of the material excavated from debris and sediment layers in 'Robber trench' and the southern sector of the site contained glass chunks, 'wasters' and bangles, stone beads, shell, bone and pottery. No glassmaking furnaces, crucibles or mould fragments have been recovered during archaeological excavations. According to Lamb (*ibid*) Arikamedu was occupied well into medieval times (*ca.* AD 10th century). Francis, (pers. comm.), suggested an even later occupation, based on historical grounds, and suggested that the site was abandoned in the 16th century. Most of the material anlaysed from Arikamedu consisted of glass wasters.

Fig.6.7.2.
Southern and eastern India, showing Arikamedu
(Redrawn from Begley 1983:463).



Purdalpur

Purdalpur is a village in Uttar Pradesh, northern India, which is heir to the north Indian glassmaking tradition. Glass beads and bangle manufacture have a long history in this area. During *Partition* many of the glassmakers from the northern area (all of whom were Muslims) went to Pakistan and the other half settled in Purdalpur (Francis, pers. comm.). A small glass fragment from Purdalpur was used for analysis.

Ceylon (Sri Lanka)

Ceylon also had early trading contacts with the Mediterranean and China, especially the port entrepôts of Mantai and Mannar (Harder 1993:272; Carswell 1978:25-68; Carswell 1976:121-198;). The site of Mantai is horseshoe-shaped and is surrounded by a double moat between triple embankments. Excavation was carried out in a limited area at the centre of the site where a large quantity of Chinese and Islamic pottery made at various centres in the Islamic Empire including Fustat, Nishapur, Kufa and Samarra was found (Carswell 1976:124). Both the Chinese and the Islamic material from Mantai indicates a 9th to 10th century date for the upper levels of the site.

Excavations at Mantai (Sri Lanka) were undertaken by Dr R. S. Da Silva (the Archaeological Commissioner) in the 1970s. Glass cullet and beads from Ceylon, belonging to the Van Riet Lowe Collection were used for analysis.

Western Malaysia

Archaeological research in western Malaysia, particularly in the provinces of Perak and South Kedah was first undertaken, at a superficial level, by a British official from 1830-1850. Although further discoveries took place, systematic archaeological investigation was not carried out until the 1920s, by Ivor H. N. Evans, G. de G. Sieveking and H. G. Quaritch Wales. After the war, no significant work was done before the end of the 1950s. During the 1970s, archaeologists, students and members from the Muzium Negra in Kuala Lumpur, the Universiti Kebangsaan (National University) and the Merbok museum became actively involved. In many instances excavators have had to overcome several difficult obstacles such as intense heat, monsoon rains, dense tropical overgrowth, tidal mud flats, and working below the water table in soil little better than liquid mud. Research continues.

In South Kedah, approximately forty structures associated with temple sculptural remains and inscriptions devoted to Buddhism and Hinduism have been found in connection with the discovery of two major sites of entrepôt ports (Jacq-Hergoualc'h 1992:1). One of these ports, known as Kampung Sungai Emas (Sungai Mas) was located about 30 kilometres from Kota Kuala Muda. Archaeological evidence in the form of subterranean sea shell suggests that the site was formerly part of the shoreline. Large numbers of glass beads, glass fragments, imported glazed ceramics and local pottery were found. The remains of Hindu architecture, Chinese, Indochinese and Malaysian ceramics mixed with glass fragments and glass beads were excavated from sandy soils, shell middens and mangrove mud. Trading activities at Kampung Sungai Emas are believed to have continued from the 5th to the 11th century (Ahmad Harun, pers. comm.). According to Andaya & Andaya (1994:28), commercial activities expanded and peaked between the 10th and 12th centuries possibly due in part to the development of wet rice (*padi*) on Kedah's alluvial plains.

Large quantities of glass beads have been excavated from Pulau Kelumpang (PK) and Kuala Selingsing, situated on the Selinsing River estuary. Six beads from these sites have been used for chemical analysis in this study. The original site of Kuala Selingsing has been broken up into eleven islands: Some of the material in Trench A (200-220cm) has a C-14 date of BC 200, while more modern levels (40-60cm) are probably 9th - 10th centuries AD (Francis, pers .comm.).

Thailand.

The ancient settlement of Klong Thom, locally known as Kuan Luk Pad or the Bead Mound, is situated about 1 kilometre south of Klong Thom District, Krabi Province, southern Thailand (07^{O}55'20"N by 99^{O}09'20"E). The site is on the coastal plain approximately 15 or 20 kilometres from the Andaman Sea (Veraprasert 1987:324) has been dated to *ca.* AD 800 - AD 1100. The Klong Thom River, which runs through the western side of the site, was an important route connecting the settlement to the Andaman Sea. Klong Thom was conveniently placed as a harbour and entrepôt for traders crossing the Peninsula from west to east. It appears to have been connected to the early maritime trading network linking the western world, via India, with Southeast China (Manguin 1993:252-279). The first settlement of the site probably dates to the late Neolithic period. In time it grew and served as a trading centre for foreign traders, concurrently with Oc-oe, which flourished as an important seaport on the coast of Cochin-China (Veraprasert 1987:329). Artefactual material included polished stone adzes, moulds for casting bronze, gold and bronze coins, glass fragments, glass, stone, tin and gold beads, and potsherds with cord-marked and incised decoration. There are other sites in Krabi which might be culturally related to the Klong Thom site.

The site of Takuapa is located on the west coast of South Thailand. According to Lamb (1966:80) there is an island at the mouth of the Takuapa river estuary, which was possibly an important trading settlement in the T'ang Dynasty (*ca.* AD 700 - 900) on the main sea route between the Middle East and the Far East and which was 'a veritable bead field'. The glass bead and glass 'blob' analysed from this site were surface finds collected by A. and T. Srisuchat, who considered it to be a beadmaking site that was occupied only in the 9th century (Francis, pers. comm.).

6.8 BURIALS AND BEADS

Burials, with beads made from a variety of materials, are found at many sites in Africa, and throughout Southeast Asia, such as in Malaysia, South Vietnam, South Sumatra, the Philippines and Java. The bulk of the grave goods, particularly those related to the southern African burials, consisted mainly of glass, OES or Achatina shell and gold beads. Some of the southern African burials contained other cultural artefacts such as ivory, copper, iron and bone ornaments and weapons (unfortunately heavily corroded) and several finely tooled earthenware bowls of a funerary type (van Riet Lowe 1936:285-286). There were no artefacts made from faience.

The majority of beads found on skeletons, including glass, gold, OES and Achatina shell, were associated with human burials at Mapungubwe; in numbers, these far exceed those found on skeletons at K2, Schroda or Skutwater. Mapungubwe is the only site where skeletons were retrieved with gold beads.

Seventy-three graves were discovered at K2, but only thirty-seven of them contained glass beads (Schofield 1958:211). According to Schofield (1955:7) skeleton 52 at K2 was buried with a wound glass bead with tapered bores, which he considered may have been similar to the so-called 'Persian' beads Kirkman found at Gedi (classes 4-8). Schofield thought that the discovery of one of these beads (amongst the grave goods of skeleton 52 at K2), may have had an important bearing on dating. Unfortunately, this 'Persian' bead has apparently been lost over time, as it was not found among any of the beads examined for this thesis. Steyn (1994:71) also mentions a brown glass bead that had been described in the literature. It is probably the same one, of supposed 'Persian' origin, as that cited by Schofield. Some of the beads from K2 skeletons appear in the inventory under field numbers preceded by the letters 'KS' in the Appendix.

Beast Burials were also found at K2, three of which contained cultural material, including glass beads. The animal remains were not confined to cattle but also other animals as well. The burials were each characterised by a covering and protective border of potsherds (most of which could be joined together to form almost complete pots) (Voight 1983:6). Gardner (1963:32) noted that among all the beast burials not a single black, or what he termed plum-coloured beads were found. He has explained this phenomenon in compelling detail.

A human juvenile skeleton from a K2 (TS2.G3) grave was described by Hertha De Villiers (*in* Eloff & Meyer 1979) as being buried with red glass and blue quartz beads scattered in amongst the bones. Two conus shells were found in the cervical region and copper bracelets around each ankle joint. Subsequent investigation in this study shows that the beads were of made of glass and not quartz. The red beads and one *Garden Roller* were reported by Steyn (1994:80) but were not included in the collection studied here.

In contrast to Islamic funerary practices, where ornamentation such as glass beads were rarely buried with skeletons, whereas in southern Africa, thousands of glass and gold beads were excavated with skeletons.

6.9 CONCLUSION

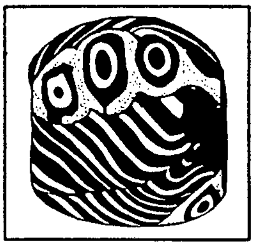
The glass beads and 'waste' material analysed for this thesis include a representative collection from twelve major sites in India, Ceylon, eastern and western Malaysia, Thailand, and Indonesia where beads were produced at various times, in what is thought to have been an unbroken sequence, from the 3rd century BC until the present. In addition, glass beads and a bracelet excavated at sites in Egypt, Palestine and Syria were available. The complete excavated collections from all the major sites in the Limpopo Valley and Lowveld regions of the Transvaal and Botswana, which span the period *ca.* AD 900 - 1250, including the massive collections of Bambandyanalo and Mapungubwe have also been included. Approximately 150 000 beads were used in my study.

The collections, particularly from southern Africa, comprise mainly small, undecorated, glass *seed* beads, which were probably preferred for their attractive colours, and their suitability for stringing or beadwork. Many of them were buried as grave goods.

The method used to study the beads has been developed over the past six years, beginning with an intensive study of the beads excavated at the Zulu capitals of Mgungundlovu and Ondini (Ulundi) (Saitowitz 1990). The system is based primarily on a standardised, internationally recognised, visual classification scheme to determine method of manufacture and appearance, followed by selective chemical and physical analysis. The results characterise the beads in sufficient detail to make unequivocal comparisons possible. Some of the techniques employed require minimal equipment and have been specifically developed for use by investigators without technical training. The combination of all these techniques represents a new approach to the study of glass beads in southern Africa. It provides an explicit taxonomy which can be repeated by other researchers, while the chemical analysis provides convincing evidence for manufacturing sources in some cases.

....

7



METHODOLOGY

7.1 INTRODUCTION

The materials analysed for this thesis include glass trade beads from all the major Iron Age sites in southern Africa (*ca.* AD 900 - AD 1250), as well as comparative bead specimens, fragments of glass bracelets, glass cullet or *wasters* - from various potential glass sources. The analysis was done in the Archaeomaterials Laboratory in the Department of Archaeology, University of Cape Town. The materials comprise both archaeological and museum specimens, obtained from many institutions and private collections, including the National Cultural History & Open Air Museum; University of Pretoria; Wellington Museum; The University of the Witwatersrand (The Van Riet Lowe Collection); Center for Bead Research, Lake Placid, NY; Sarawak Museum; The American University at Cairo and the Israel Museum. All the source material from Arikamedu and Purdalpur in India, consisting of factory 'wasters' and broken beads, was donated by Peter Francis Jr., (Center for Bead Research). The specimen from Purdalpur was a small lump of glass collected by Francis personally. The material selected from the Van Riet Lowe Collection was especially useful, containing a variety of decorated beads of reported provenance that were visually identifiable (Fig. 8.1.4.2).

Most of the glass material was well preserved, except for beads from Nqoma in Botswana, Kgopolwe III at Phalaborwa, and Schroda in the northern Transvaal. Binson (1981) and UNESCO (1981) glass conservation recommendations were applied to the beads from Schroda.

The bulk of the southern African material came from Iron Age sites dating between *ca.* AD 900-1250, with an additional later Iron Age component (*ca.* AD 1600-1800); the latter contained more modern beads, probably made in Europe. An important aspect of this thesis was to compile a classification of the beads, and to present the results in one comprehensive catalogue. This provided a convenient reference and descriptions for all the artefacts, and a base from which to select samples for further detailed examination and comparative research.

Initial preparation of the material involved considerable time and effort, particularly the sorting, cleaning and arranging of the K2 and Mapungubwe beads into chronological sequence. The beads from the earlier excavations at these sites were in a state of disarray, due to years in storage (during which time the labels had been eaten by fishmoths and the containers broken), attempted burglaries, and loans to various institutions that had not been returned (Meyer, pers. comm.). Wherever possible, published reports and documents were used to cross-reference the assemblages described by Fouché (1937), Gardner (1963) and Eloff (1979).

The Schroda and Pont Drift material had been re-packed and labelled by staff of the National Cultural History and Open Air Museum, Pretoria. The same was done by staff and students of the Anthropology and Archaeology Department, University of Pretoria, for the Mapungubwe and K2 beads excavated by Eloff and Meyer.

All the glass beads used in this study were first visually classified in respect of methods of manufacture, shape, size and colour. This stage provides a very important starting point in taxonomic analysis. However, because of manufacturing similarities of the material, classification based on appearance alone it is not sufficient to provide precise information for comparative research. In order to extract as much information from the beads as possible, various other alternatives had to be examined. These would serve to increase not only our understanding and knowledge of the chemistry of glass beadmaking technology, but also to help identify possible origins of manufacture.

The most obvious approach was to determine the chemical composition of the glass, for which a variety of techniques is available. The relative amounts of major and minor elements present in the material may be characteristic of a particular recipe; alternatively, the colouring trace elements may be uniquely diagnostic, or unintentional trace elements may reveal its origin. In addition to the major and minor chemical components, rare earth elements (REEs), and titanium and zirconium, can provide useful information on the impurities in the silica (i.e. sand) and the flux. The sand, reflected in the glass composition of the beads, is the most likely of all the ingredients to be found locally[1]. The premise was that its chemistry would not alter too dramatically over a given period in time and space. Monazite REE enriched sand analysis from Richards Bay has been used as an indicator to support this assumption (7.6.1.).

To this end various physical and chemical analytical methods were used, such as refractive index (R.I.), scanning electron microscopy (SEM), atomic absorption spectrometry (AAS), electron microprobe (EMPA), and laser ablation inductively coupled mass spectrometry (LA-ICP-MS). The combination of techniques represents a new approach to the study of glass beads in southern Africa.

All the beads from each site have been visually classified. This information has been sorted and catalogued as appendices. Tabulated summaries of this work are presented in chapter 8.1.1 - 8.1.4. together with illustrations and colour photocopy reproductions of photographs. Selected samples were chosen from the different collections for further analysis.

[1]. There are exceptions to sand found locally, as in the case of the large glass producing centres of Venice and the island of Murano, both of which imported all the raw ingredients used for glassmaking, including the sand.

7.2 CONSERVATION OF GLASS BEADS FROM SCHRODA

Only about a quarter of the Schroda beads had been colour classified in the initial work undertaken by Hanisch in 1980, due to the effects of heavy patination and leaching of the glass whilst buried. Extensive conservation measures were subsequently applied in this study, to improve visual evaluation of this important collection and also to stabilize the glass from future deterioration. Prior to treatment, most of the beads had a dark, blue-black surface colour or a whitish appearance, and on some of them the deterioration extended throughout the whole bead.

In order to improve visual analysis, various preservation techniques were used to restore the beads without damaging them. The initial stages involved washing the beads in a mild cleaning solution (Extran MA 02 neutral), using ultrasonic agitation. They were then rinsed and dried in an electric oven. The best results for removing most of the patination from the surface of the glass were obtained by chemically cleaning them with 20% HCl, sometimes also with EDTA or Calgon (Binson 1981; UNESCO 1981:112). After this had been accomplished the beads were stabilized in micro-crystalline wax with good results. Using the method described here it was possible to classify practically all of the Schroda collection.

Many of the Nqoma beads from Botswana also had deteriorated exterior surfaces. However, this was a much smaller collection than Schroda and the extent of degeneration was not as severe. The beads were not as friable, so it was possible to distinguish most of the colours without having to undertake preservation procedures.

Patination and leaching of glass is a fairly common occurrence in the archaeological record. Hancock *et al* (1994:253) reported on glass beads that were prone to disintegration, suggesting that insufficient calcium in soda-lime glasses results in an unstable material, thus causing the glass to deteriorate. This discussion is continued in chapter 8.1.5.

7.3 VISUAL CLASSIFICATION

The first level of classification divides the beads according to their methods of manufacture.

The classification and terminology published in earlier works by Beck (1928:104 -118), Gardner (1963:93-168), van Riet Lowe (1955:1-22), Schofield (1951:180-229) and others, have been re-adjusted to a modified version of that used by Kidd and Kidd (1970), Karklins (1985)[2], Sprague (1985), and Peter Francis Jr. (pers. comm.). The descriptions of all the artefacts are presented in the appendix.

All the beads were identified on the basis of method of manufacture (drawn, wound, blown, moulded) and appearance (colour, type, shape, clarity of the glass and size). Preliminary screening of each assemblage was done in the Archaeomaterials Laboratory using these standardized analytical procedures. Visual observation also includes the use of a microscope and colour identification, standardised by means of Munsell Color (1976). Colour photography has been used extensively as well.

---

[2]. Karklins (1994:1-10) has recently upgraded his classification system and increased the categories of *drawn* beads. While cognisance has been taken of this, it has not been incorporated into this thesis.

Horace Beck (1937) correctly pointed out the problems associated with colour recognition of many of the beads, particularly between the pale blue and pale green beads in the Mapungubwe collection. While standardised glass colours (Munsell 1976) have greatly assisted colour designation, there still remains a certain degree of subjectivity by the individual researcher.

The beads that were previously described in the literature, as *canes* or chopped beads, particularly from K2 and Mapungubwe, are now referred to as type Ia beads (a). The remainder in all the collections, unless specified otherwise, are small, type IIa, *seed* beads (b).

a) Ia = *drawn* and chopped beads
b) IIa = *drawn* with reworked ends (i.e. the ends have been rounded by heating or 'tumbling').

7.3.1 Refractive Index (R.I.)

Refractive Index provides a means for screening large numbers of beads without resorting to the initial expense and technical complexity of instrumental analysis. R.I. gives little indication of glass type, but methods have been presented for the direct calculation of refractive index of a glass from its composition (Sun 1947:282-287). The technique can be operated easily by inexperienced analysts. R.I. is a fast, sensitive, practically non-destructive technique, and highly reproducible. R.I. has been applied to other glass bead studies in southern Africa (Saitowitz *et al* 1994).

R.I. has an advantage over many other methods in that it is practically non-destructive and sample preparation is relatively simple. All that is needed is to polish a small inconspicuous area to give a scratch-free and flat surface of a few square millimetres.

There are many ways by which the refractive index of glass can be determined. One of the more convenient methods is based on the measurement of the critical angle of total reflection. The Raynor Dialdex refractometer, together with a sodium light source, was the instrumentation used to measure the refractive indices of the various glasses and three soapstone beads and a pendant excavated at Mapungubwe.

Refractive indices were used to select samples for further chemical analysis. The actual measurements, with an average standard deviation ranging from between 0.663 - 0.003, are presented in Table 8.2.3.1.

7.4 INSTRUMENTAL TECHNIQUES USED ON THE GLASS

Attention was given to the feasibility, capability and availability of a number of analytical techniques for use in this thesis. Another consideration was selecting the best elements to examine in order to achieve the most satisfactory classification and discrimination results. Some of the choices were based on previous work and the recommendations of other researchers in the field, although no fundamental study to determine the best elemental variables (irrespective of analytical technique) has been published. Running costs were important considerations, as was the amount of material available, especially where the very small beads were concerned. A non-destructive technique is obviously the ideal.

7.4.1 Scanning Electron Microscopy (SEM)

A Cambridge S180 scanning electron microscope with a KEVEX energy dispersive X-ray fluorescence micro-analysis system was used to analyse a rust reddish/black (Munsell 7.5R 3/8) deposit on the inside central aperture of a *Garden Roller* bead. Many of the beads that were looked at had similar deposits (Fig. 8.2.1.1.).

Analysis was done in spot and raster mode. In spot mode the volume analysed was approximately 1 micron in diameter and in raster mode $4\mu^2$. Operating conditions were: 20 KeV; 30mm WD and 200 seconds acquired time (Miller, pers. comm.) (Table 8.2.1.1.). ZAF software corrections were applied to the results to produce semi-quantitative analysis (Reed 1975). The elemental composition is expressed as oxides.

7.4.2 Atomic Absorption Spectrometry (AAS)

Initially, AAS analysis was chosen as the most appropriate method for a number of reasons. Firstly, it has the advantage of very rapid analysis of a single element in solution; secondly, it is good for samples of which only small volumes are available. It is a well known and highly recommended technique for both major and trace analysis of archaeological silicate materials and ceramics, and is routinely used. AAS has a low detection limit for many of the major and trace elements, including the rare earths (REE).

AAS has distinct cost benefits over other methods, but the technique is slow for multi-elemental analysis. Hatcher, Tite & Walsh (1995) have recently compared the use of AAS with inductively-coupled plasma emission spectrometry (ICP-AES; now abbreviated to ICP), on standard reference silicate materials at the Research Laboratory for Archaeology and the History of Art in Oxford. They found that for most of the major elements, AAS and ICP results were very close. A minor disadvantage of ICP is that 100 mg of sample is preferred, for routine analysis, compared to 25 mg for AAS. They also agreed that AAS is restricted by the fact that it cannot measure concentrations for all elements rapidly. In both techniques the sampling procedure is destructive as well.

A pilot study was carried out on a Varian - Spectra AA 10 instrument at the Sea Fisheries Research Institute in Cape Town. Nine glass beads from different sites were selected for analysis (Table 7.4.2.1). The glass colour of samples #1-8 were all visually classified as turquoise (blue-green - Munsell 5BG 7/4). Numbers #8-9 were classified as dark shadow blue (Munsell 10B 4/4).

Six trace elements (Cu, Zn, Pb, Fe, Mn and Co) were selected for a trial study. To some extent this was an arbitrary choice, because, as I have mentioned before, there is no basic published material available that recommends the best elemental variables or analytical techniques for discriminating early glasses. Certain elements or impurities can be more useful characteristics than others. For example, in relatively recent publications, Hancock & Aufreiter (1995) and Hancock, Chafe & Kenyon (1994) considered chlorine and aluminium particularly useful for characterising ceramic or glass source materials.

Table 7.4.2.1. Metal concentrations measured in micrograms per gram (µ/g).

Bead	Cu	Zn	Pb	Fe	Mn	Co
1. Phalaborwa	7636.2	137.5	624.0	2369	401.9	105.8
2. Mapungubwe	4033.6	158.9	342.2	6191	171.1	18.3
3. Kruger	2272.8	95.0	140.0	5416	175.0	5.0
4. Kruger	4383.9	1572.4	14160	1234	2892.0	63.1
5. Schroda	3607.9	N.D.	1803.9	6900	992.2	N.D
6. Skutwater	3597.8	69.8	326.7	4873	161.5	14.7
7. K2	1833.0	64.8	379.6	2890	160.1	10.8
8. Diamant	350.8	92.2	985.9	3336	2259.0	189.5
9. Schroda	405.3	67.1	727.4	1522	871.4	213.8

The results showed precise differences in trace element concentrations. Unfortunately, the elements selected for analysis were not diagnostic. Although no further investigations using AAS were carried out for this thesis, future work may benefit from this technique, once the most suitable elements for the classification of glass samples and sourcing studies have been determined.

7.4.3 Electron Probe Microanalysis (EPMA)

EPMA is one of the few, general purpose, non-destructive techniques for major and minor element analysis. The instrument is easy to use and sample preparation is relatively simple. Unfortunately, lower limits of detection for many elements are insufficient for determining most trace elements. This is a standard procedure, relatively inexpensive and quick to perform. The sample, although mounted in resin, is not destroyed and can be used for further analysis if desired. The method consists of directing a beam of electrons, produced by an electron gun, on to a polished sample. The beam is sharply focused by the electromagnetic lenses through which it has to pass. The electron beam bombards the sample and produces fluorescent X-rays. Elements which are present in the sample are identified from the wavelength of the lines in the X-ray spectrum. For quantitative analysis the intensity of the X-ray lines from the specimen are compared with standards which have been set up in the machine, allowing concentrations to be estimated and recorded. The finely focused electron beam gives the technique the advantage of being able to analyse very small selected areas (10 - 30µm).

The technique has been applied to a variety of glasses and geological materials (Willis 1986:861).

A Camebax Microbeam electron microprobe, with 4 W.D.S. spectrometers was used for these analyses in the Department of Geochemistry, University of Cape Town, where elements with atomic numbers >9 occurring in concentrations of ~500ppm (.05 wt%) are routinely analysed.

The following instrument conditions were used:

Beam current:	37.5nA (average)	
Accelerating voltage:	15kV	
Beam size:	20 microns	
Analyzing crystals:	TLAP	Na, Mg, Si, Al
	LIF200	Fe, Mn, Ni, Zn, Cu, Co, Pb
	PET	Ca, K, Ti Cr, S

Each sample was analysed at least three times, at 15kV accelerating potential and a 37.5nA (average) incident beam current using a de-focused electron beam[3]. In the case of the elements Sodium (Na), Silicon (Si), Potassium (K), and Chlorine (Cl) the counting time was reduced from 10 seconds to 5 seconds, in an effort to minimise diffusion and vaporisation, and to cause the minimum loss of sodium during the analysis. These compromise parameters have been found to give the most consistent results.

Low oxide totals for some of the analyses (Table 8.2.2.1), can possibly be explained by the displacement of a small proportion of volatile ions under the electron beam, although highly localised compositional heterogeneity is a more likely explanation (Henderson 1988). Water dissolved in glass could also be significant.

Round-robin glass standards (Brill 1972:110) used for the major element determinations were supplied by Dr Robert Brill, Corning Museum of Glass. Results were corrected using a ZAF software programme.

---

[3]. The kinetic energy of the electron beam can give rise to local heating which causes the sodium and volatile elements to migrate away from the point of impact (Henderson 1988:788).

Table 7.4.3.1.
Abundance and identity of elements used in this study and ranges of analytes in the literature

ANALYTE	RANGES IN STANDARD (Corning Museum: Brill 1970: 93-110)	RANGES IN LITERATURE (Davison 1972)	RANGES IN THIS STUDY	NOTES
Na_2O	1.00 - 17.0	8.70 - 17.0	0.74 - 17.9	
K_2O	1.10 - 11.6	0.34 - 0.87	0.32 - 17.6	Major
SiO_2	35.0 - 66.0	65.0 - 72.0	34.7 - 68.1	elements in
Al_2O_3	1.00 - 5.00	1.5 - 6.00	0.12 - 2.78	beads and/or
Fe_2O_3	0.30 - 1.10	0.60 - 4.2	nd - 3.61	standards
MgO	1.10 - 4.10	0.17 - 3.6	nd - 2.05	
CaO	5.00 - 15.0	6.00 - 12.5	0.74 - 11.3	
P_2O_5	0.10 - 3.50 -		nd - 0.52	
PbO	0.05 - 37.0	nd - 1.70	nd - 59.8	
CuO	0.40 - 2.70	nd - 0.80	nd - 2.86	
BaO	0.10 - 12.1	nd -.0.10	nd	
TiO_2	0.10 - 0.80	nd - 0.24	nd - 0.29	
MnO	0.25 - 1.00	0.02 - 2.00	nd - 2.52	Significant
Sb_2O_3	0.45 - 1.80	nd - 1.16	nd - 7.63	minor
Sn	0.03 - 0.20	nd - 1.20	nd - 0.14	elements in
Cl	0.11 - 0.35	0.50 - 2.50	nd - 1.30	beads and/or
F			nd - 1.11	standards
SO_3	0.15 -.0.55	nd - 0.35		
Sr	0.02 - 0.25	nd - 0.03	-	Trace elements in
Sr	0.02 - 0.25	nd - 0.03	-	beads and/or
Co	0.02 - 0.16	nd - 0.17	-	standards (as found
Zn	0.04 - 0.20	nd - 0.07	-	in the literature)
V	.006 - 0.03	nd	-	were not determined
Ni	0.03 - 0.10	nd	-	in this preliminary
Zr	.005 - .025	nd - 0.05	-	study. May be
Cr	<.005 -	nd -		analyzed on a
As	nd <.03	-		routine basis if they
Ag	.003 - 0.01 -	-		are found in higher
Rb	.001 - 0.01	- -		concentrations.
Th	- <0.01 -			
Sm	- <.0009 -			
Sc	- <.0011	-		Au was not found
Ta	- <.0002	-		in sufficient
Yb	- <.0004	-		quantities in this
Au	nd			study. If present it
Bi	.001 - .005	- -		would have to be
				determined at 30 kV.
U	- <.03 -		No standards	
Hf	- <.004 -		and/or not	
B	0.02 - 0.20 -	-	possible to	
Li	.005 - .03 -	-	determine on EMP	

Table 7.4.3.2
Glass bead analyses counting statistics.

QUALITY OF DATA

	Effective detection limit wt%	Lower limit of detection LLD(ppm)	Relative analytical accuracy %
Si	0.07 wt%	5310 ppm	7.70%
NaO_2	0.03 wt%	2565 ppm	2.27%
K_2O	0.01 wt%	1195 ppm	1.57%
Cl	0.07 wt%	700 ppm	7.68%
Al_2O_3	0.03 wt%	1140 pmm	3.64%
FeO	0.25 wt%	2710 pmm	23.00%
MnO	0.20 wt%	1785 ppm	11.40%
MgO	0.10 wt%	1000 ppm	2.81%
CaO	0.10 wt%	1670 ppm	1.89%
P_2O_5	0.15 wt%	1130 ppm	33.00%
CuO	0.13 wt%	2210 ppm	13.30%
Sb_2O_3	0.11 wt%	1710 ppm	11.24%
PbO	0.40 wt%	8805 ppm	27.48%

2σ ERROR (95% CONFIDENCE LIMITS)

Relative 2σ error varies with concentration. In general:

wt% OXIDE	2σ ERROR
10 - 100%	<1%
1 - 10%	<10%
< 1%	<50%

N.B. Reported values for volatile elements (especially Na & K) are generally lower than true concentration. As a result, the values for non-volatile elements may be slightly higher than the true concentration.

7.4.4 Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS)

As the University of Cape Town is not equipped for this type of analysis, the measurements were carried out by the staff of the Anglo American Research Laboratories in Johannesburg. The analytical instrument used was a VG PlasmaQuad inductively coupled plasma mass spectrometer (LA-ICP-MS). It utilises laser ablation for sample injection, making it possible to analyse samples with minimal damage. The method is capable of producing multi-element analysis over a wide range, with very low limits of detection. It has great potential for analysing archaeological specimens (as well as other antiquities), and can be recommended above more destructive methods such as AAS, ICP-AES and instrumental neutron activation analysis (INAA). LA-ICP-MS has considerable advantages over AAS, as it provides analytical data for a greater range of elements simultaneously.

LA-ICP-MS uses a short pulse of focused laser energy to vaporise a small area on the surface of the sample, thereby releasing nanogram quantities of material. The generated vapour is swept by a stream of argon carrier gas into the plasma, where the material is atomised and ionised for mass spectrometric isotope analysis. The ions produced within the plasma are extracted by a sampler and passed through a quadropole mass spectrometer, where they are separated according to their charge to mass ratio. A detector measures the intensity of selected ion beams. This results in a simple mass spectrum with characteristic high sensitivity, low background, and availability of isotope information. Results are obtained rapidly.

Definition limits for the mono-isotopic REE elements such as La, Pr, Tb, Ho, Tm and Lu are of the order of 0.05 parts per million. For the remainder of the Lanthanide group, the detection limit is 0.1 parts per million. Overall precision is 10-15% at the 95% confidence level.

The VG laserlab is built around a 500 mJ Nd-YAG laser operating at a wavelength of 1064nm. The laser was used in the Q-switched mode. The operating conditions of the ICP mass spectrometer and the laserlab are given in Tables 7.4.3.

Table 7.4.4.1. Operating parameters of the ICP mass spectrometer and the laserlab

Icp-Mass Spectrometer	
Forward power/w	1350
Gas flow rates/dm^{3}min^1	
Cool gas	14
Auxiliary	0.5
Carrier	1.30-1.40
Laser output/V	1100
Power mJ/shot	6
Repetition rate HZ	10
Crater diameter/μm	±150

Laser vaporization is a new technique, used for direct solid sampling applications. The solid sample is placed within the sample cell located on a computer controlled, motorised X-Y-Z stage. Samples are viewed through a colour CCD camera with 100X image magnification.

LA-ICP-MS Standards preparation.

Calibration standards of known composition were not available for the spectral analysis of glass, so a synthetic calibration sample was prepared. The 'model base' was produced by fusing together the main components Si, Na, Ca, Mg, K and Al, using specpure oxides and a borate flux.

The following approximate composition was employed:

SiO_2 65%, Na_2O 9%, B_2O_3 6%, CaO 6%, Al_2O_3 4%, MgO 5%, K_2O 5%

The mixture was fused in a platinum/gold crucible using a high temperature flame. The elements influence the temperature dependency of glass viscosity to varying degrees. Three fusions were therefore done on each sample, with intermediate crushing and grinding of the resulting glass disc. This resulted in a homogeneous solid solution. The resultant model base powder was spiked with specpure rare earth oxides, titanium and zirconium oxides and taken through the fuse and grind stages. Four glass discs were produced at nil blank, 25 ppm, 50 ppm and 100 ppm and these were used as calibration standards.

Calibration

The mass spectrometer was calibrated by ablating each standard at three different spots. This procedure was repeated after every ten samples to compensate for instrument drift.

7.5 PREPARATION OF GLASS SAMPLES FOR ANALYSIS

Sampling glass specimens for accurate instrumental analysis is often a difficult and laborious task, involving trial and error. In many instances preservation of the material is of great concern, especially when dealing with loaned pieces from museums and other institutions. This was a prime consideration in selecting the analytical techniques described above.

Electron microprobe sample preparation.

Sample preparation for the electron microprobe involved small samples of glass, approximately 1mm in diameter, which were mounted in polyester resin and polished flat on a Buehler Ecomet V polisher, using successive grades of waterproof silicon carbide paper up to 1200 grit. The samples were finely finished on a Buehler Ecomet III polisher using 3 micron, ½ and ¼ micron diamond pastes. Glasses are poor conductors of electrons and therefore a conducting surface layer of vacuum evaporated carbon was applied to the samples. This coating prevents localised charging and minimises subsequent distortion and deflection of the electron beam.

AAS sample preparation.

(1) Each bead (weighing approximately 0.1g) was milled to a fine powder (the powder form is not absolutely necessary but it does speed up the dissolution of the material). Care must be taken to keep the powdering equipment clean to avoid contamination.

(2) The powder was weighed accurately (to within - 0.01g) into an acid-cleaned Teflon container.

(3) 1ml of deionised water (Milli Q grade) was added to the powder, plus 8ml of 40% hydrofluoric acid (HF) and 2ml of nitric acid (HNO_3). This solution was allowed to stand for 2 hours at room temperature. After 2 hours most of the powder is dissolved. 1ml of concentrated perchloric acid was added to the mixture and heated on a hot plate at 120^0C until just dry (Price 1985:230, Carter 1978:262-264). Precaution must be taken not to heat the mixture past *just dryness* as this causes charring of the residue and loss of the more volatile metals.

(4) The residue was dissolved in 10ml of 1% nitric acid and the solution analysed by flame AAS (Atomic Absorption Spectroscopy). If the trace element concentrations are too low in the beads the solution has to be adapted for AAS using a graphite furnace. (Perchloric acid for digesting the glass for flame spectroscopy must be avoided, as it can damage expensive graphite furnace tubes).

Obviously, this sample preparation destroys the bead.

LA-ICP-MS sample preparation

Sample preparation is almost minimal. Any solid sample can be analysed in virtually any shape, form or surface texture. Use of the laser makes it possible to analyse small beads with minimal damage: a small crater results which is a few microns deep and across, virtually impossible to detect with the unaided eye.

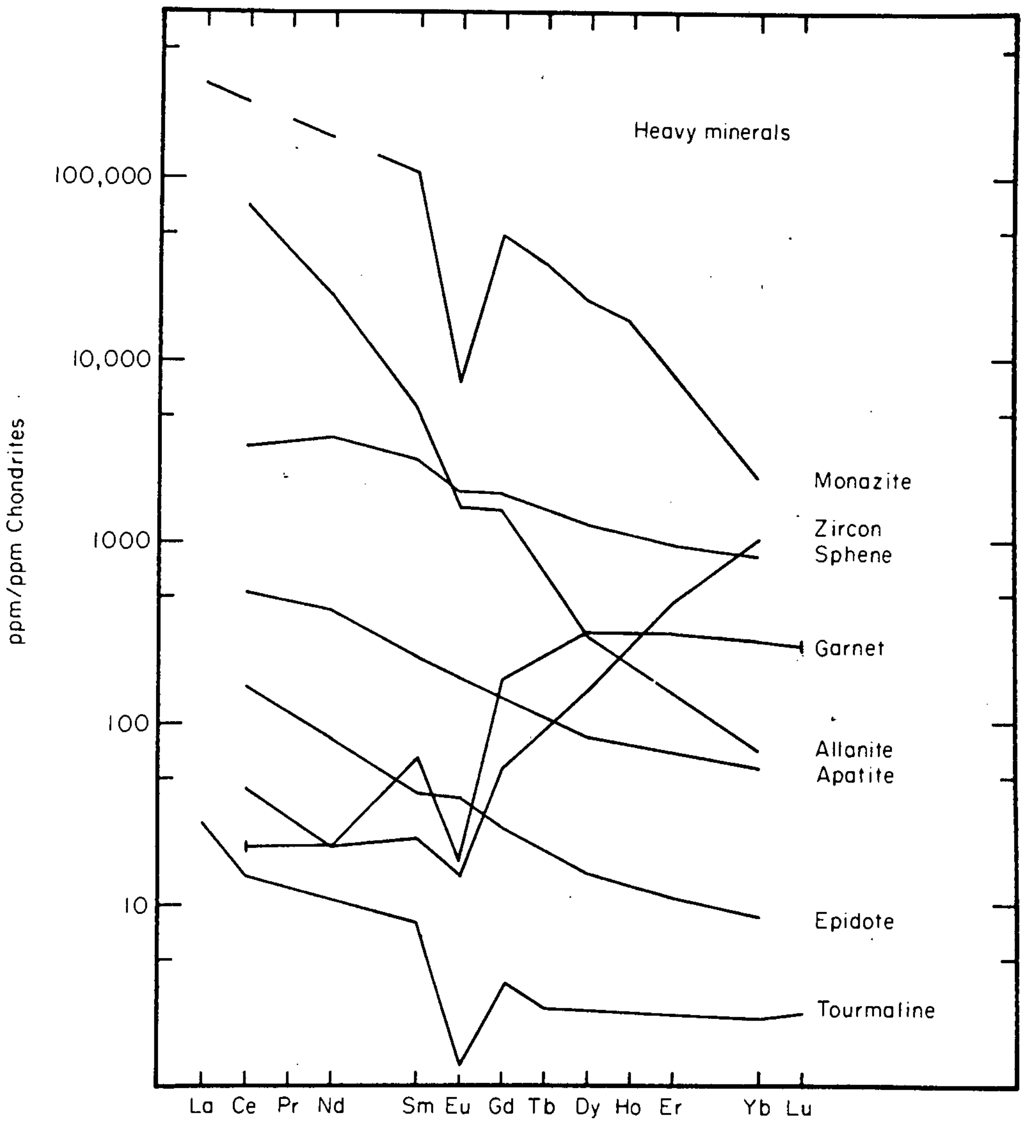
7.6 RARE EARTH ANALYSIS

The Rare Earth Elements are frequently divided into two groups: Light (LREE), La to Sm, and heavy (HREE), Gd to Lu.

The REE occur at only trace levels. They are elements which are dispersed amongst a number of common major rock-forming minerals in the earth's crust, rather than being concentrated in a select few. Consequently, they form few natural minerals, but may be concentrated in common trace minerals such as zircon, monazite, garnet and tourmaline. These minerals are resistant to alteration, e.g., by weathering, and are, therefore, relatively stable in surface geological processes. The stability of the REE gives them an advantage over other elements for chemical characterisation.

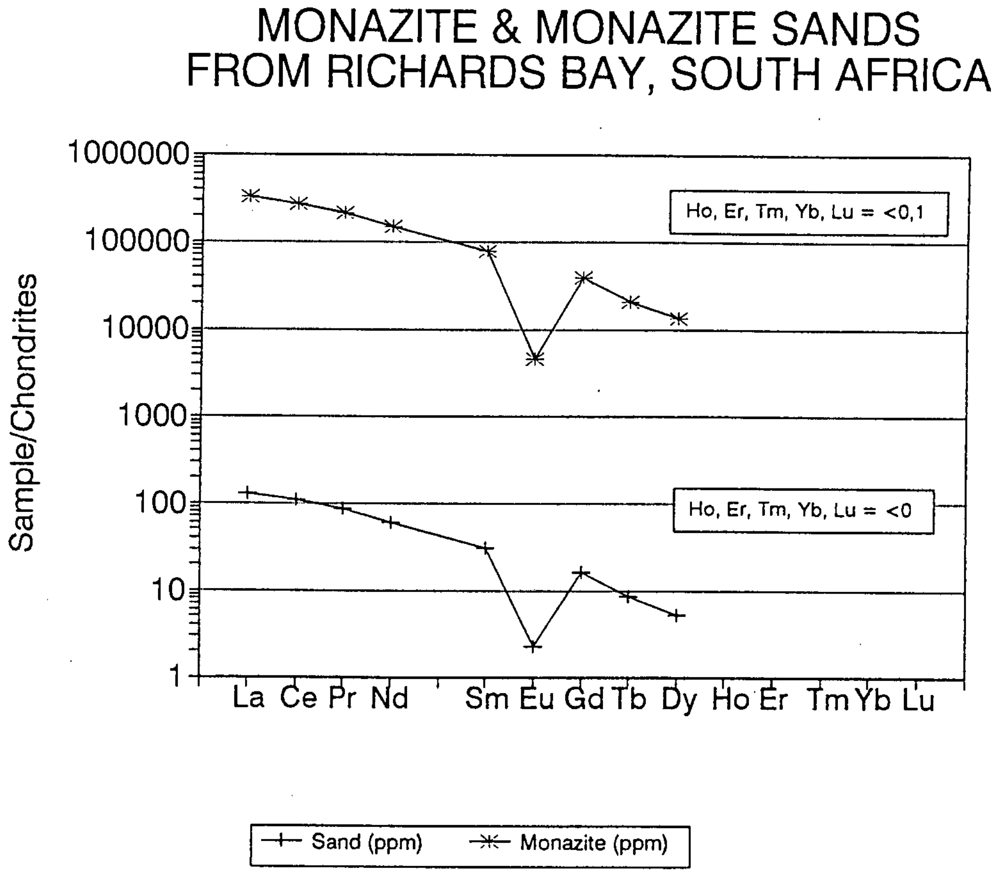
When normalised to some reference materials (such as chondritic meteorites) the REE show smooth abundance patterns. Individual REE-bearing minerals have very distinctive patterns and can be easily recognised and described systematically (Fig. 7.6.1.).

Fig. 7.6.1.
Examples of chondrite-normalised REE diagrams of common heavy minerals showing distinctive patterning (Taylor & McLennan 1985).



Since the raw materials of early glasses are made up of natural mainerals such as sand, flux, stabilisers, colourants etc. the REE patterns may provide an insight into the nature of these ingredients and provide a means by which different glasses can be 'fingerprinted'. REE were used in this study to investigate whether the REE signature could be carried through the glass making process into chemically distinctive types of glass beads. Geochemical confirmation may allow further characterisation of glass and provide definitive benchmarks for comparative studies.

Fig. 7.6.2.
Chondrite-normalised REE diagram of monazite and monazite sand (ppm)
(courtesy of Richards Bay Minerals).

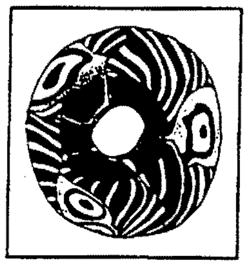


NOTE

Figure 7.6.2. is an example of how the REE-rich mineral, monazite, can exert a powerful influence on the REE pattern of its host. In this case monazite occurs as a detrital component in coastal dune sands at Richards Bay, Natal, South Africa. The REE pattern of pure monazite is clearly displayed in the sand despite several orders of dilution. This data (by courtesy of Richards Bay Minerals) was taken from sand sampled over an area of approximately 30km in Richards Bay (Houchin, pers.comm.).

Compare the similarity between the REE monazite pattern and that obtained from a peculiar blob of 'glass' recovered from the site of Takuapa in Thailand (chapter 8.3.1).

8



RESULTS & DISCUSSION

In this chapter, the results of various analytical procedures applied to the beads excavated from over thirty archaeological sites in southern Africa are reported. Eleven of the sites, such as K2, Mapungubwe, Schroda, Pont Drift and Skutwater were in the northern Transvaal. Ten were from Botswana. A representative sample of glass beads and 'wasters' from twelve potential source areas, including Egypt, Palestine, Syria, India, Ceylon, eastern and western Malaysia, Thailand, and Indonesia is also presented.

Where possible, the information has been summarised and presented diagrammatically or as tables. The results are presented in three sections: 1..Visual classification; 2. Chemical analysis; 3. Significance of REE profiles Discussion and evaluation follows each subdivision

8.1. VISUAL CLASSIFICATION

8.1.1 The Beads from southern African Iron Age Sites

Visual classification of the beads relied upon a number of criteria (outlined in Chapter 7), consisting of a series or levels of analysis which provide precise and repeatable taxonomy. Approximately 150,000 glass beads from over thirty archaeological sites in southern Africa were categorised according to these visual classification procedures. Two classes of *drawn* beads were noted, according to whether or not their ends have been rounded. The predominant bead type found in all the collections is that of monochrome, *drawn* beads of type IIa (Karklins, 1985). Except for the modern component, hardly any *wound* or decorated beads were found in the collections. This appears to be generally the case, although reference has been made to them in early publications on Mapungubwe (Fouché, 1937).

Figs. 8.1.1. to 8.1.4 represent tabulated summaries of the glass beads; Figs. 8.1.a. - 8.1.d. include illustrations of some of the different varieties of beads such as shell, bone and metal. Appendix I contains classification catalogues of all the artefacts from each site. Many of the beads from earlier excavations at K2 and Mapungubwe have no provenance and have been catalogued as 'no labels'.

Fig. 8.1.1.
Bead frequencies from Greefswald including Mapungubwe & K2.

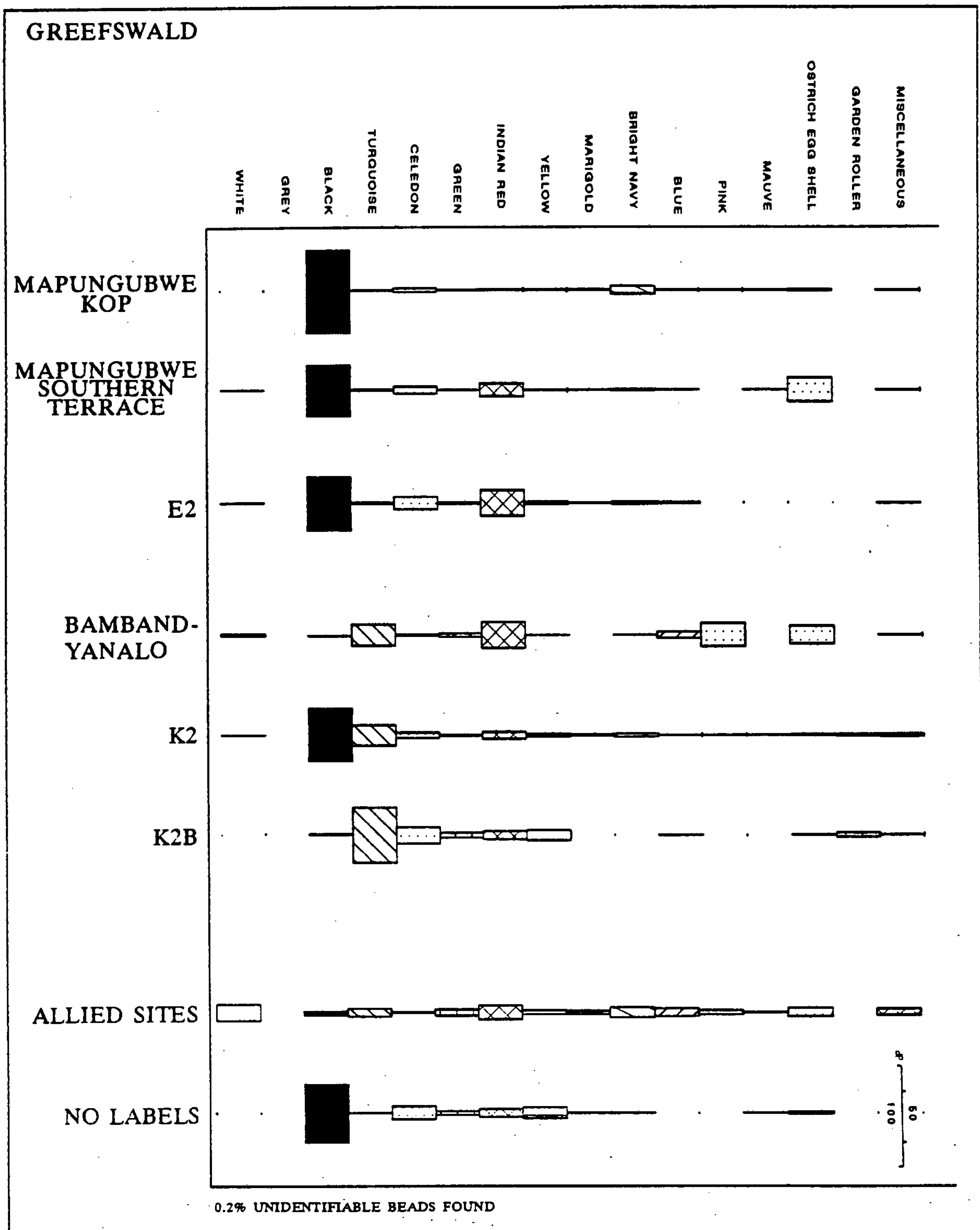


Fig. 8.1.2.
Bead frequencies from the northern Transvaal.

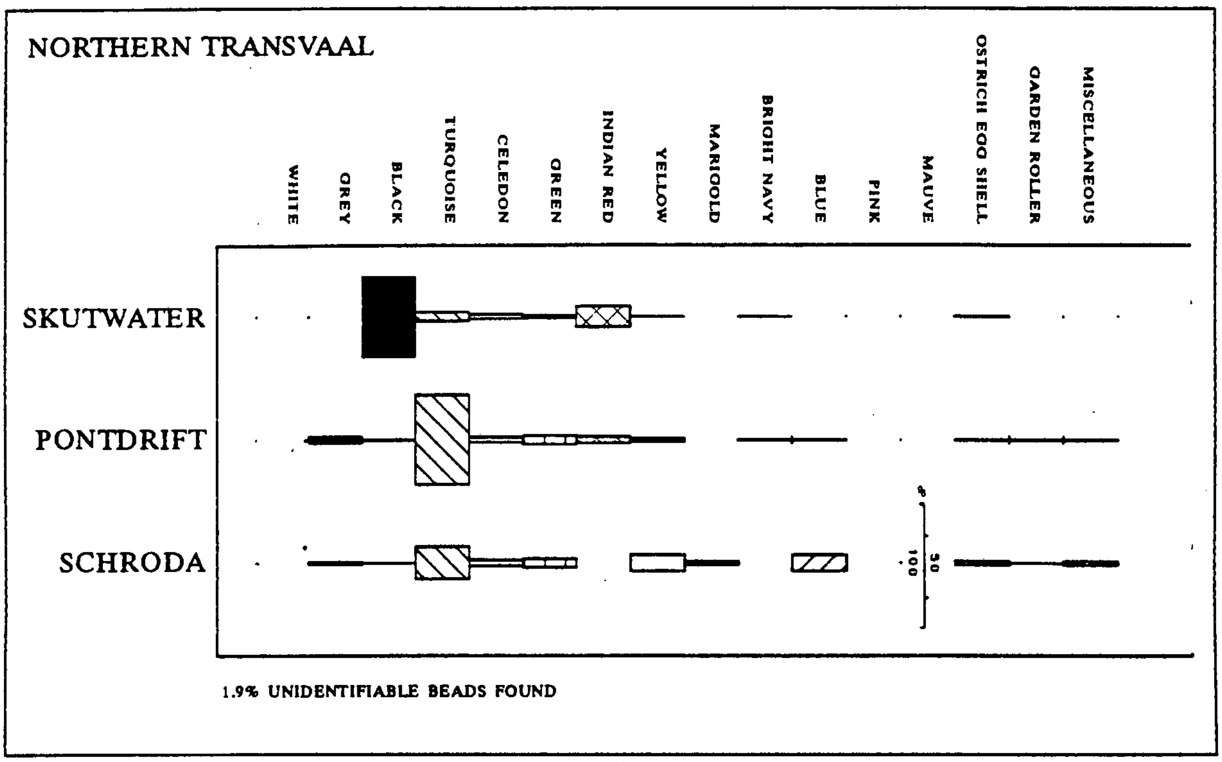


Fig. 8.1.3.
Bead frequencies from the eastern Transvaal.

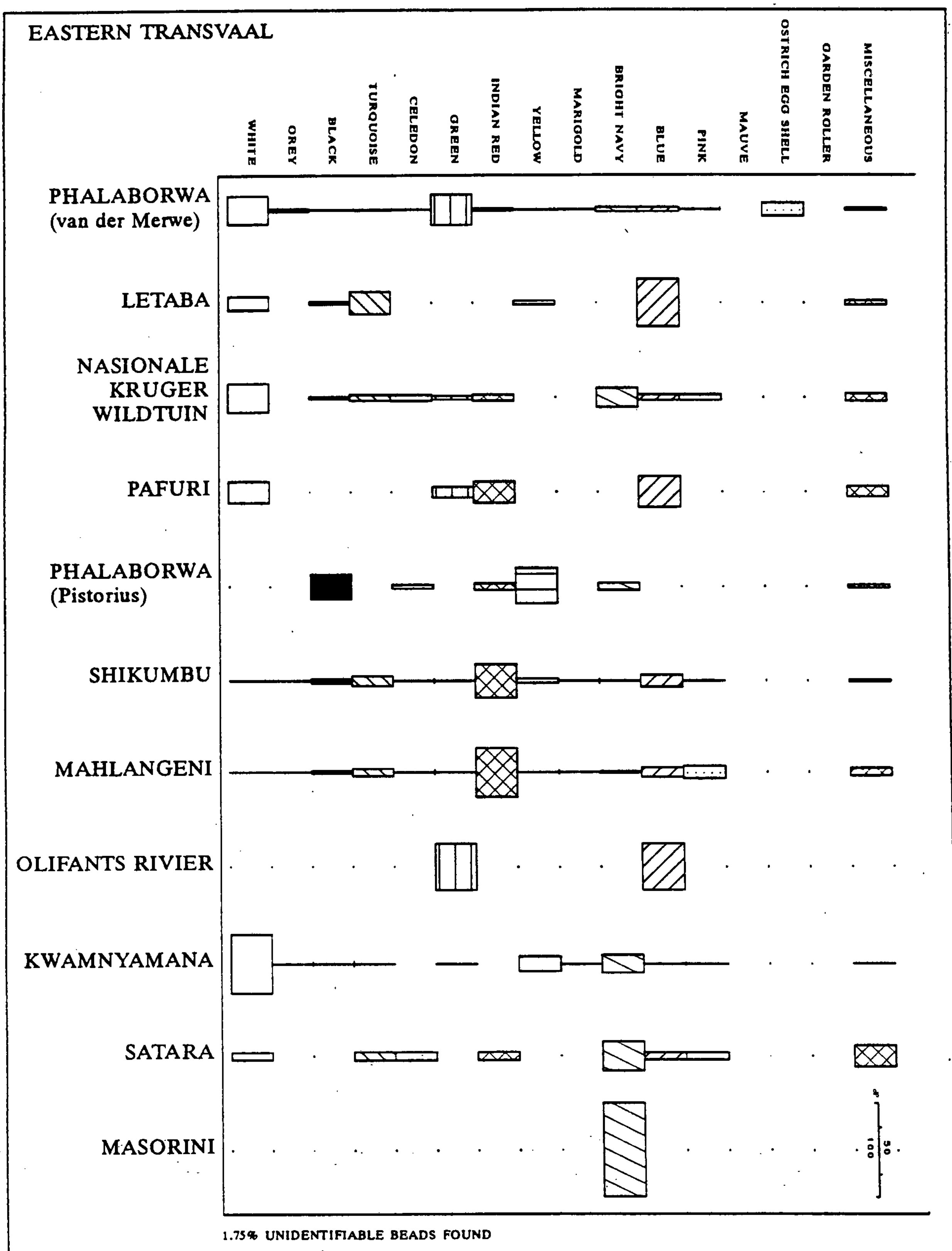


Fig. 8.1.4.
Bead frequencies from Botswana.

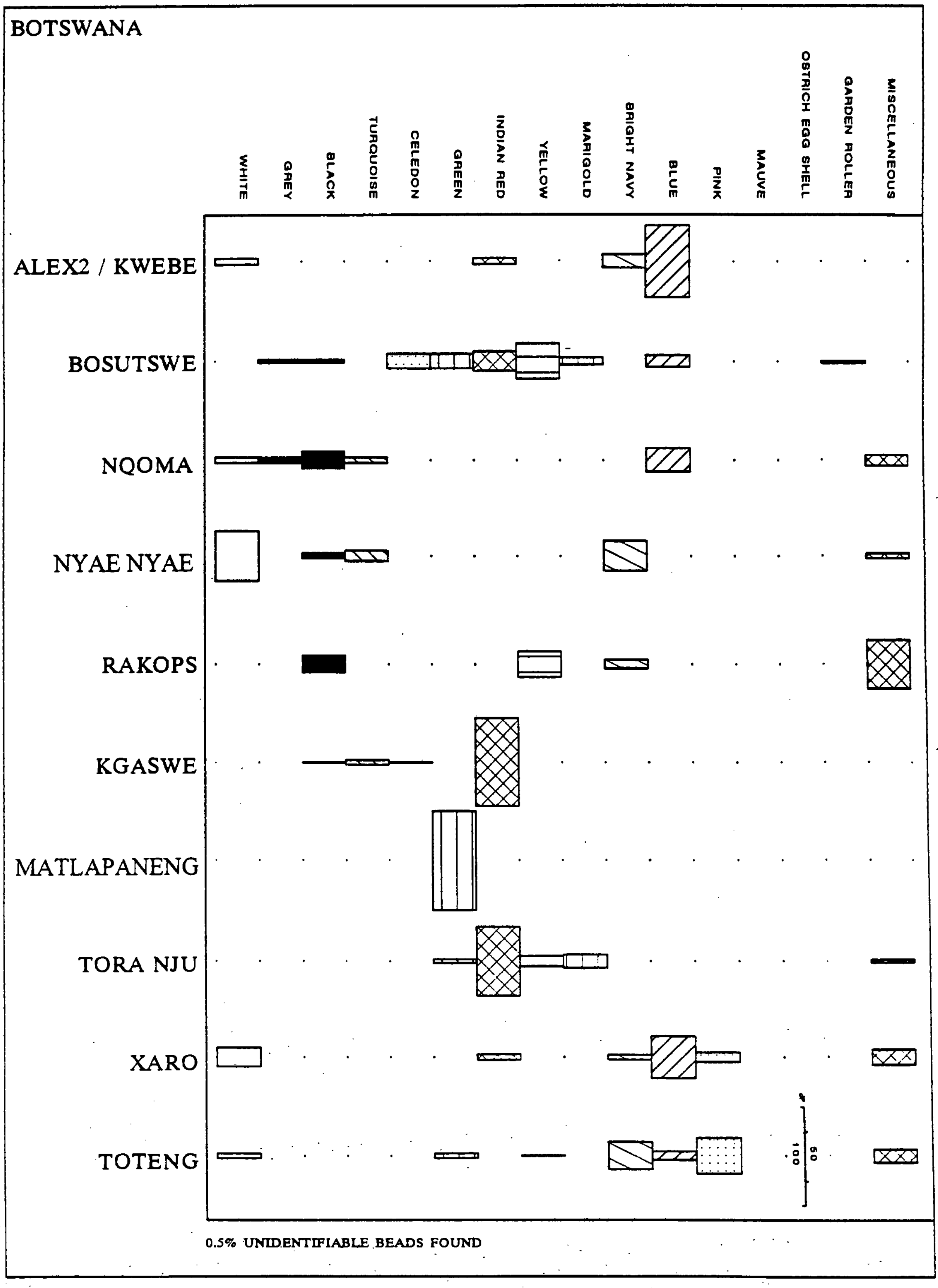


Fig. 8.1.a. Different bead varieties from K2.

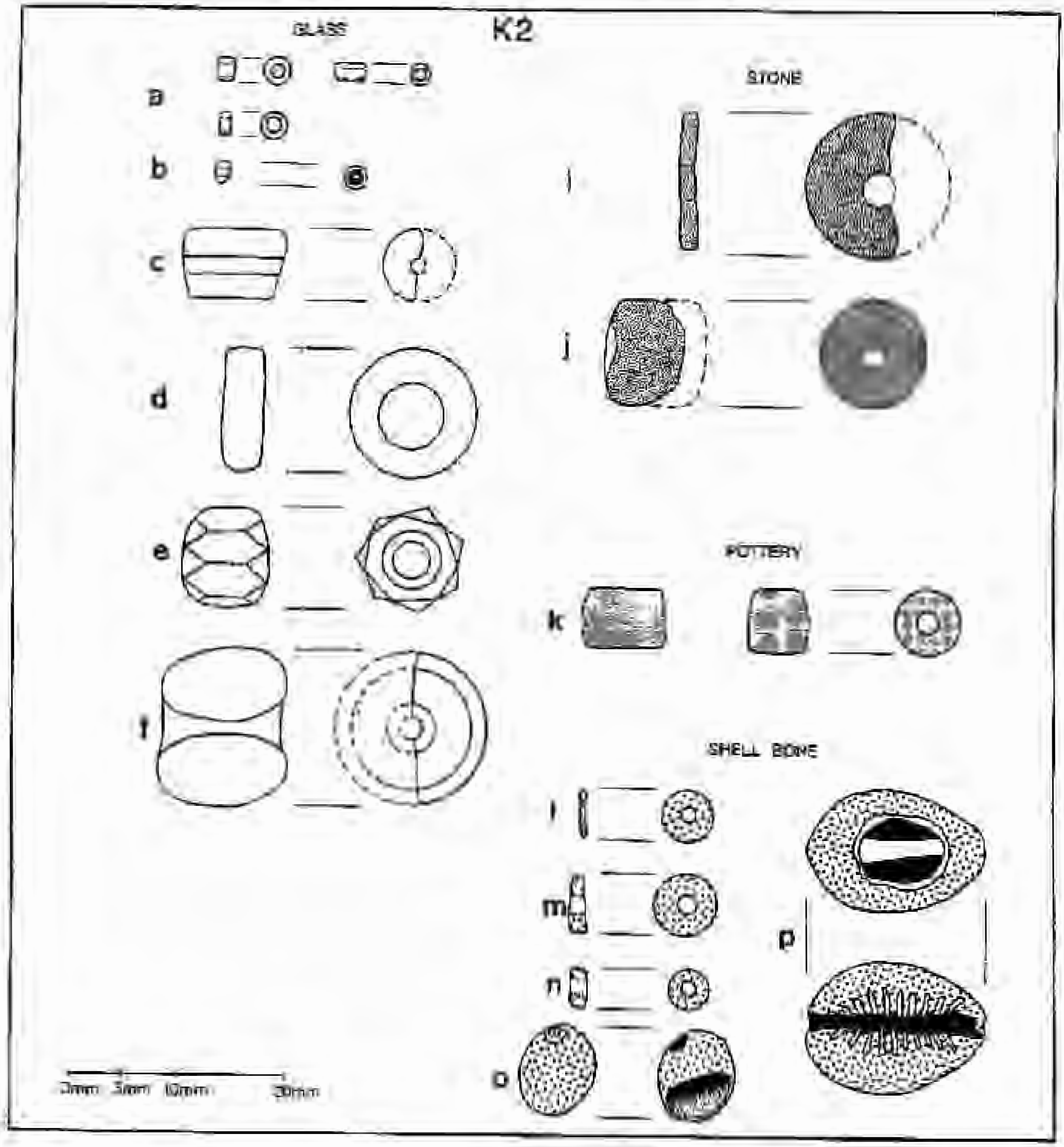


Fig. 8.1.b. Different bead varieties from Mapungubwe

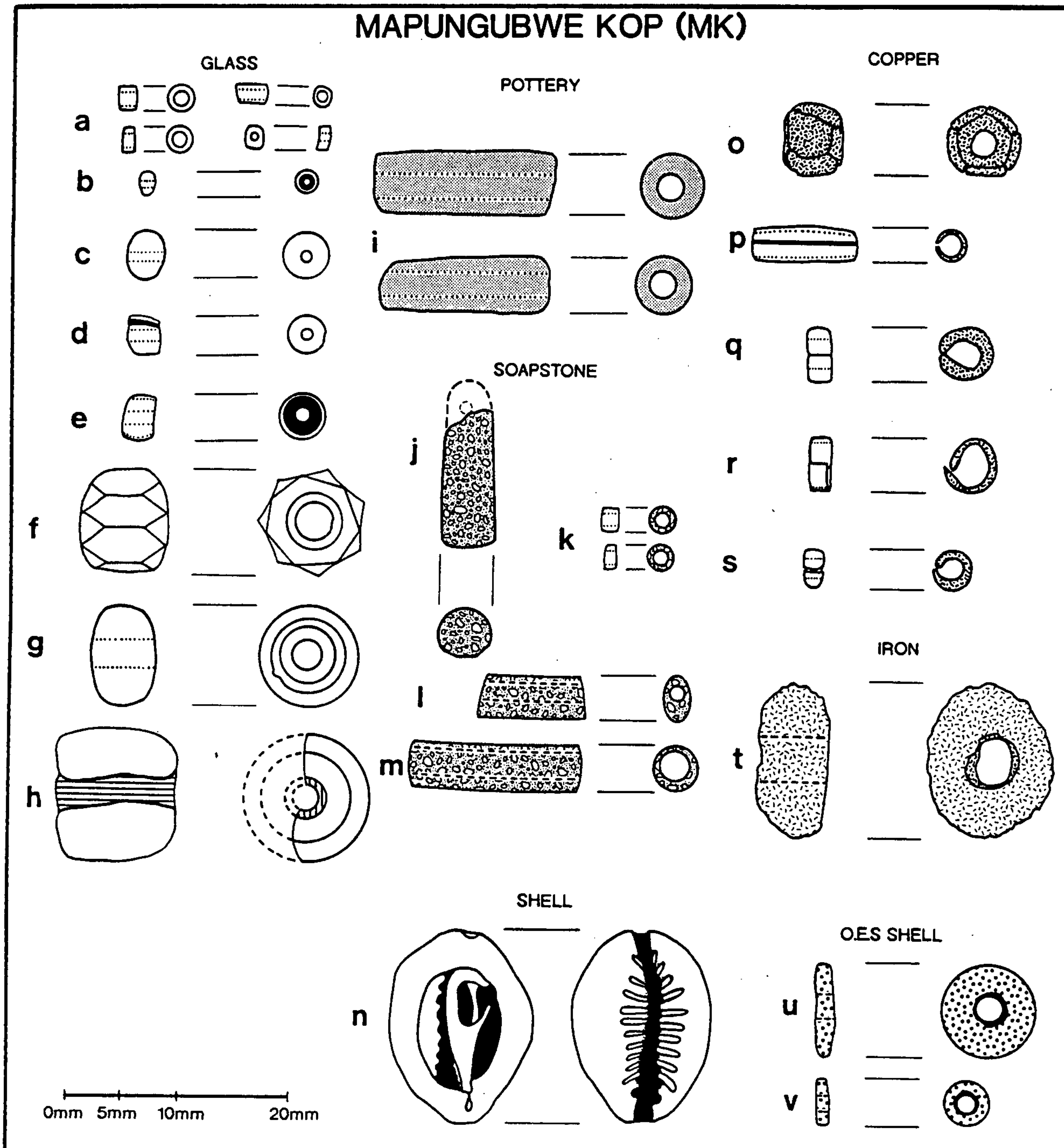
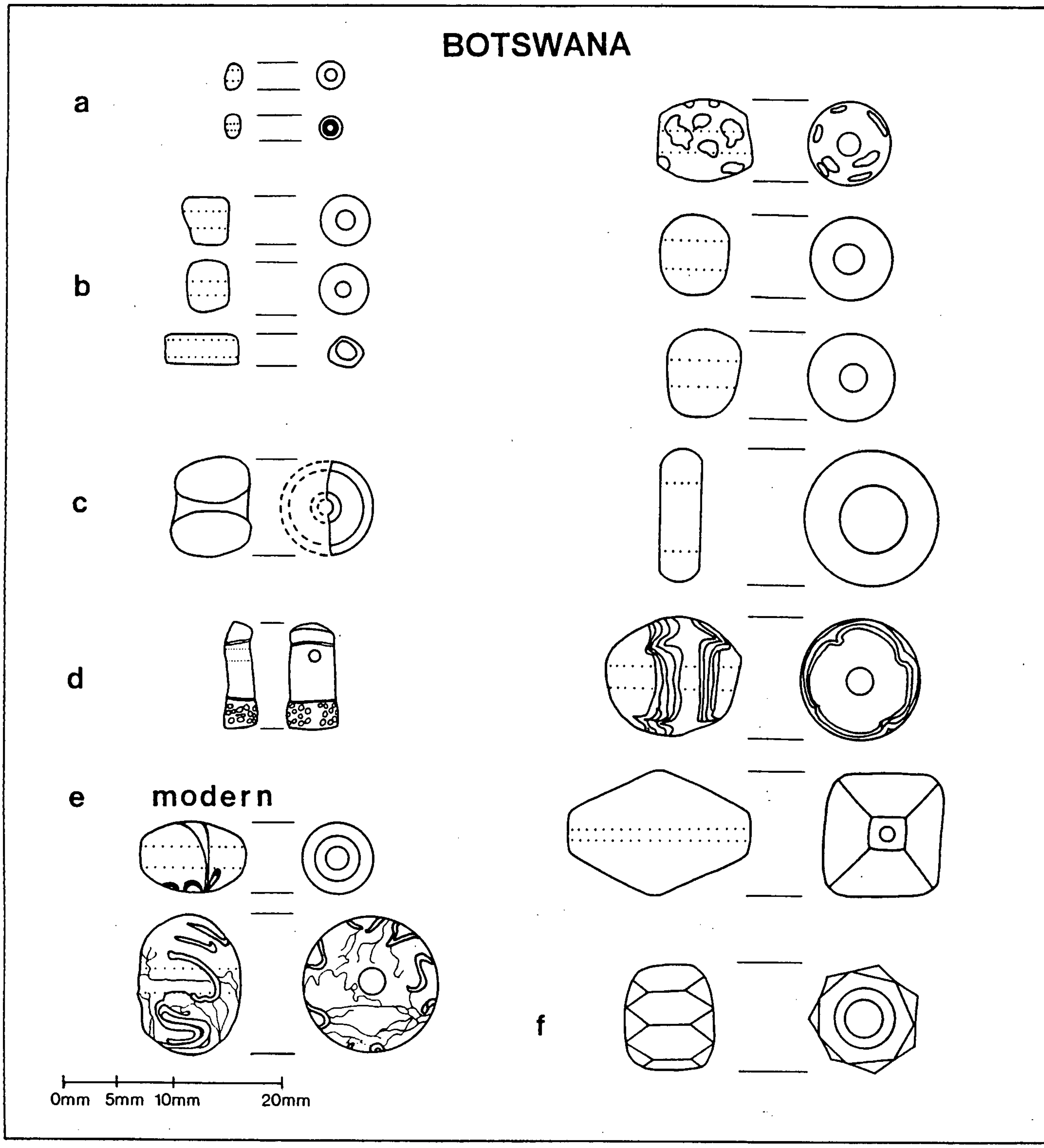
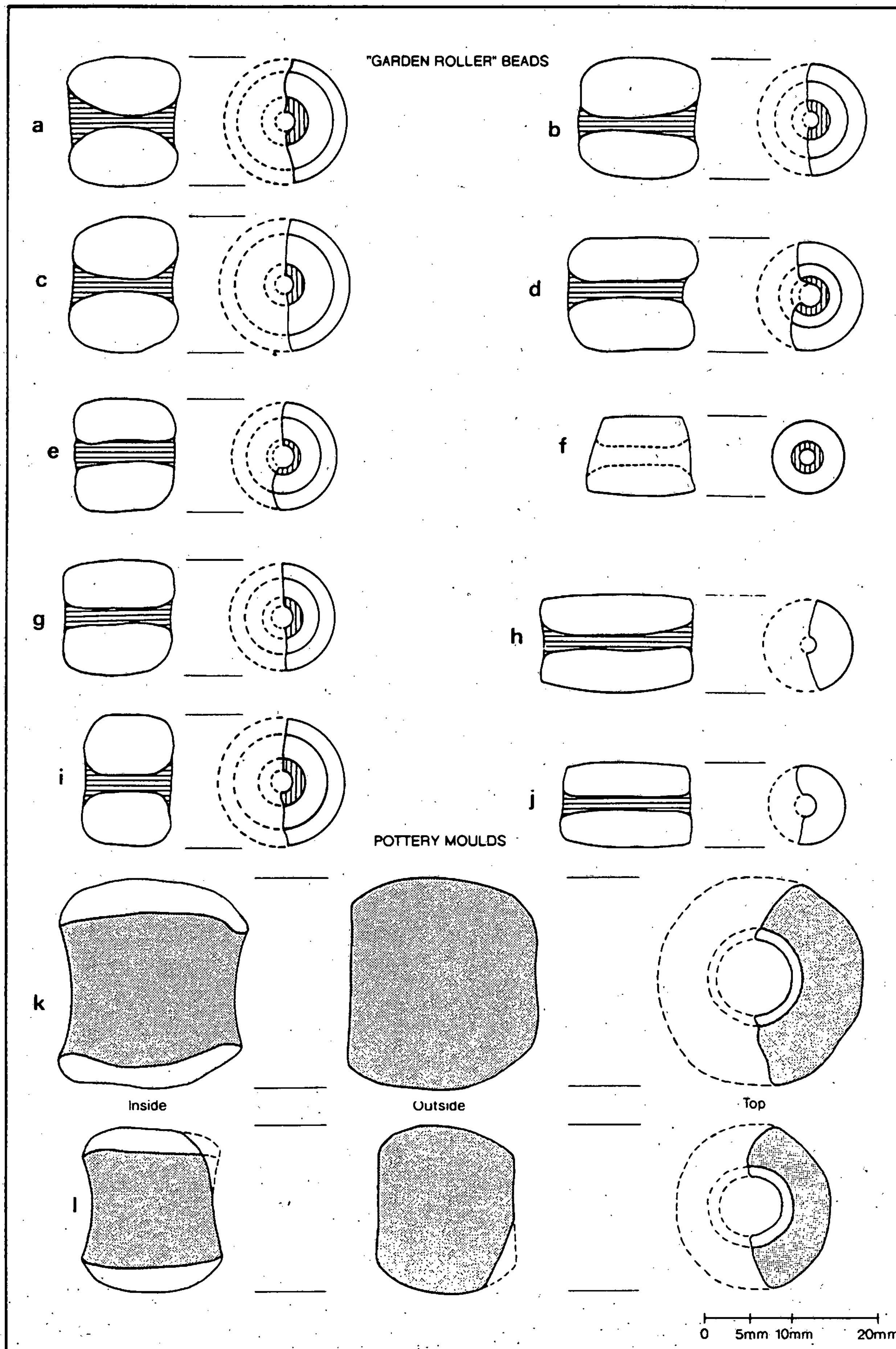


Fig. 8.1.c.
Different bead varieties from Botswana



a Glass *seed* beads. Types IIa & IVa (Karklins, 1985).
b 'Trade wind' beads. Type IIa (Karklins, 1985).
c *Garden Roller* bead.
d Soapstone pendant.
e Modern beads. Types WIb, WId, WIIIa, WIIIb & WIIq (Karklins, 1985). Probably made in Italy.
f Type If (hexagonal) (Karklins, 1985).

Fig. 8.1.d.
Variety of *Garden Roller* bead shapes and moulds.



8.1.2 Schroda Beads re-classified

A total number of 667 beads were recovered from Schroda. Of these, a substantial proportion (77%) were covered with a heavy patina deposit. In others, the glass had deteriorated throughout the bead. Compared to the Pont Drift collection, which contained only 2% that could not be distinguished, this proportion was very high. As a result it was possible to classify only 34% of the entire assemblage (Hanisch 1980). Using conservation methods recommended by UNESCO, outlined in the previous chapter, I was able to improve the condition of the glass and increase classification to 98%.

An important reason for improving the visual description of the Schroda collection is that Hanisch (1980:169) reported a fair proportion of the beads (7.2%) as white. This finding can be somewhat misleading, because white beads tend to be associated with a more modern period in southern African bead history - *ca.* AD 1600 onwards. It was, therefore, necessary to corroborate this information.

Subsequent re-evaluation of the beads in this study showed that the thick patina accumulated on the beads gave the wrong impression of a whitish/yellowish appearance. Once this deposit had been removed and the remaining glass stabilized, the colour underneath became discernable. This was especially true for translucent, dark shadow blue (Munsell 10B 4/4) and opaque, yellow (Munsell 5Y 8.5/10) glass beads.

Six hundred and twenty-six beads (n=626) were excavated at Pont Drift. In contrast to the beads found at Schroda, only 12 or 1.92% of those recovered from Pont Drift were heavily patinated, so it was possible to determine their colour. Since relatively few specimens were affected, no conservation procedures were carried out on the beads. Hanisch (1980:282) was of the opinion that the beads from Schroda and Pont Drift were basically the same. Eight similar colour varieties were identified at Pont Drift, with the exception that no white beads were specified. An interesting feature of colour selection is the complete absence of 'Indian' red colour beads from Schroda. At Pont Drift and other more or less contemporaneous sites, such as K2, 'Indian' red beads were very popular.

Comparative chemical analysis carried out on some of the beads from both collections shows a difference between the two. The most obvious difference is that the majority of the Schroda beads have a relatively higher calcium content (in excess of 6.18%) than those from Pont Drift. This concentration is far in excess of Hancock, Chafe & Kenyon's (1994:257-259) findings, which showed that glasses with less than 3% calcium were susceptible to leaching and disintegration. The evidence for most of the beads analysed from Pont Drift discloses less than 3% average calcium content, and yet relatively few of them deteriorated. In this instance, the results do not support the theory proposed by Hancock *et al* (*op. cit*). Alternative suggestions are discussed below in section 8.2.5.

8.1.3 Comparative Source and Site Material

All the imported glass beads from southern Africa sites were compared to representative samples of material from a variety of potential beadmaking areas in Egypt, the Near East and Southeast Asia. Specimens from thirteen possible beadmaking locations were used, including Tel el-Amarna and Fustat in Egypt; Khirbet el-Minyeh in Palestine and Ba'albakk in Syria; Arikamedu & Purdalpur in India; Ceylon; Gunang Wingo and Kambang Unglen in Indonesia; Gedong, Bukit Sandong and Bongkissam in eastern Malaysia; Kuala Selinsing and Sungai Mas in western Malaysia; and Klong Thom and Takuapa in Thailand.

Other than the decorated, visually distinctive beads, such as the *Fustat Fused Rod Bead* (FFRB)[1] and mosaic[2] beads (Fig. 8.1.3.1.), most of the source material consisted of *seed* beads, made from a range of opaque, translucent and transparent glass types and 'wasters' from Arikamedu. Except for the wasters, which contained a great deal of inclusions, the quality of the different glasses was relatively homogeneous, free of impurities and large air bubbles. The material from Palestine consisted of three glass bracelets, excavated at an Islamic burial from Khirbet el-Minyeh (AD 850).

In many instances, the *seed* beads from the overseas sites *look* very similar to the ones from southern Africa. A particular example is illustrated in Fig. 8.1.3.1.m. This bead from Sumatra, is almost identical visually (and chemically) to a *seed* bead excavated from a skeleton at Mapungubwe .

Over 300 unusual beads were excavated at Shikumbu and Mahlangeni. They are described as beads with *unusual triangular cross sections* (Fig. 8.1.3.1.q). Initially, they were thought to have been made of soapstone. They were chosen for chemical analysis because (1) there was no way of telling what material they were made from and (2) there were so many of them.

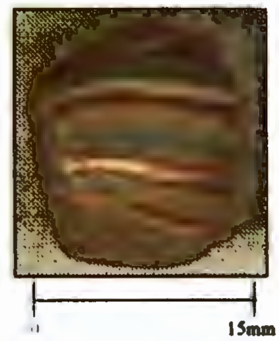
Colour photocopy reproductions, taken originally from colour photographs, illustrate some of the beads used in this study (Fig. 8.1.3.1 a-q).

[1]. Two of the three FFRB beads used for analysis, were purchased from M. H. Mansoor in Cairo. The third bead was excavated from Fustat by George Scanlon.

[2]. These types of beads have both been well documented (Sherr Dubin 1987; Beck 1930:163-182; Lamb 1966:80-94).

Fig.8.1.3.1.a-q. Comparative source and site material.

a. *Fustat Fused Rod Bead* (FFRB). Fustat, Egypt. Yellow, white & black 'eyes'. Opaque. Van Riet Lowe Collection.

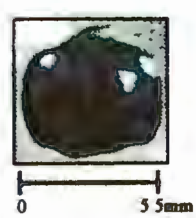


b. FFRB. Fustat, Egypt. 'Indian' red, green, white. Opaque. Van Riet Lowe Collection.

c. FFRB. Fustat. 'Indian' red, yellow, green (opaque), clear (TP). George Scanlon, Cairo (#21a-c).

d. Early Islamic bead. Opaque *wound* black with yellow dragged 'trials'. Van Riet Lowe Collection.

e. Fustat. Olive green (TL), & opaque 'Indian' red 'trailed' decoration. T'alhakimt, Van Riet Lowe Collection.



f. Fustat. *Segmented* beads. Transparent turquoise. Van Riet Lowe Collection.

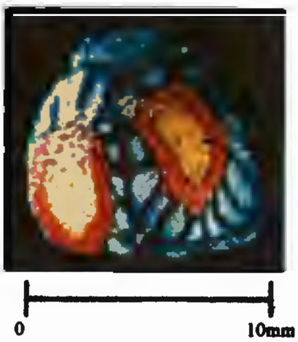
g. Fustat. *Wound* coil bead. Transparent turquoise. Van Riet Lowe Collection.

Fig. 8.1.3.1.a-q. Comparative source and site material (continued).

h. Palestine. Hebron bead. *Wound.*
Opaque dirty yellow.
Van Riet Lowe Collection. (#58).

i. Palestine. Hebron bead. *Wound.*
Opaque green.
Van Riet Lowe Collection. (#59).

j. Southeast Asia. Sungai Mas.
Translucent, dull royal blue with
opaque white mosaic decoration.
P. Francis Jr. (#75a).



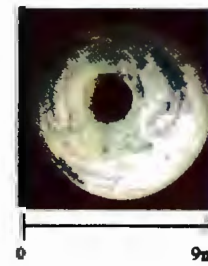
k. Southeast Asia. Sungai Mas. Mosaic
with translucent blue canes (broken).
P. Francis Jr. (#74-75).

l. Southeast Asia. Sungai Mas.
Mosaic with translucent green &
yellow canes (broken).
P. Francis Jr.

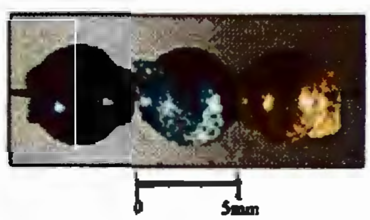
m. Southeast Asia. Sumatra. Kambang
Unglen. 'Indian' red & olive.
Drawn, Translucent. (#51).

Fig. 8.1.3.1.a-q. Comparative source and site material (continued).

n. South Africa. Mapungubwe. M.5.1. 11'20'5'. Opaque, *wound* green. Gardner & Van Tonder (1939). University of Pretoria. (#95).



o. Makahane, South Africa. Opaque, green wound. M. Küsel. National Cultural History & Open-air Museum. (#103).



p. Shirbeek. South Africa. Segmented beads. Transparent, yellow & turquoise. University of Pretoria. (#152).

q. Shikumbu & Mahlangeni. South Africa Translucent, dark brown. University of Pretoria. (#80a).

NOTES

a-c. *Fustat Fused Rod Beads* (*type* beads *ca.*AD 900-1000).

e. Bead reminiscent of *t'alhakimt* and *tanaghilt* ornaments (Liu 1977:21). This particular bead was identified by the Director of the Museum of Arab Art, Cairo (1937) as 'Byzantine from Foustât'[sic].

h-i. Beads thought to have been made at Hebron *ca.* 18th century AD (van Riet Lowe Collection; Francis Jr.(1990:23-26)

g. According to Francis Jr. (1995) *wound* coil beads found in the Awad Collection from Fustat were made in China. This type of bead was also amongst the Fustat beads in the van Riet Lowe Collection. Similar looking beads were excavated by Caton-Thompson at Great Zimbabwe (1931).

k-l. Sherr Dubin (1987:348) is of the opinion that even though millifiore beads found in Southeast Asia resemble those of the Roman era, they differ considerably from actual Roman examples. She also suggested that the cane layers used to make this type of bead in Indonesia, were cut locally from preformed glass ingots made in the Roman Empire.

m. An almost identical bead, both visually and chemically was found on a Mapungubwe skeleton sample #97 (Tables 8.2.2. & 8.2.3.).

n-o. *Furnace wound* beads. Similar types have also been found at Great Zimbabwe.

p-q. According to Francis Jr. (1995:10), segmented beads and beads with unusual cross sections were also manufactured in Fustat.

Soapstone bead from Mapungubwe

Four soapstone beads and one soapstone pendant were excavated from different locations at Mapungubwe. The pendant is undecorated, and fashioned in a solid cylinder or rod shape. Unfortunately, the hole for suspension has been broken off. None of these artefacts have been reported previously. Their discovery warranted further investigation, because they are unique. Inquiry focussed mainly on the material that was used to make them and also on the method of manufacture[3]. Soapstone is a relatively soft and friable material (Talc is 1 on Moh's scale, serpentine is 3), so that fabricating very small beads, such as those found at Mapungubwe, to such perfection, is difficult to understand.

All the artefacts were first cleaned, measured and coded using a Munsell colour chart 8.1.1.(A). - (E). Three of these have been reproduced from colour photographs and are illustrated in Fig. 6.2.1. d.- g.

Two of the soapstone beads are cylinder shaped with worked ends. The the other two are very small oblate shaped beads of various proportions. The aperture diameters, drilled completely through all the bead, range in size from between 1.03mm to 2.05mm.

8.1.1.(A). Oblate bead
Site: Mapungubwe Hill
Excavators: Gardner & Schofield (1934)
Skeleton: Skeleton exposed but not removed

Measurements:	D: 2.56mm
	L: 1.05mm
Aperture:	D: 1.03mm
Colour:	Light olive green (Munsell 10Y 3/4)

8.1.1.(B). Pendant (broken)
Site: Mapungubwe Hill
Excavator: A. Meyer (1993)
Surface finds:

Measurements:	D: 5.10mm
	L: 12.11mm
Aperture:	(broken)
Colour:	Dark olive green (Munsell 10Y 2/2)

8.1.1.(C). Cylinder bead
Site: MST
Excavators: Coertzer & Sentiker (1954)
Block: C2R -6"/-12" String nr 76/54

Measurements:	D: 2.06mm
	L:16.01mm
Aperture:	D: 1.06mm
Colour:	Light olive green (Munsell 10Y 3/4)

8.1.1.(D). Oblate bead
Site: MST E2: OV1
Excavator: Eloff (1968-1970)
Block: B8(d) DET. (Spit):-34"/-42"

Measurements:	D: 4.06mm
	L: 1.04mm
Aperture:	D: 2.04mm
Colour:	Dark olive green (Munsell 10Y 2/2)

8.1.1.(E). Oblate bead
Site: E2
Excavator: Eloff (1968-1970)
Block: B70/10

Measurements:	L:10.06mm
	D: 4.07mm
Aperture	D: 2.05mm
Colour:	Yellow olive green (Munsell 10Y 2/2)

3.. The possible factory site sources in the western Transvaal have already been discussed in chapter 6.

Fig. 8.1.3.1.(A). Micrograph of soapstone bead sample showing the top view with small grooves. Measurements D:2.56mm L:1.03mm.

8.1.4 Discussion of Visual Classification

Scanning electron microscopy (SEM) was used to examine one of the oblate soapstone beads (Figure 8.1.3.1.(A). The illustration shows he top view of the bead, accentuating a groove on the edge of the bead which could have been the result of suspending it from a piece of cord. Investigation of other areas illustrate striations or cut markings on the inside. These do not show any specific direction or orientation. The outside surface of the bead was smooth and well polished. The beads were probably made with a thin metal saw, or thin hard plate with a serrated edge (Harger 1941:137). The R.I. of this bead is 1.5833 ± 0.0026).

As there is no prior evidence at Mapungubwe or K2 of indigenous manufacture in the form of chippings or other factory waste, and no known recorded soapstone deposits in the area, it is possible that these finds were trade goods emanating from the eastern Transvaal (Evers, 1979; Harger 1941). They are rare examples of soapstone artefacts retrieved from any Iron Age sites in the Limpopo Basin, and outstanding examples of the dexterity involved in their production.

The dominant type of glass beads described and classified in this thesis, both whole beads and fragments, were made by the *drawn*, type IIa method (Karklins 1985). They are small, monochrome, oblate shape beads, made in a relatively limited range of colour. They have been referred to as *seed* beads throughout this work. The average size of most of the beads varies from between 2.0mm-2.5mm.

Seed beads, made by the *drawn* technique, are associated with mass production rather than individual working. Some of the beads are of the same colour but made in different shades. This is a particular characteristic amongst the blue green varieties. It can probably be attributed to slight differences in batch ingredients. The colours include opaque black or plum-colour, bright navy blue, light [shadow] blue, 'Indian' red, yellow, light and dark yellow ochre [marigold][4], green, and turquoise. A total of 29 hues have been annotated, although for presentation purposes this number has been condensed (Figs. 8.1.1. to 8.1.4).

Many of the beads from various sites, sometimes hundreds of kilometres apart, are so similar that it is almost impossible to distinguish between them. In southern Africa, this was presumably due to the restricted number of types available in the trade before European contact. Acceptance of these varieties probably set the pattern of consumer demand which has lasted for centuries, thus illustrating the conservative and discerning nature of the customers.

The beads are not uniform in shape and size. However, one particular kind of *seed* bead is quite distinctive. It is found in translucent, yellow, light and dark marigold (Munsell 2.5Y 6/10 - 7.5YR 6/10), light sage green (Munsell 5GY 5/6), turquoise, black and dark mauve colours. They have characteristically small aperture diameters, and are uniformly spherical rather than oblate shaped. They occur in are small sizes (±2mm) and larger ones (±3mm). Microscopic examination of a polished section showed the glass to be clear and homogeneous, and almost free of impurities and air bubbles. These beads were only found at Mapungubwe, particularly on skeletons, including MK 1 (original gold skeleton), MK 14 and MK 19.

The small, glass, monochrome, *seed* beads found at southern African sites, are also ubiquitous at archaeological sites throughout the Indian Ocean Rim, such as India, Sri Lanka, Malaysia, Indonesia, Thailand, Philippines and Vietnam. These were used for chemical analysis in this thesis. Francis (1990:1), has termed them *Indo-Pacific* beads and describes them as

> *...(s)mall, usually under 6mm in diameter. They are undecorated and come in a limited range of colours: various hues of opaque red, orange, green, yellow and 'black', translucent blue and green and less often translucent violet, amber, and clear and opaque white.*

No bright orange (Munsell 3.75YR 6/14 - typically found in Southeast Asia) or white colour beads occur in southern African between AD 900 - AD 1250. Translucent oyster white (Munsell 5GY 9/1) first appear after *ca.* AD 1600, and opaque white (Munsell

---

[4]. This colour has replaced the orange colour which has been used in previous publications. which should not be confused with the bright orange bead (Munsell 3.75YR 6/14) characteristic in the Southeast Asian trade.

N9.5/90.0/R) appear much later *ca.* 1800s (Saitowitz, 1990). To date, none of the orange beads have been identified even in more modern collections. Four (n=4) beads identified as clear crystal (Munsell N8.25/63.65R) were selected for chemical analysis.

One of these was initially misidentified. Visually the bead was classified as an imported, clear crystal, *wound* glass bead. However, chemical analysis (Tables. 8.2.3.1. #93) showed that it contained 63% calcium. Other than chemical analysis there was no way of establishing this information. There is no reason to believe that this bead was imported as other examples of local stone bead technologies have been found. Gardner (1963:34) for example, reported on what he considered to be an indigenous rock crystal bead that was found with incomplete drilling at each end of the sphere. The soapstone bead industry, already referred to, would also be included in this category.

Very few decorated *wound* beads occur at any of the Iron Age sites mentioned so far, except those from later colonist-contact occupation. This is regrettable as they offer wide scope for investigation.

Only one striped bead was identified from the entire Greefswald collection (MAP 40: APPENDIX I). It has a black background with an 'Indian' red stripe. Other striped beads (Table. 8.2.3.1.- sample #198) were found at Shikumbu in the eastern Transvaal.

The European component of the collection from Botswana varies from elaborate Venetian wound beads to hexagonal (cornerless cube) facetted drawn beads (Fig. 8.1.c.). The distribution of these is attributed to Reverend Campbell (Wilmsen, pers. comm.) who took large quantities of glass trade beads with him on his missions throughout Botswana and the eastern Cape (Campbell 1822: 228-274).

Generally, the beads recovered from sites in Botswana represent four classes of beads from different chronological sequences. These are described as 'Early Iron Age', 'Later Iron Age', 'trade wind' and European beads. Interestingly, the beads from the lower levels of Bosutswe (70-100cms) differ significantly to those found in upper levels, in that they resemble 'Early' Iron Age beads such as those from the Waterberg dated AD 750, while the rest of the beads from the upper levels resemble what are known as the 'trade wind' beads.

The Mapungubwe sample is characterized by a high proportion of black beads, contrasting with assemblages from K2, where turquoise is the prevalent colour. It is not clear whether this marked absence of black was due to change in supply or whether it was a local phenomenon based on consumer demand.

The glass beads from these sites represent a narrow range of types compared to the range of beads that was probably available on world-wide markets at the time. The dominant bead-type excavated from all the Iron Age sites is monochrome, type IIa *seed* bead. Types IIb and IVa are the next most frequent. Most of the others (including If, WIb and WII) account for less than 1% of the beads in each sample. Bead types IVa, If & decorated *wound* beads such as WIIIa and WIIIb (Karklins 1985) are considered to be much more modern. 'Indian' red or Redwood on green core beads were recovered from most of the sites but very few from Mapungubwe Hill and none from Schroda.

The beads described here are distinguished from those referred to as 'trade wind' (van der Sleen 1967 & Davison 1972), which I consider to be from a later sequence introduced by the Portuguese. The 'trade wind' colours are very drab and the beads are very misshapen and usually larger than the ones found at these sites.

The other bead varieties found at K2 and Mapungubwe are similar except that no *Garden Roller* beads were found at Mapungubwe.

The two visually distinct bead types believed to be *Early* Islamic glass, and identified by Francis (1995:7-10) as having been made in Fustat, were excavated at southern African sites. Three segmented beads were found at Shirbeek, and over 300 unusual cross section beads (triangular) were found at Shikumbu (Fig. 8.1.3.1.q.). The major and minor elemental composition of the beads from Shikumbu and Mahlanegni are almost identical. The REE trace-elements are comparable to beads made at Fustat (Table 8.2.2.1).

....

8.2 CHEMICAL ANALYSIS

8.2.1 Scanning Electron Microscopy (SEM) of *Garden Roller* and soapstone beads

Scanning electron microscopy was used to examine the reddish (Munsell 2.5YR 3/8)/black deposit found on the inside of *Garden Roller* beads and also on one of the small soapstone bead excavated from Mapungubwe. Semi-quantative abundances within the *Garden Roller* were obtained with SEM (Table 8.2.1.1.) (Miller, pers. comm.).

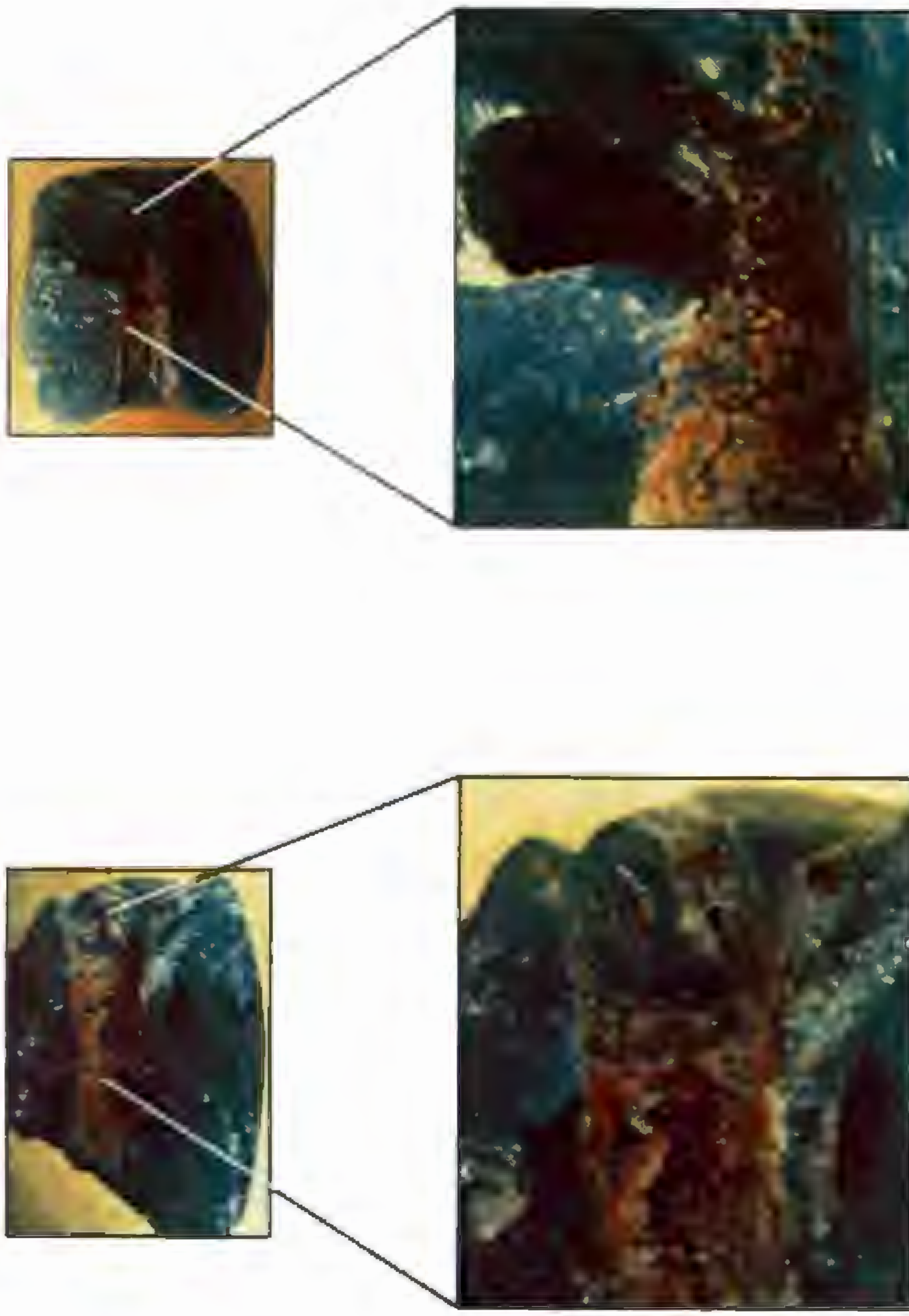
***Garden Roller* bead from K2**

The majority of the *Garden Roller* beads reported on in this study were found broken, being split in half down the centre. In some of the beads the glass is very 'bubbly' with large air pockets. Others have the appearance of the glass having been stirred or 'whirled'. Most of the beads have a reddish/black deposit in the central groove area, particularly on either side of the aperture. The same colour deposit is found in the matrix of the glass, in some of the 'whirls'. Chemical analysis of the blackish deposit showed a high iron (FeO) content.

Table. 8.2.1.1. Chemical analysis of deposit found in the glass matrix of a *Garden Roller* bead.

Composition	Weight %
SiO_2	53.8%
TiO_2	0.5%
Al_2O_3	4.9%
FeO	14.2%
NiO	6.9%
CuO	5.3%
CaO	2.8%
K_2O	7.6%
P_2O_5	1.1%
SO_3	2.2%
Cl	0.7%

Fig. 8.2.1.1. Broken *Garden Roller* beads showing reddish/black iron deposit and large air bubbles. Most of the *Garden Rollers* examined in this work have similar characteristics.



8.2.2. Electron Microprobe Major and Minor Elemental Analysis (EPMA)

One hundred and seventy four (n=174) archaeological glass samples, including beads and glass 'waste' material were analysed. The major and minor elemental concentrations are given in Table 8.2.2.1. The constituents of the glass together with their minor colourants and additives were present in detectable amounts. EPMA was used to determine (n=14) major and minor elements.

8.2.3. REE and Trace Element Analysis

REE analyses on one hundred and fifty (n=150) beads from (n=33) archaeological sites were obtained using LSA-ICP-MS. Analytical techniques employed have been discussed in Chapter 7.

The REE and trace-element concentrations of zircon and titanium are presented in Table 8.2.3.1. Zirconium is most commonly found in nature as the mineral zircon ($ZrSiO_4$). Titanium also commonly occurs in the mineral ilmenite. Both minerals often exist as a heavy mineral component in dune sands.

REE chemical analyses of the glass presented here have provided precise information suitable for sourcing studies. The Ce anomaly would have derived from the fluxing agent under strongly oxidising conditions, as for example are present in sea water. It is most likely that the REE content, including the LREE and HREE slope; accessory phases; and enriched or negative and Eu anomalies would have stemmed from the rock source and ultimately from the sand.

8.2.4. Discussion of Results

Major and minor elements.
Soda-lime-silica was the base composition or predominant type of glass used to make most of the beads investigated for this thesis. Of these, 169 contained relatively high amounts of sodium (about 6-13%) and lower amounts of potassium (under 6%). The potassium content of two *wound* beads from Syria (#15 & 16), and in three Indian samples (#32, 35 & 38) was particularly high (between 14.34% - 17.89%) (Table 8.2.2.1).

Generally, there is an inverse relationship between sodium and potassium content. In some cases, particularly in very high lead glasses, potassium is usually very low. Predictably, the silica content decreases as the lead increases as well, and some high lead glasses showed higher refractive indices.

A notable difference was detected in the potassium of glass rods from Tel el-Amarna ((Table 8.2.2.1 - #162-173a). None of the fourteen samples (n=14) contained high K_2O; this contradicts Miles (1948:55), who reported that most of the glasses from Tel el-Amarna contained significant K_2O. Possible reasons for this would include trade or secondary worked glass, which would support the argument presented in Chapter 3.3.

I have already discussed in previous chapters fluxing or alkali metals, which are essential ingredients in glassmaking, noting the variety of alkali salts such as carbonate, bicarbonate, chloride, and sulphate. Determining the alkali is problematic, particularly Na, and unfortunately could not be accomplished using micro-probe analysis.

Calcium and Magnesium.

The CaO versus MgO of all glass samples show good correlation. The Ca (lime) and Mg of these early glasses was probably added to the glass *batch* unintentionally, either with the silica or the alkali. This is supported by Turner's suggestion (1955T:282-297) that the calcium, magnesium and chlorine content of glasses made at Fustat and Tel el-Amarna could have come from either (1) the sand found south of Cairo near the Nile to Luxor, which contains relatively high proportions of calcium, or (2) salt from evaporated Nile water which could have had sodium and potassium carbonates, chlorides and sulphates as well as calcium and magnesium carbonates.

Alternatively, calcium could very well have been added intentionally in the form of marine shell fragments which probably would have been burnt first to remove the CO_2. Some very early recorded batch recipes specifically refer to the addition of calcium or lime as discussed in earlier chapters.

Another feature which should be noted is the calcium, magnesium and lead content of the distinctive bright orange beads, associated with Southeast Asian sites, but not southern African. Analysis by Harrisson (1962:237) revealed that orange beads with very light black striae from Sarawak in eastern Malaysia contained 3.8 - 3.9% calcium; 0.14 - 0.15% magnesium and 0.61-0.75% lead. Compared to our analytical data on a bright orange bead from western Malaysia, the calcium, magnesium and lead measurements were much higher (Pulau Kelumpang #73 - Table 8.2.2.1.).

Three samples #64, 65 & 69, this time from eastern Malaysia, were found to contain extremely high quantities of calcium. The beads range from opaque to transparent. The overall chemistry and R.I. are very similar. The beads were all manufactured by the *wound* technique, WIb & WIIk (Karklins, 1985).

Lead (Pb).

Eighty-four (n= 84 or 48%) specimens out of the total of one hundred and seventy-four (n=174) contained detectable amounts of PbO. Nine contained appreciable amounts, ranging from 13%-60%.

Chemical analyses of Islamic glasses by Sayre *et al* (1961:1824 - Table 4.6.1) show lead in amounts of up to 36%. They also note that typical Islamic 8-10th century soda-lime glass contains a low content of antimony and high lead.

Brill (1991:28) acknowledges that

> *...In the West, the earliest presently known uses of lead as a major ingredient in a base composition was used in emerald green Islamic cameo glasses of the 10-11th centuries and in certain Eastern European glasses, most often in the form of beads.*

A most significant find was the high lead and antimony (Sb) content of glass beads excavated at Mapungubwe and Skikumbu (Table 8.2.3.1. - #'s 151, 151a, 198 & 200). Two are yellow *seed* beads from different Mapungubwe burials. This evidence supports

Brill's (1991:28) findings that lead antimonate ($Pb_2Sb_2O_7$) was used as the colouring agent in yellow opaque glasses. These data provide an important benchmark for future analysis. They are also typical of the visually diagnostic beads described above as 'uniformly spherical' - rather than oblate shaped *seed* beads, with relatively small aperture diameters.

The beads from Shikumbu are also *seed* beads but do not have the same physical attributes as those from Mapungubwe. Some of them have distinctive striations owing to the presence of numerous air bubbles. Neutron activation detection of antimony in similarly described modern glass beads (after AD 1660) have been reported by Hancock *et al.* (1994) & Kenyon, Hancock & Aufreiter (1995). The Shikimbu samples could be part of the modern component and belong to this group. Unfortunately, neutron activation is not a suitable technique for lead analysis and, therefore, no such information is available. These data are unusual and therefore can be considered diagnostic.

According to (Davison 1974), 'trade wind' beads also contain antimony.

Alumina.

Hancock *et al* (1994) also describe Al as being very useful in characterising glass source materials, but they overlook the fact that it also contributes towards the durability and strength of the glass and is therefore an important ingredient. In their study, most of the deteriorated beads contain less than 1.2% Al_2O_3, which is similar to the Schroda beads (with one exception at 9.51%). On the other hand, the Pont Drift beads, which did not deteriorate, have considerably higher Al_2O_3 content, ranging between 7.83% and 11.14%. Further studies using Al as an indicator would be constructive.

Overall, the chemical differences in the glass composition used to make the beads in this study is small. This is not surprising when considering that the relative proportions of major and minor elements manifest in batch components, such as soda, lime, and silica are rather limited. However, results of this work are important as certain inferences can be made about 1) changes in the chemistry of glass technology 2) the use of local raw materials and; 3) differences in batch material. Recent work looks at glass beads within a particular time range and creates chemical profile controls against which beads of unknown or uncertain age can be compared (Kenyon *et al* (1995). Major and minor-elemental analysis have a limited application for sourcing studies. For this reason I decided on trace element characterisation, using the rare earth elements (REE) as tracers.

Table 8.2.2.1. Major & minor chemical analyses of glass beads, bracelets & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand.

+ = University of Pretoria.
# = National Cultural History & Open Air Museum, Pretoria.

Sample	UCT accession	Location	Colour	Diap	Type	SiO2%	Na2O%	K20%	Cl%	Al2O3%	Fe2O3%	MnO%	MgO%	CaO%	P2O5%	CoO%	CuO%	Sb2O3%	PbO%
		SOUTH AFRICA (Northern Transvaal)																	
	+	Site: K2																	
86	K2-567-127	K2-TS3-layer 2	shadow blue	TL	Ia	66.70	13.76	3.07	0.71	3.17	1.31	1.34	3.80	6.61	0.26	ND	ND	ND	ND
87	K2-632(i)-128	K2-TR-D4/a1/1	TP turquoise	TP	IIa	67.63	11.56	2.23	0.67	10.39	2.27	ND	0.63	3.87	0.11	ND	1.23	ND	ND
88	K2B-650-54	K2B-BLOCK:10 -layer13	blue green	OP	Ia	61.47	15.66	2.59	0.93	5.58	1.26	ND	5.54	5.68	0.39	ND	0.10	ND	0.89
89	K2-466-53	KS.skeleton No.60	deep turquoise	TL	IIa	66.22	12.75	2.53	0.67	10.05	1.46	ND	0.34	2.69	0.10	ND	0.91	ND	ND
90	K2-463-51	KS.skeleton No.18	yellow	OP	IIa	61.98	13.80	2.99	0.93	5.78	1.28	0.24	3.96	4.20	0.38	ND	ND	ND	5.32
91	K2-595-126	K2-TS6-layer 5	"Indian" red	OP	IIa	63.79	11.19	3.49	0.82	9.44	3.97	ND	0.64	2.73	0.13	ND	0.35	ND	ND
92	K2-466-52	KS. skeleton No.60	blue green	TP	IIa	62.82	13.04	3.65	0.60	9.01	1.08	ND	0.43	1.46	0.10	ND	0.10	ND	ND
AA	352-K2	K2-B3 TS 3.2 layer 1	turquoise	TP	IIa	62.30	13.27	2.66	0.89	5.76	1.21	0.11	0.53	2.03	0.09	ND	0.79	ND	0.18
AA	353-K2	K2-B3 TS 3.2 layer 1	turquoise	TP	IIa	67.32	13.47	3.03	0.67	7.04	1.44	ND	0.57	2.15	0.13	ND	1.02	ND	0.13
AA	354-K2	K2-B3 TS 3.2 layer 1	turquoise	TP	IIa	61.20	14.03	2.79	0.67	6.24	1.55	ND	0.98	3.76	0.17	ND	0.59	ND	ND
	+	Site: Mapungubwe Hill (MST & E2)																	
93	MAPK-239-129	A3M-36"/-42"	clear crystal	TP	IIa	ND	ND	ND	ND	ND	ND	ND	ND	63.00	ND	ND	ND	ND	ND
94	MAPK-17-130	MK. skeleton No.14	deep turquoise	OP	IIa	63.27	14.22	3.32	0.92	5.40	0.86	ND	5.69	4.42	0.26	ND	1.12	ND	0.35
95	MAPK-26-59	M: 5.1.11'20'5'1939 (skeleton)	celedon green	OP	WIb	60.06	15.36	2.80	0.67	6.07	1.32	ND	5.46	5.57	0.43	ND	1.26	ND	1.58
96	MAPST-300-63	MST-B3M-Z/-6" dosie 43/54	blue green	OP	IIa	51.20	14.46	2.30	0.70	5.00	0.68	0.07	5.03	4.33	0.24	ND	1.20	ND	5.19
96a	MAP-BB45-302	MK. skeleton No. 23	green	TL	IIa	57.97	9.61	2.28	0.65	4.81	1.30	ND	3.73	5.34	0.36	ND	1.02	ND	15.04
96b	MAP-BB45-303	MK. skeleton No. 23	mauve	TL	IIa	60.09	12.96	3.01	0.79	6.55	1.44	1.71	5.66	6.96	0.51	ND	ND	ND	ND
97	MAPK-47-140	MK. skeleton No. 23	"Indian" & olive	TL	IIa	62.69	13.84	2.20	1.15	8.52	4.43	ND	0.83	2.73	0.06	ND	ND	ND	ND
98	MAPST-355-64	MST-layer 2(i): Block :F4 B6	blue green	OP	IIa	52.05	13.36	2.45	0.68	4.02	0.76	0.09	4.97	4.39	0.39	ND	1.19	ND	5.79
99	MAPK-189-60	MK3-layer 5: Block :A1 B15	medium bright green	OP	IIa	59.12	13.50	2.80	0.80	5.76	1.43	0.21	5.12	5.41	0.46	ND	1.93	ND	4.53
100	MAPK-196-62	MK3-layer 3: Block:A2 B8	yellow	OP	IIa	56.47	13.77	2.61	0.83	5.45	1.40	0.45	4.69	4.92	0.41	ND	ND	ND	6.59
101	E2-703-65	E2-Block:B11 DET:-12"/-18".	yellow	OP	IIa	56.85	12.60	2.58	0.79	5.53	1.52	0.44	4.36	4.55	0.46	ND	ND	ND	8.81
102	MAPK-196-61	MK3-layer 3: Block:A2 B8	blue green	OP	IIa	61.88	15.50	3.04	0.97	5.81	1.50	ND	4.42	4.96	0.46	ND	1.11	ND	0.34
149	BB17 TQ-163	MK. skeleton No.14:133	blue	TP	IIa	64.64	14.10	0.83	1.35	1.62	0.65	0.21	3.78	9.64	0.17	ND	ND	0.29	0.95
150	BB17 GR-164	MK. skeleton No.14:133	green	OP	IIa	59.44	14.37	3.30	0.87	5.19	1.03	ND	5.62	4.43	0.28	ND	2.17	ND	3.54
151	BB17 YE-165	MK. skeleton No.14:133	bright yellow	OP	IIa	50.42	10.60	2.34	0.63	4.42	0.91	0.50	5.09	4.21	0.24	0.08	0.22	0.17	18.93
151a	BB44-ZIM-143	MK. skeleton No. 19 F.O.G.G.A.	yellow	TL	IIa	50.72	10.69	2.55	0.80	4.60	1.06	0.70	4.90	4.19	0.27	0.12	0.15	0.12	17.12
152	BB-709-166	Shirbeek	turquoise	TP	Segm	60.24	11.88	1.28	0.13	2.35	ND	ND	ND	7.16	ND	ND	2.21	ND	5.87
153	BB370 OL-167	MST KB:B1 Layer 1 (1)	olive	TL	IIa	62.61	11.06	1.09	1.49	7.88	2.44	ND	1.08	3.79	0.12	ND	ND	ND	2.34
154	BB40 AM-168	302 F.E.G.A Ex No 1	dark marigold	TL	IIa	59.28	13.36	3.20	0.89	5.18	0.89	0.40	4.62	4.17	0.32	ND	ND	ND	6.27
	#	Site: Pont Drift																	
104	PON-9-74	TPD 1/2 OPG 2:A1 layer 8	bright dusty yellow	TL	IIa	64.59	12.25	3.50	0.72	8.77	1.29	ND	0.69	3.70	0.06	ND	0.45	ND	ND
105	PON-21-72	TPD 1/2 OPG 2:B1 layer 6	blue green	TL	IIa	63.18	12.84	3.12	0.93	11.14	2.41	0.07	1.03	3.81	0.19	ND	0.71	ND	0.10
106	PON-37-71	TPD 1/2 OPG 2:2A layer 6	blue green	TL	IIa	63.59	9.24	3.30	0.74	10.63	2.06	ND	0.73	2.62	0.05	ND	0.10	0.07	5.49
107	PON-47-75	TPD 1/2 OPG 2:2AA layer 6	TP turquoise	TP	IIa	60.58	12.76	3.31	0.90	10.50	2.43	ND	1.17	3.90	0.16	ND	ND	ND	2.17
108	PON-61-73	TPD 1/2 OPG 2:2B layer 11	bright dusty yellow	TP	IIa	62.96	12.43	3.19	0.90	10.99	2.29	ND	0.99	3.76	0.17	ND	0.73	ND	ND
AA	349-PON	TPD 1/2 OPG 2:B1 layer 6	TP turquoise	TP	IIa	61.37	14.05	3.27	0.92	10.79	2.19	0.09	0.97	0.69	0.23	ND	0.69	ND	ND
AA	350-PON	TPD 1/2 OPG 2:B1 layer 6	TP turquoise	TP	IIa	66.17	14.87	3.06	1.08	7.94	1.45	ND	0.55	2.52	0.13	ND	0.90	ND	ND
AA	351-PON	TPD 1/2 OPG 2:B1 layer 6	blue green	TP	IIa	66.17	14.20	3.02	1.18	7.83	1.48	ND	0.56	3.72	0.12	ND	0.84	ND	ND

Table 8.2.2.1. Major & minor chemical analyses of glass beads, bracelets & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (continued).

+ = University of Pretoria
# = National Cultural History & Open Air Museum, Pretoria.
^ = University of Cape Town

Sample	UCT accession	Location	Colour	Diap	Type	SiO2%	Na2O%	K2O%	Cl%	Al2O3%	Fe2O3%	MnO%	MgO%	CaO%	P2O5%	CoO%	CuO%	Sb2O3%	PbO%
		SOUTH AFRICA (Northern Transvaal)																	
	#	Site: Schroda																	
109	SCH-45-79	TSR 1/1-OPG 6:B4 layer	vaseline yellow	TL	Ia	66.48	13.42	3.04	0.50	2.50	0.50	1.39	5.00	5.52	0.40	ND	ND	ND	2.46
110	SCH-35-77	TSR 1/1-OPG 3:C1 layer 1	dark shadow blue	TL	Ia	67.24	13.63	2.96	0.66	2.73	0.72	0.38	5.16	6.38	0.13	ND	ND	ND	ND
111	SCH-123-80	TSR 1/1-OPG 6:2f layer 1.a.	dark shadow blue	TL	Ia	52.04	6.43	2.63	0.67	2.92	0.71	0.15	4.20	6.52	0.25	ND	1.13	ND	23.08
112	SCH-69-76	TSR 1/1-OPG 6:6B layer 4	bright dusty yellow	TL	Ia	63.59	13.13	2.94	0.84	3.03	0.76	1.76	4.92	6.87	0.20	ND	ND	ND	1.90
113	SCH-14-81	TSR 1/1-OPG 2:4A Layer 2	blue green	TL	IIa	67.41	8.91	3.19	0.98	3.60	1.28	1.29	4.33	7.71	0.33	ND	ND	ND	ND
114	SCH-78-78	TSR 1/1-OPG 6:C4 layer 4	dark shadow blue	TP	Ia	67.26	12.83	3.04	0.55	3.20	1.27	0.84	4.45	6.57	0.26	ND	ND	ND	0.10
115	SCH-174-82	TSR 1/1-OPG 6:5C layer 5	shadow blue	TP	Ia	68.07	8.05	2.67	0.99	6.37	1.17	ND	4.56	4.57	0.48	ND	1.13	ND	ND
116	SCH-191-83	TSR 1/1-OPG 6:6A layer 2	blue green	TL	IIa	62.76	13.39	2.81	1.61	9.51	1.39	ND	0.58	2.66	0.05	ND	0.79	ND	ND
AA	363-SCH-161	TSR 1/1-OPG 6:4E layer 4	dull yellow	OP	IIa	62.34	14.12	2.02	0.87	1.43	0.61	ND	4.95	6.55	ND	-	0.41	ND	0.29
AA	365-SCH-161	TSR 1/1-OPG 6:4E layer 4	turquoise	OP	IIa	64.65	16.37	3.30	0.90	1.00	0.37	ND	5.47	5.85	ND	-	0.55	ND	0.32
AA	366-SCH-165	TSR 1/1-OPG 6:4F layer 5	green grey	OP	IIa	64.82	16.37	3.54	0.90	1.99	0.40	ND	5.59	6.02	ND	-	0.51	ND	0.25
AA	362-SCH	TSR 1/1-OPG 6:3D layer 4	turquoise	OP	IIa	83.14	0.04	0.31	0.04	1.69	0.83	ND	0.73	1.10	ND	-	1.31	ND	0.19
AA	364-SCH	TSR 1/1-OPG 6:4E layer 4	dull yellow	OP	IIa	69.06	12.90	3.07	1.10	1.23	0.56	ND	4.73	5.52	ND	-	0.50	0.21	ND
	#	Site: Skutwater																	
117	SK-318-84	TWS 1/1:E11 layer 4	celedon turquoise	OP	IIa	64.82	16.37	3.54	0.90	0.99	0.40	ND	5.59	6.02	ND	ND	0.51	ND	0.25
118	SK-319-85	TWS 1/1:E11 layer 5	celedon turquoise	TP	IIa	62.25	15.75	3.25	0.95	5.40	1.10	ND	5.19	4.12	0.35	ND	1.20	ND	0.33
119	SK-332-86	TWS 1/1:E11/142 layer 91B2D	black	OP	IIa	71.06	5.68	3.04	1.11	10.33	2.59	ND	0.74	7.87	0.17	ND	ND	ND	ND
120	SK-332-87	TWS 1/1:E11/142 layer 91B2D	TP turquoise	TP	IIa	60.97	12.66	3.23	0.51	8.90	0.86	ND	0.38	1.36	ND	ND	0.36	ND	ND
121	SK-332-88	TWS 1/1:E11/142 layer PCB2	TP turquoise	TP	Ia	69.14	12.20	2.91	0.74	6.80	1.25	ND	0.46	2.22	ND	ND	0.83	ND	ND
124	SK-337-91	TWS 1/1:E14 layer 4	TP turquoise	TP	IIa	59.73	13.54	2.55	0.95	5.79	1.03	ND	4.46	4.29	0.34	ND	0.84	ND	0.11
		SOUTH AFRICA (Eastern Transvaal)																	
	+	Site: Letaba																	
77	LET-819-57	TER:LET-STRAT:ASGA	deep turquoise	OP	IIa	66.72	10.78	1.50	0.51	7.24	1.15	ND	0.27	2.67	ND	ND	0.66	ND	ND
78	LET-821-58	TER:LET-6.6:Layer 1	TP turquoise	TP	IIa	71.99	11.34	1.71	0.43	6.96	1.17	ND	0.24	2.61	ND	ND	0.63	ND	ND
	+	Site: Shikumbu																	
79	SHI-885:124	TER:NKW SH4	dark brown	TL		56.07	13.86	0.40	0.94	1.44	0.71	9.43	1.13	3.28	0.17	ND	ND	ND	4.52
198	SHI-857	TER:NKW SH3-STRAT:layer 1	"striped" bead	OP	IIa	39.16	7.76	1.87	0.50	0.74	0.27	ND	ND	1.79	ND	ND	ND	0.39	54.95
199	SHI-D866	TER:SH4	crystal clear	TP	Ia	52.29	3.68	8.00	0.16	0.30	ND	ND	ND	3.87	ND	ND	ND	0.16	27.67
200	SHI-D874	TER:SH4	grey & olive yellow	OP	IIa	35.76	1.88	0.68	0.12	0.70	ND	ND	ND	1.11	ND	ND	ND	0.39	60.44
	+	Site: Olifants Rivier																	
80	OLI-935-70	TER:OPN. TERREIN 0120	shadow blue	TP	Ia	65.19	13.70	3.29	0.70	3.12	1.21	1.04	4.40	6.36	0.28	ND	ND	ND	0.43
	+	Site: Mahlangeni																	
80a	MAL-D919	TER:Ma2Ma3 ST. OPNAME.	dark brown	TL		60.40	13.32	0.44	1.03	1.58	1.05	11.53	1.25	3.57	0.21	ND	ND	0.08	4.79
	^	Site: Phalaborwa (SPK)																	
81	PHA-743-120	SPK-III-D-H 7"	deep turquoise	TP	IIa	62.02	13.32	4.03	0.90	6.74	1.24	ND	3.97	6.42	0.71	ND	1.12	ND	0.94
82	PHA-756-119	SPK-III K 1'5" - 1'6"	deeep turquoise	OP	IIa	64.98	12.33	2.95	0.88	5.07	0.74	ND	4.14	4.47	0.33	ND	1.41	0.11	ND
	^	Site: Nagome																	
83	PHA-773-122	MN3-House 2: 1-12"	blue green	TL	IIa	72.55	9.82	2.65	1.51	1.03	0.56	ND	1.13	5.47	0.28	ND	2.12	ND	0.39
84	PHA-770-121	MN3-House 1: Unit 2 0-12"	blue green	OP	broken	61.97	13.12	3.19	0.79	6.19	1.34	ND	4.60	5.68	0.58	ND	1.80	ND	0.71
85	PHA-773-123	MN3-House 2: 1-12"	"Indian" red	OP	IIa	60.39	12.65	3.26	0.87	6.05	2.05	0.26	4.20	8.23	1.06	ND	1.08	ND	1.13

Table 8.2.2.1. Major & minor chemical analyses of glass beads, bracelets & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (continued).

* = Van Riet Lowe Collection.

! = E. Wilmsen & J. Denbow

= National Cultural History & Open Air Museum, Pretoria.

Sample	UCT accession	Location	Colour	Diap	Type	SiO2%	Na2O%	K20%	Cl%	Al2O3%	Fe2O3%	MnO%	MgO%	CaO%	P2O5%	CoO%	CuO%	Sb2O3%	PbO%
		SOUTH AFRICA (North western Transvaal)																	
	#	Site: Makahane																	
103	K?-MAK2-125	Surface: south terrace: west area	celedon green	OP	WIb	60.85	14.25	2.31	0.84	5.68	1.40	ND	5.16	6.66	0.39	ND	1.01	ND	1.23
189	K?-MAK2-203	Lower settlement	bright navy	TP	WIb	68.84	9.54	3.23	0.74	5.26	1.92	0.45	2.89	4.72	0.33	ND	ND	ND	ND
190	K?-MAK2-204	Lower settlement	med. bright green	TL	IIa	61.49	11.08	3.39	0.67	6.56	1.60	ND	4.49	7.39	0.63	ND	1.40	ND	1.70
191	K?-MAK2-205	Lower settlement	med. bright green	TL	IIa	59.77	12.82	3.06	0.81	6.63	1.73	ND	5.26	7.56	0.70	ND	1.22	ND	1.11
	#	Site: Diamant																	
125	AUK-1-98	DIA-D1-17	shadow blue	TL	Ia	64.73	14.22	2.89	0.80	3.34	1.55	0.71	4.69	6.54	0.24	ND	ND	ND	0.31
126	AUK-1-133	DIA-D1-17	bright shadow blue	TP	IIa	72.05	10.89	2.87	0.76	3.51	1.04	0.47	3.73	4.58	0.27	ND	ND	ND	ND
	#	Site: Goegap																	
127	K?-GOE5-99	GG2-SquareI:1-layer 2	TP turquoise	TP	Ia	68.26	12.47	5.21	1.23	1.10	0.52	ND	1.29	8.88	0.67	ND	1.29	0.17	ND
		BOTSWANA																	
	!	Site: Kgaswe																	
1	BOT:785-56	KG-Hut floor (in pot)	blue green	TP	IIa	63.63	13.47	3.23	1.12	8.64	3.84	ND	0.56	2.14	0.16	0.35	ND	ND	ND
2	BOT:785-55	KG-Hut floor (in pot)	"Indian" red	OP	IIa	63.86	13.77	3.47	0.63	8.24	1.33	ND	0.47	2.27	0.11	ND	0.85	ND	ND
		Site: Matlapaneng																	
3	BOT:786-66	MAT-281.275: 55-65cm	shadow blue	TP	Ia	67.66	13.71	2.98	0.89	3.78	1.33	0.78	4.20	5.76	0.94	ND	ND	ND	ND
		Site: Nqoma																	
4	BOT:779-69a	NQ-40.00: 60-70cm	TP turquoise	TP	IIa	67.10	10.14	3.51	1.16	3.86	0.96	0.33	4.81	7.90	0.76	ND	ND	ND	ND
5	BOT:776-68a	NQ-180w.107n: 60-70cm	shadow blue	TP	Ia	67.17	11.31	3.33	0.73	2.91	0.69	0.48	5.46	6.94	0.79	ND	ND	ND	ND
6	BOT:774-67	NQ-80.625: 40-50cm	blue green	OP	IIa	63.37	12.13	3.25	0.61	8.58	1.27	ND	0.47	2.16	0.14	ND	0.78	ND	ND
		Site: Bosutswe																	
6a	BOT:728a-228	Surface: Block 5	celedon green	OP	WIb	60.41	12.94	2.89	0.77	6.40	1.38	ND	5.71	6.91	0.47	ND	1.37	ND	1.41
	*	EAST AFRICA																	
13	VRL-93a	Sofala	dirty yellow	OP	IIa	57.99	9.60	2.06	1.14	7.49	2.41	0.57	1.71	10.18	0.54	ND	ND	ND	2.99
14	VRL-92a	Sofala	"Indian" red	OP	IIa	63.52	8.43	2.08	1.38	10.90	4.49	1.25	2.87	0.19	ND	0.57	ND	ND	ND
	*	Site: Zanzibar																	
134	VRL-186	Zanzibar	"Indian" red	OP	IIa	65.49	7.81	0.93	1.39	7.24	5.61	ND	0.86	6.69	0.09	ND	0.41	ND	ND
134a	VRL-187	Zanzibar	sea green	TP	IIa	61.98	11.96	2.64	0.93	6.37	1.55	ND	4.98	6.67	0.54	ND	1.37	ND	ND
134b	VRL-188	Zanzibar	yellow	OP	IIa	59.97	12.39	2.54	0.86	6.37	1.24	0.96	6.44	6.60	0.48	ND	ND	ND	2.54

Table 8.2.2.1. Major & minor chemical analyses of glass beads, bracelets & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (continued).

GS = George Scanlon
MS = Israel Museum
• = Van Riet Lowe Collection
WM = Wellington Museum

Sample	UCT accession	Location	Colour	Diap	Type	SiO_2%	Na_2O%	K_2O%	Cl%	Al_2O_3%	Fe_2O_3%	MnO%	MgO%	CaO%	P_2O_5%	CoO%	CuO%	Sb_2O_3%	PbO%
		EGYPT																	
	WM	Site: Tel el-Amarna																	
162	UCT-WEL	Tel el-Amarna	green	TL	bead	79.06	6.67	0.60	0.99	1.04	0.45	ND	0.17	1.21	ND	ND	1.96	ND	4.83
26	VRL-FUS-20	Tel el-Amarna	turquoise	TL	rod	71.60	7.80	1.46	1.46	0.67	0.50	ND	3.43	6.95	0.12	ND	1.20	0.78	ND
163	UCT-WEL	Tel el-Amarna	bright navy	TP	rod	68.77	9.14	2.66	0.96	1.72	0.41	ND	5.03	7.85	ND	ND	ND	ND	0.14
164	UCT-WEL	Tel el-Amarna	dark green	OP	rod	69.98	5.71	0.83	1.46	0.73	0.55	ND	3.67	7.98	0.11	ND	2.30	0.19	2.65
165	UCT-WEL	Tel el-Amarna	dark mauve	TL	rod	9.02	ND	0.07	ND	1.21	0.81	ND	0.95	1.07	0.26	ND	46.85	ND	ND
166	UCT-WEL	Tel el-Amarna	bright blue	TL	rod	68.54	8.90	1.39	1.23	1.50	0.47	0.14	4.17	9.05	0.17	ND	0.24	ND	ND
167	UCT-WEL	Tel el-Amarna	bright turquoise	TL	rod	67.73	7.89	2.15	1.07	0.74	0.35	ND	4.92	8.94	0.17	ND	1.25	1.65	ND
168	UCT-WEL	Tel el-Amarna	dull turquoise	OP	rod	68.66	7.61	2.54	0.98	1.41	0.70	ND	4.82	10.05	0.71	ND	0.63	1.07	ND
169	UCT-WEL	Tel el-Amarna	bright navy	TP	rod	69.66	8.46	1.42	1.28	1.51	0.47	0.15	4.79	9.05	0.17	ND	0.22	ND	ND
170	UCT-WEL	Tel el-Amarna	green	OP	rod	67.98	8.50	1.79	1.21	0.67	0.38	ND	5.05	10.10	0.15	ND	1.41	ND	0.51
171	UCT-WEL	Tel el-Amarna	yellow ochre	OP	rod	64.17	10.81	1.77	0.75	0.82	0.66	ND	5.35	9.67	0.17	ND	ND	0.48	4.63
172	UCT-WEL	Tel el-Amarna	green	OP	rod	64.90	11.60	1.72	0.85	0.57	0.26	ND	4.98	9.93	0.14	ND	1.48	0.66	1.81
173	UCT-WEL	Tel el-Amarna	bright turquoise	OP	rod	65.86	9.39	2.13	1.18	0.78	0.58	ND	5.34	6.60	0.61	ND	2.62	1.51	ND
173a	UCT-WEL-19a	Tel el-Amarna	royal blue	TP	rod	66.54	10.07	1.49	1.37	1.52	0.40	ND	4.22	9.15	0.15	ND	0.23	ND	ND
	• & SC	Site: Fustat																	
20a	VRL-25/37	Fustat 25/37 Foustat [sic]	light green	TL	Segm	67.81	7.63	1.35	1.14	2.25	1.08	0.21	1.88	10.74	1.73	ND	ND	ND	ND
21	VRL-FUS-134	Fustat	clear crystal	TP	IIa	67.21	11.67	2.56	1.16	0.88	0.57	0.97	3.16	11.75	0.36	ND	ND	0.75	ND
21a	GS-FUS-182	"Fustat Fused Rod Bead"	multi-colour (green)	OP	FFRB	66.31	11.07	2.49	0.95	2.87	0.85	1.62	4.71	8.90	0.35	ND	0.67	ND	3.06
21b	GS-FUS-182	"Fustat Fused Rod Bead"	multi-colour (clear)	OP	FFRB	63.77	11.43	2.97	0.85	3.44	1.65	1.45	4.55	9.35	0.36	ND	1.26	ND	ND
21c	GS-FUS-182	"Fustat Fused Rod Bead"	multi-colour ("Indian")	OP	FFRB	63.62	6.36	2.47	0.83	3.27	2.67	1.40	3.48	9.38	0.34	ND	1.46	ND	0.36
23a	VRL-EGY-136	Fustat (I'alhakimi)	"Indian" red & olive	TL	arrow	80.50	10.20	3.08	0.91	5.24	0.90	0.41	4.51	4.20	0.33	ND	ND	ND	6.44
24a	VRL-FUS-304	Fustat (coil wound)	turquoise	TP	CWnd	67.08	11.40	1.85	1.23	0.96	0.61	0.26	4.86	7.02	0.20	ND	1.20	ND	ND
25	VRL-FUS-18	Fustat	clear crystal	TP	IIa	69.91	10.20	2.48	1.03	0.84	0.43	0.86	2.98	11.65	0.32	ND	ND	0.07	ND
25a	VRL-FUS-305	Fustat (segmented)	teal blue	TP	BIa	68.56	9.68	1.91	0.76	2.34	0.98	ND	1.93	8.22	0.31	ND	0.94	ND	ND
27	VRL-FUS-24	Fustat	bright green	TL	IIa	66.25	11.56	2.66	0.57	9.33	0.74	ND	0.29	1.74	ND	ND	0.68	ND	1.48
		PALESTINE																	
	MS	Site: Khirbet el-Minyeh																	
54	SPA-IS-46	Khirbet el-Minyeh	bright navy	TP	Brclt	70.18	10.45	2.47	0.90	0.90	0.83	0.31	4.38	8.90	0.34	ND	ND	ND	ND
55	SPA-IS-45	Khirbet el-Minyeh	dark navy	TL	Brclt	68.96	10.18	3.04	0.80	1.34	1.01	1.05	4.04	10.20	0.42	ND	ND	0.07	ND
56	SPA-IS-47	Khirbet el-Minyeh	light turquoise	TL	Brclt	78.40	8.63	3.61	0.69	1.02	0.50	ND	0.41	3.42	0.15	ND	0.68	ND	ND
	^	Site: Kibbutz Ginosar																	
57	UCT-131	Kibbutz Ginosar	amber/turq & yellow	TP	Brclt	72.92	12.68	2.31	1.14	0.44	0.32	ND	2.65	5.99	0.22	ND	ND	ND	ND
	•	Site: Hebron																	
58	VRL-48	Hebron	dirty yellow	OP	Wnd	64.10	10.83	2.69	1.13	1.84	1.11	1.32	1.69	5.88	0.43	ND	1.29	0.15	7.50
59	VRL-49	Hebron	celedon green	OP	Wnd	65.65	8.28	2.56	1.24	1.92	1.04	0.81	1.80	3.44	0.49	ND	1.99	ND	6.02
		SYRIA																	
	•	Site: Ba'albakk																	
15	VRL-EGY-15	Ba'albakk	bottle green	TP	WIb	65.28	1.31	17.89	0.17	1.10	2.49	0.17	0.74	9.91	0.81	ND	ND	0.18	ND
16	VRL-EGY-16	Ba'albakk	green turquoise	TP	WIb	64.13	1.19	17.45	0.18	0.44	2.41	ND	0.38	11.47	0.37	ND	ND	0.17	ND

Table 8.2.2.1. Major & minor chemical analyses of glass beads, bracelets & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (continued).

~ = Peter Francis Jr.
• = Van Riet Lowe Collection

Sampl	UCT accession	Location	Colour	Diap	Type	SiO2%	NaO%	K20%	Cl%	Al2O%	Fe203%	MnO%	MgO%	CaO%	P2O5%	CoO%	CuO%	Sb2O3%	PbO%
		SOUTHEAST ASIA																	
		INDIA																	
	~	Site:Arikamedu-Viram-Pattinam																	
28	FRA-AV-42	XI-027:a	pale turquoise	TP	cullet	75.75	10.08	0.76	0.84	3.19	0.88	0.25	1.98	4.47	0.52	ND	ND	ND	ND
29	FRA-AV-43	XI-027:b	pale green	TP	cullet	78.17	9.81	0.70	0.91	2.44	2.63	ND	0.45	4.79	0.17	ND	ND	ND	ND
30	FRA-AV-34	XI-003:b (late Medieval)	mid blue	TP	cullet	67.06	16.00	2.48	0.13	6.46	2.18	1.13	1.20	2.31	0.82	ND	ND	ND	ND
31	FRA-AV-33	XI-003:a (late Medieval)	dark mauve	OP	cullet	70.93	10.29	1.85	0.72	4.51	1.55	4.74	0.87	3.74	0.30	ND	ND	ND	ND
32	FRA-AV-40	XI-67a (n.d. - early)	dark mauve	OP	cullet	74.24	0.38	14.34	0.24	3.77	1.16	3.33	0.26	0.87	0.53	0.18	ND	0.16	ND
33	FRA-AV-25	VI-013 (imported?)	bright green	TP	cullet	67.77	15.16	2.02	0.95	1.99	1.40	0.39	1.83	6.71	0.88	ND	2.94	ND	ND
34	FRA-AV-36	XI-004:b-late Medieval:loci	shadow blue	TP	cullet	74.26	10.54	1.27	0.83	3.87	1.45	0.40	0.63	4.03	0.13	ND	ND	ND	ND
35	FRA-AV-41	XI-67:b (n.d. - early)	dark mauve	OP	cullet	74.29	0.25	15.27	0.19	1.60	0.75	4.29	0.26	1.09	0.77	ND	ND	0.23	ND
36	FRA-AV-27	VII-004:b-late medieval	bright blue	TP	cullet	75.74	9.68	2.45	0.86	1.73	2.00	3.04	0.56	3.64	0.26	0.16	0.42	ND	ND
37	FRA-AV-30	VII-052:early/late Medieval	medium green	TP	cullet	72.00	11.90	1.18	1.03	5.29	1.41	ND	0.80	4.54	0.19	ND	ND	ND	ND
38	FRA-AV-32	VII-114 (BC 9 - AD 10)	bright blue	TP	cullet	77.58	0.27	16.12	0.10	2.04	1.43	1.82	0.31	1.30	0.34	ND	ND	ND	ND
39	FRA-AV-29	VII-007:b-late Medieval:loci	medium green	TL	cullet	72.42	11.84	1.22	1.06	5.29	1.50	ND	0.80	4.58	0.20	ND	ND	ND	ND
40	FRA-AV-38	XI-030a(local or import?)	lichen green	OP	cullet	61.49	5.40	8.01	0.47	2.31	1.39	0.59	1.09	2.85	0.67	0.17	3.43	0.28	13.56
41	FRA-AV-28	VII-007:a-late Medieval:loci	"Indian" red	OP	cullet	68.87	11.14	3.44	0.94	3.85	1.47	ND	2.19	4.94	1.07	ND	2.36	ND	ND
42	FRA-AV-26	VII-004:a-late medieval	"Indian" red	OP	cullet	68.03	12.78	3.63	0.86	4.71	1.51	ND	2.04	4.98	1.04	ND	2.03	ND	ND
43	FRA-AV-35	XI-004:a-late Medieval:loci	black	OP	cullet	59.98	14.48	6.32	0.94	5.47	2.24	0.24	4.01	4.47	0.08	ND	ND	ND	ND
44	FRA-AV-37	XI-004:c-late medieval:loci	"Indian" red	OP	cullet	73.99	9.65	2.26	0.70	3.89	1.10	0.34	3.45	4.13	0.77	ND	1.80	ND	ND
45	FRA-AV-31	VII-108 (10BC - AD20)	"Indian" red	OP	cullet	68.07	11.16	3.78	0.90	3.41	1.12	0.21	2.25	4.76	0.90	ND	2.11	ND	ND
46	FRA-AV-39	XI-030:b (local or import?)	black	OP	cullet	71.87	9.49	7.72	0.75	2.36	1.23	0.16	2.98	3.68	0.71	ND	ND	0.20	ND
	~	Site: Purdalpur																	
47	FRA-PU-44	PUR-082	"soil salts"	TP	cullet	71.47	15.26	1.94	0.12	6.87	1.74	ND	0.88	1.95	0.18	ND	ND	ND	ND
	•	CEYLON																	
7	VRL-11	Ceylon	bright navy	TP	IIa	72.54	7.01	1.28	0.92	3.11	1.62	0.16	3.37	7.03	0.31	ND	ND	ND	ND
8	VRL-13	Ceylon	shadow blue	TP	cullet	77.65	4.48	1.52	0.85	5.39	1.17	0.87	0.51	5.07	0.19	ND	ND	ND	ND
9	VRL-9	Ceylon	dirty yellow	OP	cullet	70.61	8.00	1.23	0.67	4.07	0.94	ND	0.63	7.26	0.12	ND	0.12	0.07	6.16
10	VRL-10	Ceylon	apple green	OP	cullet	71.08	5.69	1.66	0.96	12.33	1.49	ND	0.35	2.45	0.09	ND	0.91	ND	0.09
11	VRL-14	Ceylon	"Indian" red	OP	cullet	67.74	6.38	1.55	1.61	11.66	1.52	ND	0.63	2.69	0.13	ND	1.40	ND	0.40
12	VRL-12	Ceylon	peacock blue	TL	IIa	69.88	7.67	3.12	0.94	3.62	1.26	1.08	4.41	6.07	0.27	ND	ND	ND	ND
		INDONESIA																	
Bag Q	~	Site: Gunang Wingo (Java)																	
48	FRA-Q-50	JAV: V-Y 3	dark green blue	TL	IIa	65.19	13.70	3.29	0.70	3.12	1.21	1.04	4.40	6.36	0.28	ND	ND	ND	0.43
48a	VRL-185	Slab grave	"Indian" red	OP	IIa	67.45	8.09	1.72	0.88	7.34	4.01	0.19	1.95	5.67	1.07	ND	2.04	ND	2.87
Bag K	~	Site: Kambang Unglen (Sumatra)																	
49	FRA-K-97	KAM-068 (surface)	turquoise & clear	TP	Mos	63.67	13.74	4.41	0.77	1.92	0.80	0.24	6.07	9.14	0.39	ND	ND	0.14	ND
50	FRA-K-96	KAM-067 (surface)	black & white	OP	Mos	68.29	10.50	3.29	0.82	2.62	0.75	0.64	4.97	6.52	0.35	ND	ND	ND	0.42
51	FRA-K-141	KAM-078 (surface)	"Indian" & olive	TL	IIa	64.84	11.03	1.68	0.49	14.10	2.23	ND	0.51	3.46	0.07	ND	0.83	ND	0.23
52	FRA-K-94	KAM-065 (surface)	pale citrus	OP	Ia	72.18	5.46	1.60	0.50	9.45	1.43	ND	0.38	2.40	ND	ND	ND	ND	3.44
53	FRA-K-95	KAM-066 (surface)	"Indian" red	OP	IIa	67.60	8.80	1.30	0.30	16.12	1.19	ND	0.30	3.60	0.06	ND	0.63	ND	ND

Table 8.2.2.1. Major & minor chemical analyses of glass beads, bracelets & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (continued).

~ = Peter Francis Jr.

Sample	UCT accession	Location	Colour	Diap	Type	SiO2%	Na2O%	K2O%	Cl%	Al2O3%	Fe2O3%	MnO%	MgO%	CaO%	P2O5%	CoO%	CuO%	Sb2O3%	PbO%
		EASTERN MALAYSIA																	
Bag I	~	Site: Gedong (Sarawak)																	
60	FRA-I-137	GED-053: N/E6 6-12" (SF No.128)	blue green	TP	IIa	41.30	0.11	3.39	0.23	0.30	0.50	0.22	0.11	2.61	0.10	0.39	1.86	0.42	50.53
61	FRA-I-2	GED-048: N/E5 6-12" (SF No.132)	yellow green	OP	WIIk	65.05	10.66	2.27	1.26	9.61	1.99	ND	1.03	3.02	0.11	ND	ND	ND	2.19
62	FRA-I-1	GED-052: 69/H8 6-12" (Box 164)	"Indian" red	OP	WIIk	61.68	11.23	3.13	1.04	8.88	5.82	ND	0.59	2.15	0.14	ND	0.10	ND	0.28
Bag P	~	Site: Bukit Sandong (Sarawak)																	
63	FRA-P-6	BUK-104: A/2 12-18"	clear crystal	TP	WIb	59.18	3.89	8.29	0.93	3.55	0.40	ND	4.12	16.63	ND	ND	ND	0.27	ND
64	FRA-P-4	BUK-105: H/14 0-6"	aqua green	OP	WIb	57.78	3.78	7.98	0.93	3.87	0.49	ND	4.45	16.54	ND	ND	0.75	0.31	0.26
65	FRA-P-5	BUK-106: H/H3 0-6"	sea green	TP	WIb	62.53	12.46	3.75	0.81	9.17	4.97	ND	0.64	2.60	0.05	ND	0.48	ND	ND
66	FRA-P-3	BUK-107: 0-6"	"Indian" red	OP	WIb	66.77	3.70	2.28	1.33	1.84	1.12	0.73	1.70	6.41	0.43	ND	2.39	0.15	5.18
Bag V	~	Site: Bongkissam (Sarawak)																	
67	FRA-V-8	BON-156: I I 6-12" (1955)	yellow	OP	WIIK	58.93	3.78	8.15	0.88	3.72	0.40	ND	4.24	16.60	ND	ND	0.32	0.26	0.13
68	FRA-V-7	BON-161: J J 6-12" (1955)	"Indian" red	OP	WIIK	62.82	12.30	3.69	0.85	9.06	5.03	ND	0.59	2.29	ND	ND	0.49	ND	ND
		WESTERN MALAYSIA																	
	~	Site: Pulau Kelumpang (Kuala Selingsing)																	
72	FRA-PK-138	KS:1-Trench I:200-220cm Pk/1/89	"Indian" red	OP	IIa	69.33	10.50	1.99	0.47	7.17	1.65	ND	0.71	2.73	0.25	ND	3.28	ND	ND
73	FRA-PK-139	KS:1-Trench A:40-60cm Pk/5/90	bright orange	OP	IIa	52.69	11.71	3.69	0.69	9.77	2.75	0.17	2.74	6.02	1.68	ND	8.20	0.18	1.72
Bag O	~	Site: Sungai Mas																	
74	FRA-SUNG-11	SG-MAS-089 (surface finds)	blue mosaic	OP	Mos	69.42	16.32	1.75	1.06	1.86	0.53	0.18	4.01	6.61	ND	ND	1.14	ND	0.84
75	FRA-SUNG-11	SG-MAS-089 (surface finds)	green mosaic	OP	Mos	67.98	13.84	1.69	0.99	1.67	0.61	0.21	3.83	6.34	0.14	ND	ND	ND	3.45
75a	FRA-SUNG-11	SG-MAS-090 (surface finds)	green mosaic	OP	Mos	62.34	15.39	2.84	0.74	2.53	2.07	0.47	3.51	8.54	0.32	ND	1.98	ND	0.93
76	FRA-SUNG-30	SG-MAS (dull royal blue with white)	dull royal blue/white	Mos	Mos	66.79	12.87	3.67	0.77	2.81	0.56	1.16	3.38	7.71	0.26	ND	0.87	ND	ND
		THAILAND																	
Bag B	~	Site: Klong Thom																	
128	FRA-B-142	KT-008-1 (surface)	light green	TP	frag	67.61	13.22	3.17	0.55	2.33	1.03	0.75	5.79	7.03	0.25	ND	ND	ND	ND
129	FRA-B-144	KT-013 (surface)	blue green	TL	IIa	64.87	11.30	1.96	1.07	12.81	1.38	ND	0.40	3.00	0.90	ND	0.50	ND	0.10
130	FRA-B-145	KT-014 (surface)	deep turquoise	TL	IIa	66.37	10.41	2.77	0.89	12.81	0.96	ND	0.32	2.35	0.12	ND	0.89	ND	ND
131	FRA-B-143	KT-010 (surface)	"Indian" red	OP	IIa	64.60	11.89	2.42	0.95	14.03	1.31	ND	0.43	2.77	0.16	ND	1.85	ND	0.25
Bag N	~	Site: Takua Pa																	
132	FRA-N-147	TP-087 (surface)	dark green blue	TP	IIa	64.77	13.32	2.71	0.70	1.81	1.22	0.74	4.07	6.82	0.24	ND	ND	ND	ND
133	FRA-N-146	TP-084 (surface)	black	OP	cullet	42.70	0.29	0.98	ND	5.91	10.13	7.20	0.55	3.42	0.63	ND	0.28	0.18	ND

8.3. SIGNIFICANCE OF REE PROFILES

8.3.1 Discussion

Fifteen (n=15) glass beads from six southern African sites at K2, Mapungubwe, Makahane, Kgopolwe, Nagome Hill and Shikimbu have pronounced negative Cerium (Ce) anomalies (Fig. 8.3.1.1). All the beads are small *seed* beads (Figs. 8.3.2.3; 8.3.2.6), except for two, *wound*, green beads from Mapungubwe and Makahane (Fig. 8.3.2.4), and an unusual, dark brown, triangular cross section bead from Shikimbu (Fig. 8.3.2.9).

Negative Ce anomalies were found in five (n=5) beads from Fustat, including one *seed* bead (IIa); two Fustat Fused Rod Beads (FFRB), a bead referred to as a *t'alhakimt*, and a black bead with yellow *trailing* (Fig. 8.3.2.2).

Nine (n=9) beads, from four Southeast Asian sites at Pulau Kelumpang and Sungai Mas (western Malaysia) and Klong Thom and Takuapa (Thailand) have Ce anomaly (Figs. 8.3.2.17; 8.3.2.21). Specimens included glass *seed* beads and mosaic beads (Sungai Mas) and a most interesting 'blob' of dark blackish/brown cullet from Takuapa (Thailand) (Fig. 8.3.2.22).

In sum, a total of eleven (n=11) sites contained glass specimens with the distinctive negative Ce anomaly. None of the glass beads or wasters from the important beadmaking site at Arikamedu have similar Ce-depletion.

Europium (Eu) and Cerium (Ce), are distinctive Lanthanide elements, that can provide useful markers. The REE usually occur in solution as trivalent cations, but Ce and Eu can occur in different oxidation states (Figs. 8.3.1.2; 8.3.1.3). Thus, two of the most salient REE features shown in this study are the pronounced negative Ce an Eu anomalies.

Other REE patterns show characteristic similarities in the steep slope of the LREEs and HREEs (e.g. Figs. 8.3.2.7; 8.3.2.11; 8.3.2.12). The REE patterns of three beads excavated at various sites in Indonesia and eastern Malaysia, are so alike, they could have been manufactured from the same batch of glass (Fig. 8.3.2.16).

Some of the REE analytical results reported on glass beads for this thesis are unique. It is evident, however, that they do not represent the entire macrocosm of sites at which glass trade beads were produced.

Cerium* (Ce) *anomalies

Preferential extraction of Ce is thought to be due to its oxidation from Ce^{3+} to Ce^{4}+ and its subsequent scavenging from the water column during the formation of bottom precipitates (such as manganese nodules), or inclusion in the skeletons of benthic (deep water) marine organisms. The cerium (Ce)-depleted REE pattern is unique to seawater and its derivatives (marine organisms and certain precipitates) (Henderson, 1984).

***Europium* (Eu) *anomalies*.**

Under reducing conditions Eu is present as Eu^{2+}; it behaves similarly to Sr^{2+}, so that it can be preferentially extracted along with Sr, in common rock-forming minerals such as feldspars (Taylor & McLennon 1985). Feldspar-enriched rocks are thus characterised by *positive* Eu anomalies. Igneous rocks produced through the preferential *removal* of feldspar develop a complementary *negative* Eu anomaly. The majority of terrestrial rocks have Ce and Eu anomalies. These are displayed graphically using chondrite normalised REE patterns (Figs. 8.3.2.1 - 8.3.2.26). The magnitude of the anomaly is measured by comparing the observed Ce_N and Eu_N values with those predicted by interpolation from adjacent elements. Mathematically, the anomaly is calculated using the following formulae:

Ce anomaly = $Ce/Ce^* = Ce_N/(La_N \times Pr_N)^{1/2}$

Eu anomaly = $Eu/Eu^* = Eu_N/(Sm_N \times Gd_N)^{1/2}$

When Ce/Ce^* = >1 it is positive, and Eu/Eu^* <1 = negative (Taylor & McLennon 1985).

Fig 8.3.1.1. Chondrite-normalised REE abundances in seawater (taken from Fleet 1984:343-369).

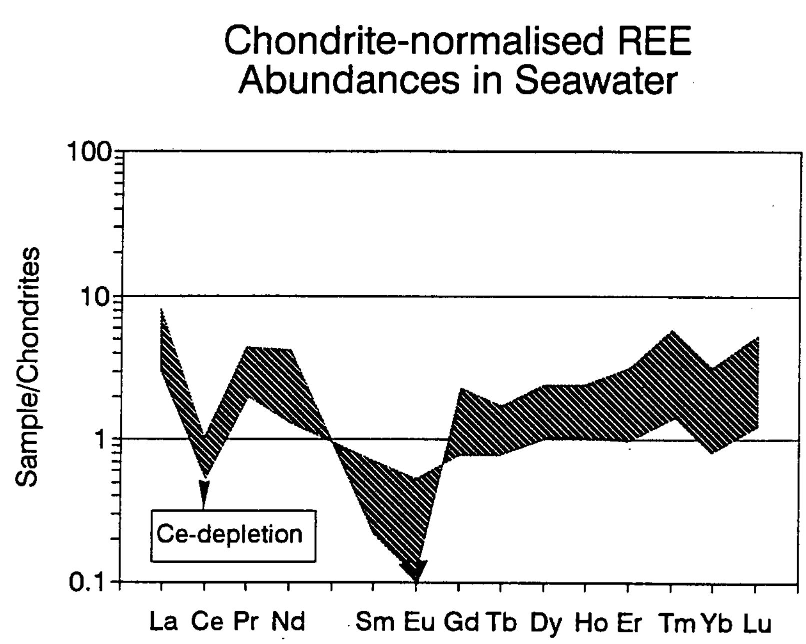


Fig. 8.3.1.2. Example of negative and positive Ce and Eu anomalies.

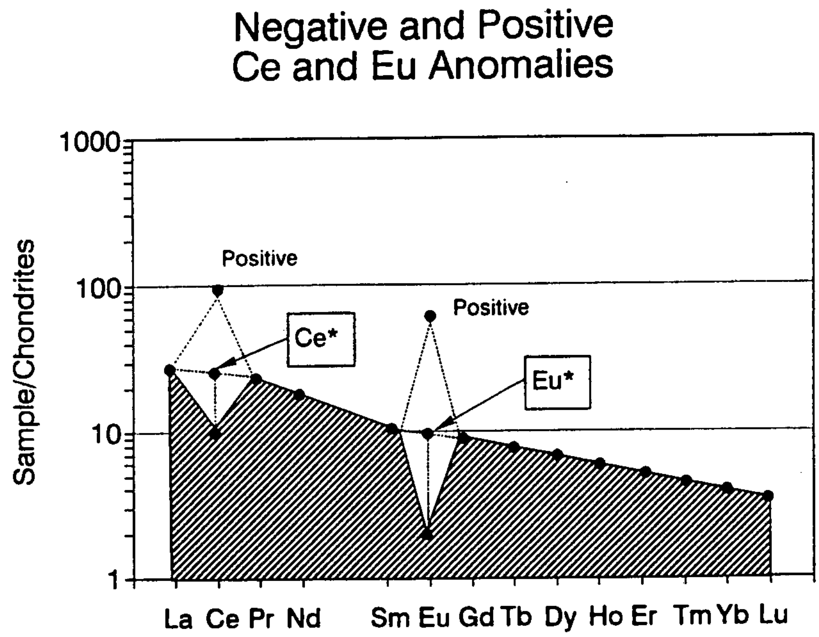
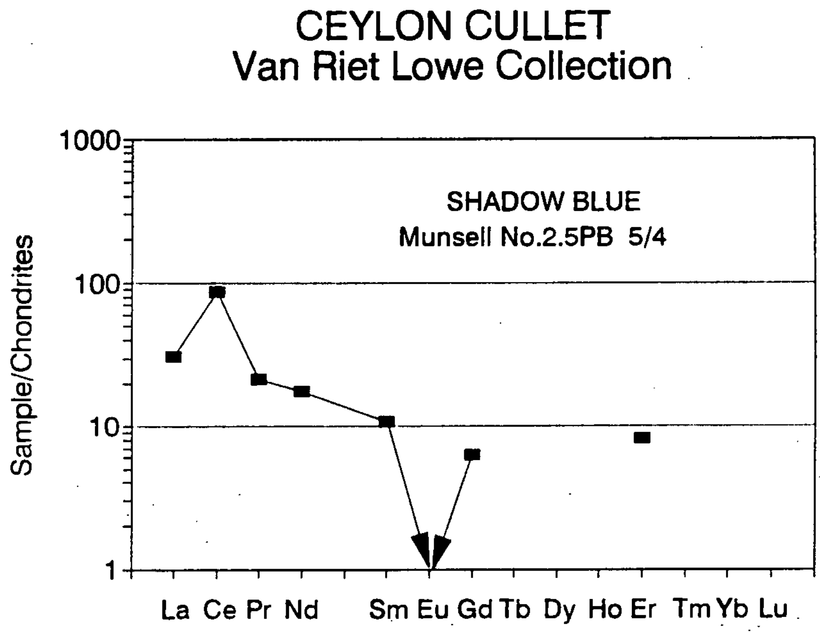


Fig. 8.3.1.3. Chondrite-normalised REE abundance showing positive Eu anomaly in a piece of glass cullet from Ceylon.



Coastal or interior dune sands are normally pure quartz as wave or wind actions tend to remove all the impurities, so that a negative Ce anomaly would not be expected. The seawater signature can only be obtained from the sand if significant amounts of seaweed (or some other shallow marine organic remains) are present. Therefore, it is unlikely that the sand component of glass (silica or alumina) can be the source of this anomaly. Resistant heavy minerals do not have negative Ce anomalies either.

The chief sources of soda flux for making glass are usually attributed to plant ash or evaporites. Only ash derived from marine organisms (e.g. seaweed, coastal salt marsh vegetation), or soda in the form of coastal marine evaporites, can provide a Ce-depleted REE pattern.

Fustat's semi-arid desert environment and easy access to coastal marine evaporite deposits favours their exploitation over the use of ash from the terrigenous vegetation of desert areas.

Alternatively, if lime used to make the glass was obtained by heating up seashells, then the seawater signature could also have been inherited. Glassmaking centres in regions with abundant forests, such as Europe or India, coupled with limited access to evaporite deposits, would predictably derive flux from more potassic ash.

The available information on Fustat as a glassmaking centre makes it a primary candidate for producing the beads found in South Africa. To test this connection, some beads reported to have been made at Fustat, including *seed* beads and *Fustat Fused Rod Beads*, have been compared with material from archaeological sites in South Africa and sites in Syria, Palestine and Southeast Asia.

Soil salts from alluvial plains in India, for example, will not produce a Ce anomaly, except if they are (or have been) situated in close proximity to coastal deltas where evaporation will involve mixtures of river and seawater. The Ganges delta and the Indus delta (possibly to a lesser extent) are characterised by extensive wetlands, whereas the Nile delta and other Mediterranean/Red sea estuaries are more arid. It is unlikely, therefore, that evaporitic salts would be found at Indian sources. In terms of the REEs, Indian soil salts will not have the Ce anomaly, because there is limited REE distinction between plants or soils. This is not to say, however, that there may not be other types of geochemical variation. Soil salts would probably have more rock-derived impurities.

....

Table 8.3.1.1. REE & trace-element (zircon & titanium) analyses of glass beads, bracelets, & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (concentrations reported in ppm).

+ = University of Pretoria
# = National Cultural History & Open Air Museum, Pretoria

Sampl	UCT accession	Location	Colour	Diap	R.I.	Type	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ti	Zr
		SOUTHERN AFRICA (Northern Transvaal)																				
	+	Site: K2																				
86	K2-567-127	K2-TS3-layer 2	shadow blue	TL	1.5202	Ia	4.48	4.99	1.62	8.72	2.87	<1.0	3.23	<1.00	3.18	<1.00	<1.00	<1.00	1.05	<1.00	380.0	56.0
87	K2-632(i)-128	K2-TR-D4/a1/1	TP turquoise	TP	1.5290	IIa	11.23	13.73	3.06	15.23	4.55	<1.0	4.76	<1.00	5.11	<1.00	1.25	<1.00	1.85	<1.00	720.0	154.0
88	K2B-650-54	K2B-BLOCK:10 -layer13	blue green	OP	1.5203	Ia	5.73	9.40	<1.00	5.84	<1.00	<1.0	2.10	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1141.0	42.1
89	K2-466-53	KS. skeleton No.60	deep turquoise	TL	1.5247	IIa	10.20	16.50	2.45	9.03	1.83	<1.0	2.28	<1.00	2.09	<1.00	<1.00	<1.00	<1.00	<1.00	1550.0	105.5
90	K2-463-51	KS. skeleton No.18	yellow	OP	1.5360	IIa	8.58	12.80	2.72	11.70	2.56	<1.0	2.99	<1.00	4.03	<1.00	1.68	<1.00	1.48	<1.00	2316.0	73.9
91	K2-595-126	K2-TS6-layer 5	"Indian" red	OP	1.5179	IIa	40.95	61.73	9.02	38.88	10.94	<1.0	9.43	<1.00	9.23	<1.00	2.31	<1.00	4.64	<1.00	2456.0	560.0
92	K2-466-52	KS. skeleton No.60	blue green	TP	1.5151	IIa	18.30	36.00	3.27	19.10	4.50	<1.0	3.54	<1.00	4.81	1.07	3.56	<1.00	2.77	<1.00	2522.0	156.4
	+	Site: Mapungubwe Hill (MST & E2)																				
93	MAPK-239-129	A3M-36"/-42"	clear crystal	TP	1.5510	IIa	<1.00	<1.00	<1.00	5.80	1.65	<1.0	3.06	<1.00	2.37	<1.00	<1.00	<1.00	<1.00	<1.00	2.8	<1.00
94	MAPK-17-130	MK. skeleton No.14	deep turquoise	OP	1.5193	IIa	4.02	5.27	1.76	10.00	3.45	<1.0	4.16	<1.00	3.39	<1.00	<1.00	<1.00	1.32	<1.00	582.0	46.0
95	MAPK-26-59	M.5.1.11'20'5' (skeleton)	celedon green	OP	1.5404	WIb	3.53	4.66	<1.00	3.81	1.54	<1.0	1.89	<1.00	1.06	<1.00	<1.00	<1.00	<1.00	<1.00	821.7	33.1
96	MAPST-300-63	MST-B3M-Z/-6" dosie 43/54	blue green	OP	1.5312	IIa	4.51	6.53	<1.00	3.04	<1.00	<1.0	2.03	<1.00	1.74	<1.00	<1.00	<1.00	1.61	<1.00	829.1	51.0
97	MAPK-47-140	MK. skeleton No.25	"Indian" & olive	TL	1.5340	IIa	10.04	13.27	2.59	12.91	3.57	<1.0	5.94	<1.00	4.75	<1.00	1.05	<1.00	2.31	<1.00	1075.0	188.0
98	MAPST-355-64	MST-layer 2(i): Block :F4 B6	blue green	OP	1.5290	IIa	5.14	9.34	<1.00	4.91	1.26	<1.0	2.56	<1.00	1.22	<1.00	<1.00	<1.00	<1.00	<1.00	1214.0	65.2
99	MAPK-189-60	MK3-layer 5: Block :A1 B15	medium bright green	OP	1.5530	IIa	6.41	12.50	1.41	10.90	<1.00	<1.0	3.19	<1.00	1.37	<1.00	<1.00	<1.00	<1.00	<1.00	1357.0	65.6
100	MAPK-196-62	MK3-layer 3: Block:A2 B8	yellow	OP	1.5400	IIa	6.01	10.10	1.11	8.05	1.38	<1.0	2.31	<1.00	1.43	<1.00	<1.00	<1.00	1.18	<1.00	1534.0	59.7
101	E2-703-65	E2-Block:B11 DET:-12"/-18".	yellow	OP	1.5439	IIa	3.56	12.20	1.39	9.96	1.20	<1.0	2.56	<1.00	3.81	<1.00	<1.00	<1.00	<1.00	<1.00	1728.0	59.8
102	MAPK-196-61	MK3-layer 3: Block:A2 B8	blue green	OP	1.5223	IIa	6.98	13.60	1.86	9.05	1.86	<1.0	2.28	<1.00	1.18	<1.00	<1.00	<1.00	<1.00	<1.00	1858.0	71.1
	#	Site: Pont Drift																				
104	PON-9-74	TPD 1/2 OPG 2:A1 layer 8	bright dusty yellow	TL	1.5212	IIa	118.20	223.90	26.90	103.00	20.40	2.26	6.68	3.60	10.50	1.50	5.13	<1.00	6.01	<1.00	4616.0	1182.0
105	PON-21-72	TPD 1/2 OPG 2:B1 layer 6	blue green	TL	1.5301	IIa	92.40	207.50	22.50	107.10	22.90	2.93	11.50	2.91	10.60	2.13	4.68	<1.00	4.73	1.57	5694.0	2083.0
106	PON-37-71	TPD 1/2 OPG 2:2A layer 6	blue green	TL	1.5342	IIa	110.30	224.40	18.90	101.80	20.50	3.38	11.20	2.41	11.80	1.70	5.83	<1.00	4.90	<1.00	5996.0	1096.0
107	PON-47-75	TPD 1/2 OPG 2:2AA layer 6	TP turquoise	OP	1.5299	IIa	133.50	284.60	33.20	160.10	14.80	4.64	7.20	3.20	8.18	2.08	5.75	<1.00	6.81	1.09	6690.0	1451.0
108	PON-61-73	TPD 1/2 OPG 2:2B layer 11	bright dusty yellow	TP	1.5270	IIa	129.10	276.90	30.50	203.10	14.30	4.29	26.50	2.45	13.10	2.25	6.20	<1.00	5.97	1.30	6922.0	2261.0
	#	Site: Schroda																				
109	SCH-45-79	TSR 1/1-OPG 6:B4 layer	vaseline yellow	TL	1.5285	Ia	11.60	23.90	1.02	12.30	1.95	1.11	<1.00	<1.00	<1.00	<1.00	3.20	<1.00	<1.00	<1.00	496.3	99.1
110	SCH-35-77	TSR 1/1-OPG 3:C1 layer 1	dark shadow blue	TL	1.5201	Ia	3.85	6.34	<1.00	6.46	1.33	<1.0	2.63	<1.00	1.33	<1.00	<1.00	<1.00	<1.00	<1.00	560.1	42.0
111	SCH-123-80	TSR 1/1-OPG 6:2f layer 1.a.	dark shadow blue	TL	1.5568	Ia	11.40	28.70	3.09	11.60	1.14	1.21	<1.00	<1.00	1.84	<1.00	<1.00	<1.00	1.21	<1.00	738.4	158.1
112	SCH-69-76	TSR 1/1-OPG 6:6B layer 4	bright dusty yellow	TL	1.5253	Ia	10.50	24.40	2.40	29.40	4.12	1.02	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	892.2	151.1
113	SCH-14-81	TSR 1/1-OPG 2:4a Layer 2	blue green	TL	1.5300	IIa	14.20	31.50	3.07	19.70	3.79	1.24	<1.00	<1.00	1.73	<1.00	<1.00	<1.00	3.36	<1.00	956.3	128.1
114	SCH-78-78	TSR 1/1-OPG 6:C4 layer 4	dark shadow blue	TP	1.5109	Ia	5.21	10.60	1.62	7.56	1.67	<1.0	3.47	<1.00	1.44	<1.00	<1.00	<1.00	<1.00	<1.00	956.2	72.3
115	SCH-174-82	TSR 1/1-OPG 6:5c layer 5	shadow blue	TP	1.5221	Ia	15.00	38.60	5.40	26.10	3.09	<1.0	<1.00	<1.00	2.94	<1.00	<1.00	<1.00	<1.00	<1.00	2562.0	417.1
116	SCH-191-83	TSR 1/1-OPG 6:6A layer 2	blue green	TL	1.5351	IIa	83.10	217.20	20.20	101.00	17.80	3.12	5.10	1.75	11.70	1.60	4.60	<1.00	3.66	<1.00	4638.0	1184.0
	#	Site: Skutwater																				
117	SK-318-84	TWS 1/1:E11 layer 4	celedon turquoise	OP	1.5280	IIa	24.70	43.50	5.26	26.70	5.58	1.75	<1.00	<1.00	2.78	<1.00	2.05	<1.00	1.21	<1.00	2065.0	252.2
118	SK-319-85	TWS 1/1:E11 layer 5	celedon turquoise	TP	1.5281	IIa	14.50	34.10	5.35	35.20	6.29	<1.0	<1.00	<1.00	<1.00	1.06	<1.00	<1.00	1.18	<1.00	1769.0	150.7
119	SK-332-86	TWS 1/1:E11/142 layer 9IB2D	black	OP	1.5391	IIa	142.00	267.30	27.90	116.50	14.00	3.59	4.10	1.40	3.96	1.69	5.01	<1.00	1.97	<1.00	6192.0	1547.0
120	SK-332-87	TWS 1/1:E11/142 layer 9IB2D	TP turquoise	TP	1.5250	IIa	91.10	149.10	16.10	79.90	14.50	1.94	1.76	<1.00	3.93	<1.00	3.28	<1.00	2.15	<1.00	2029.0	648.7
121	SK-332-88	TWS 1/1:E11/142 layer PCB2	TP turquoise	TP	1.5234	Ia	102.30	202.30	23.50	92.50	12.60	1.53	2.87	1.61	9.80	1.42	6.45	<1.00	5.03	<1.00	2346.0	928.4
122	SK-334-89	TWS 1/1:E14 layer 1	blue green	TP	1.5175	IIa	24.10	46.20	6.22	30.90	6.29	2.26	<1.00	<1.00	<1.00	<1.00	1.68	<1.00	<1.00	<1.00	1922.0	313.7
123	SK-334-90	TWS 1/1:E14 layer 1	bright dusty yellow	OP	1.5205	IIa	32.10	63.70	8.03	35.00	9.26	2.19	<1.00	<1.00	1.68	<1.00	1.07	<1.00	<1.00	<1.00	2903.0	332.1
124	SK-337-91	TWS 1/1:E14 layer 4	TP turquoise	TP	1.5200	IIa	31.60	58.90	7.17	40.40	7.53	2.51	<1.00	<1.00	1.05	1.40	1.52	1.20	<1.00	<1.00	2731.0	318.1

Table 8.3.1.1. REE & trace-element (zircon & titanium) analyses of glass beads, bracelets, & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (concentrations reported in pmm) (continued).

! = E. Wilmsen & J. Denbow
* = Van Riet Lowe Collection
+ = University of Pretoria
^ = University of Cape Town
# = National Cultural History & Open Air Museum, Pretoria

Sampl	UCT accession	Location	Colour	Diap	RI	Type	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ti	Zr
		SOUTH AFRICA (North-eastern Transvaal)																				
+	+	**Site: Letaba**																				
77	LET-819-57	TER:LET-STRAT:ASGA	deep turquoise	OP	1.5247	IIa	56.10	86.40	12.00	57.80	5.73	1.54	4.65	<1.00	5.72	1.35	3.19	<1.00	6.29	1.21	6726.0	1240.0
78	LET-821-58	TER:LET-6.6:Layer 1	TP turquoise	TP	1.5250	IIa	65.00	100.20	12.80	55.70	9.21	1.19	7.58	<1.00	5.31	1.95	6.92	1.04	7.64	<1.00	7878.0	1302.0
+	+	**Site: Shikumbu**																				
79	SHI-885-124	TER:NKW SH3-STRAT:layer 1	dark brown	TL	1.5400		3.08	3.00	1.14	7.93	2.93	<1.0	3.93	<1.00	3.43	<1.00	<1.00	<1.00	1.16	<1.00	279.0	20.0
+	+	**Site: Olifants Rivier**																				
80	OLI-935-70	TER:OL OPN. TERREIN 0120	shadow blue	TP	1.5215	Ia	17.80	30.90	4.63	17.50	2.80	1.25	1.73	<1.00	3.91	<1.00	2.22	<1.00	2.69	<1.00	1603.0	269.8
^	^	**Site: Phalaborwa (SPK)**																				
81	PHA-743-120	SPK-III-D-H 7"	deep turquoise	TP	1.5280	IIa	1.99	1.56	1.20	6.43	2.19	<1.0	3.06	<1.00	2.96	<1.00	<1.00	<1.00	1.19	<1.00	187.0	16.0
82	PHA-756-119	SPK-III K 1'5" - 1'6"	deeep turquoise	OP	1.5135	IIa	5.41	6.97	1.92	9.06	2.56	<1.0	3.96	<1.00	3.31	<1.00	<1.00	<1.00	<1.00	<1.00	567.0	41.0
83	PHA-773-122	MN3-House 2: 1-12"	blue green	TL		IIa	5.72	6.08	2.00	9.68	2.75	<1.0	4.70	<1.00	3.72	<1.00	<1.00	<1.00	1.29	<1.00	730.0	65.0
84	PHA-770-121	MN3-House 1: Unit 2 0-12"	blue green	OP	1.5255	broken	8.71	11.25	2.35	13.08	3.73	<1.0	5.08	<1.00	4.47	<1.00	<1.00	<1.00	1.42	<1.00	1019.0	96.0
85	PHA-773-123	MN3-House 2: 1-12"	"Indian" red	OP	1.5191	IIa	9.13	13.57	2.63	13.38	4.60	<1.0	5.16	<1.00	4.65	<1.00	<1.00	<1.00	1.99	<1.00	1218.0	112.0
		SOUTH AFRICA (North-western Transvaal)																				
	#	**Site: Makahane**																				
103	K?-MAK2-125	MAK-2 (surface) south terrace:	pale celedon	OP	1.5400	WIb	3.50	3.94	1.44	8.26	2.93	<1.0	3.92	<1.00	3.06	<1.00	<1.00	<1.00	1.06	<1.00	497.0	37.0
	#	Site: Diamant																				
125	AUK-1-98	DIA-D1-17	shadow blue	TL	1.5195	Ia	1.67	3.51	<1.00	1.65	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	212.4	28.3
126	AUK-1-133	DIA-D1-17	bright shadow blue	TP	1.5203	IIa	3.55	3.09	1.21	7.90	2.48	<1.0	4.51	<1.00	3.38	<1.00	<1.00	<1.00	<1.00	<1.00	235.0	36.0
	#	Site: Goegap																				
127	K?-GOE5-99	GG2-SquareI:1-layer 2	TP turquoise	TP	1.5275	Ia	3.66	6.46	<1.00	3.06	<1.00	<1.0	1.05	2.04	2.43	<1.00	<1.00	<1.00	<1.00	<1.00	462.5	25.7
		BOTSWANA																				
	!	**Site: Kgaswe**																				
1	BOT-785-56	KG-Hut floor (in pot)	blue green	TP	1.5235	IIa	44.30	75.90	9.32	39.70	7.44	<1.0	7.00	<1.00	3.99	1.08	3.11	<1.00	3.54	<1.00	3213.0	676.5
2	BOT-785-55	KG-Hut floor (in pot)	"Indian" red	OP	1.5192	IIa	58.50	125.90	12.30	48.50	11.20	<1.0	5.92	<1.00	5.68	1.33	3.61	<1.00	4.16	<1.00	4937.0	809.1
	!	Site: Matlapaneng																				
3	BOT-786-66	MAT-281.275:55-65cm	shadow blue	TP	1.5175	Ia	20.30	34.20	2.41	17.30	3.85	<1.0	2.09	<1.00	2.99	<1.00	2.48	<1.00	1.38	<1.00	1734.0	243.7
	!	**Site: Nqoma**																				
4	BOT-779-69	NQ-40.00:60-70cm	TP turquoise	TP	1.5255	IIa	34.60	54.80	7.72	39.40	12.10	1.40	10.90	2.60	9.23	1.96	4.19	<1.00	3.59	<1.00	<1.00	360.7
5	BOT-776-68	NQ-180w.107n:60-70cm	shadow blue	TP	1.5281	Ia	40.80	76.70	9.35	47.50	10.30	2.99	9.33	2.22	10.50	1.45	4.76	<1.00	3.59	<1.00	<1.00	390.6
6	BOT-774-67	NQ-80.625:40-50cm	blue green	OP	1.5231	IIa	29.80	61.70	4.80	24.60	3.92	<1.0	3.19	<1.00	2.07	<1.00	1.33	<1.00	1.65	<1.00	3821.0	445.8
		EAST AFRICA																				
	*	Site: Sofala																				
13	VRL-SOF-93	Sofala	dirty yellow	OP	1.5337	IIa	56.60	101.30	10.80	57.10	7.11	<1.0	6.24	<1.00	3.90	1.27	3.27	<1.00	4.13	<1.00	3967.0	400.1
14	VRL-SOF-92	Sofala	"Indian" red	OP	1.5243	IIa	91.40	164.80	17.50	83.00	12.30	2.94	14.30	1.31	8.72	1.53	5.16	<1.00	5.61	<1.00	7130.0	558.8

Table 8.3.1.1. REE & trace-element (zircon & titanium) analyses of glass beads, bracelets, & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (concentrations reported in pmm) (continued).

^ = University of Cape Town
S = George Scanlon
MS = Israel Museum
* = Van Riet Lowe Collection
W = Wellington Museum

Sampl	UCT accession	Location	Colour	Diap	RI	Type	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ti	Zr
		EGYPT																				
	W	Site: Tel el-Amarna																				
26	VRL-FUS-20	Tel el-Amarna	turquoise	TL	1.5721	rod	20.00	44.90	5.79	43.50	8.23	2.35	8.06	1.65	3.97	2.85	2.98	<1.00	1.03	1.39	2331.0	356.9
	*	Site: Fustat																				
20	VRL-FUS-17a	Fustat	bright navy	TP	1.5300	IIa	5.52	13.40	2.46	15.50	1.94	<1.0	3.10	<1.00	<1.00	<1.00	1.91	<1.00	<1.00	<1.00	121.2	5.3
21	VRL-FUS-134	Fustat	clear crystal	TP	1.5250	IIa	2.89	2.47	1.32	7.69	2.43	<1.0	3.49	<1.00	2.99	<1.00	<1.00	<1.00	<1.00	<1.00	315.0	13.0
22	VRL-FUS-109	'Fustat Fused Rod Bead' "eye"	multi-colour	OP	1.5490	FFRB	4.03	4.30	1.49	8.33	3.16	<1.0	3.45	<1.00	2.72	<1.00	<1.00	<1.00	<1.00	<1.00	351.0	44.0
23	VRL-FUS-110	'Fustat Fused Rod Bead'	multi-colour	OP	1.5420	FFRB	6.14	7.87	2.12	11.03	2.93	<1.0	4.00	<1.00	3.51	<1.00	<1.00	<1.00	1.47	<1.00	625.0	52.0
23a	VRL-FUS-136	Fustat (t'alhakimt)	'Indian' & olive	TL	1.5500	arrow	10.27	13.04	3.16	13.48	3.80	<1.0	4.22	<1.00	<1.00	<1.00	1.57	<1.00	1.57	<1.00	887.0	61.0
24	VRL-FUS-135	Fustat	black & yellow	OP	1.5493	WIIIj	5.48	6.20	1.91	9.35	3.06	<1.0	4.25	<1.00	3.16	<1.00	<1.00	<1.00	1.05	<1.00	793.0	67.0
25	VRL-FUS-18	Fustat	clear crystal	TP	1.5296	IIa	25.40	36.90	4.77	43.20	7.83	<1.0	3.92	1.68	5.96	3.08	8.31	<1.00	3.46	1.85	2047.4	261.3
27	VRL-FUS-24	Fustat	bright green	TL	1.5405	IIa	57.20	77.20	8.59	46.30	4.67	<1.0	5.23	<1.00	3.61	<1.00	2.20	<1.00	1.20	<1.00	3248.0	798.4
		PALESTINE																				
	MS	Site: Khirbet el-Minyeh																				
54	SPA-IS-46	Khirbet el-Minyeh	bright navy	TP	1.5178	Brclt	1.83	3.56	<1.00	2.51	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	168.3	12.2
55	SPA-IS-45	Khirbet el-Minyeh	dark navy	TL	1.5300	Brclt	1.67	3.83	<1.00	<1.00	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	242.4	88.0
56	SPA-IS-47	Khirbet el-Minyeh	light turquoise	TL	1.5002	Brclt	2.85	8.04	<1.00	2.87	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	570.6	162.2
	^	Site: Kibbutz Ginosar																				
57	UCT-131	Kibbutz Ginosar	amber/turq & yellow	TP	1.5329	Brclt	2.21	1.93	1.09	7.08	1.67	<1.0	2.97	<1.00	2.38	<1.00	<1.00	<1.00	<1.00	<1.00	134.0	30.0
	*	Site: Hebron																				
58	VRL-48	Hebron	dirty yellow	OP	1.5529	Wnd	8.15	18.60	2.16	13.20	1.37	<1.0	<1.00	<1.00	2.23	<1.00	<1.00	<1.00	1.28	<1.00	1530.0	177.9
59	VRL-49	Hebron	celedon green	OP	1.5499	Wnd	9.28	23.20	3.23	8.96	<1.00	<1.0	2.98	<1.00	3.23	<1.00	<1.00	<1.00	1.36	<1.00	1501.0	178.3
		SYRIA																				
	*	Site: Ba'albakk																				
15	VRL-EGY-15	Ba'albakk	bottle green	TP	1.5256	WIb	<1.00	<1.00	<1.00	<1.00	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	17.5	1.1
16	VRL-EGY-16	Ba'albakk	green turquoise	TP	1.5272	WIb	1.28	<1.00	1.03	<1.00	<1.00	<1.0	<1.00	<1.00	1.62	<1.00	<1.00	<1.00	<1.00	<1.00	46.8	<1.00

Table 8.3.1.1. REE & trace-element (zircon & titanium) analyses of glass beads, bracelets, & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (concentrations reported in pmm) (continued).

~ = Peter Francis Jr.

Sampl	UCT accession	Location	Colour	Diap	RI	Type	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ti	Zr
		SOUTHEAST ASIA																				
		India																				
	~	Site: Arikamedu-Viram-Pattinam																				
28	FRA-AV-42	XI-027:a	pale turquoise	TP	1.5012	cullet	1.01	5.77	<1.00	1.06	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	108.5	17.6
29	FRA-AV-43	XI-027:b	pale green	TP	1.5011	cullet	1.41	10.40	<1.00	<1.00	1.26	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.43	<1.00	187.1	40.4
30	FRA-AV-34	XI-003:b (late Medieval)	mid blue	TP	1.5068	cullet	4.90	17.60	<1.00	1.87	2.89	<1.0	2.19	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	324.6	45.2
31	FRA-AV-33	XI-003:a (late Medieval)	dark mauve	OP	1.5201	cullet	7.10	17.50	1.30	6.03	<1.00	<1.0	1.87	<1.00	1.51	<1.00	<1.00	<1.00	<1.00	<1.00	413.3	83.6
32	FRA-AV-40	XI-67a (n.d. - early)	dark mauve	OP	1.4945	cullet	6.15	19.10	1.08	10.40	1.71	<1.0	3.47	<1.00	1.61	<1.00	<1.00	<1.00	<1.00	<1.00	436.1	26.8
33	FRA-AV-25	VI-013 (imported?)	bright green	TP	1.5323	cullet	1.90	7.21	<1.00	3.43	<1.00	<1.0	1.48	<1.00	1.41	<1.00	<1.00	<1.00	<1.00	<1.00	445.5	35.6
34	FRA-AV-36	XI-004:b-late Medieval:loci	shadow blue	TP	1.5076	cullet	4.84	17.60	<1.00	4.86	<1.00	<1.0	3.09	<1.00	<1.00	<1.00	2.55	<1.00	<1.00	<1.00	532.4	83.2
35	FRA-AV-41	XI-67:b (n.d. - early)	dark mauve	OP	1.5000	cullet	8.78	24.10	1.91	13.00	2.04	<1.0	4.66	<1.00	1.60	<1.00	<1.00	<1.00	<1.00	<1.00	614.3	41.8
36	FRA-AV-27	VII-004:b	bright blue	TP	1.5048	cullet	11.30	122.60	3.91	16.20	6.54	1.13	3.39	<1.00	4.16	<1.00	1.74	<1.00	1.95	<1.00	650.9	61.9
37	FRA-AV-30	VII-052:early/late Medieval	medium green	TP	1.5101	cullet	9.12	25.20	2.57	12.10	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.48	<1.00	762.7	142.3
38	FRA-AV-32	VII-114 (9BC - AD10)	bright blue	TP	1.5102	cullet	13.30	41.00	3.62	13.60	3.04	<1.0	3.47	<1.00	<1.00	<1.00	<1.00	<1.00	1.58	<1.00	845.1	77.5
39	FRA-AV-29	VII-007:b-late Medieval:loci	medium green	TL	1.4994	cullet	8.73	24.70	1.40	19.50	1.68	<1.0	1.70	<1.00	2.47	<1.00	<1.00	<1.00	1.76	<1.00	955.6	151.7
40	FRA-AV-38	XI-030a(local or import?)	lichen green	OP	1.5371	cullet	20.90	61.00	5.66	28.90	6.55	1.05	6.06	<1.00	3.04	<1.00	1.73	<1.00	2.98	<1.00	1081.0	199.1
41	FRA-AV-28	VII-007:a-late Medieval:loci	"Indian" red	OP	1.5127	cullet	13.20	38.10	3.02	20.10	1.56	<1.0	2.16	<1.00	1.39	<1.00	1.08	<1.00	2.16	<1.00	1841.0	272.2
42	FRA-AV-26	VII-004:a	"Indian" red	OP	1.5162	cullet	15.60	40.30	3.19	18.30	1.77	<1.0	2.67	<1.00	<1.00	<1.00	<1.00	<1.00	1.32	<1.00	1896.0	252.5
43	FRA-AV-35	XI-004:a-late Medieval:loci	black	OP	1.5175	cullet	24.40	60.50	6.90	30.60	4.54	1.46	6.60	<1.00	2.55	<1.00	<1.00	<1.00	3.48	<1.00	2742.0	230.2
44	FRA-AV-37	XI-004:c-late medieval:loci	"Indian" red	OP	1.5096	cullet	29.30	63.00	5.77	29.60	5.53	<1.0	5.81	<1.00	2.70	<1.00	1.74	<1.00	1.94	<1.00	3792.0	581.8
45	FRA-AV-31	VII-108 (10BC - AD20)	"Indian" red	OP	1.5196	cullet	41.60	88.00	7.63	35.20	4.72	1.40	6.71	<1.00	4.55	<1.00	1.81	<1.00	1.87	<1.00	3930.0	563.3
46	FRA-AV-39	XI-030:b (local or import?)	black	OP	1.5101	cullet	38.90	100.20	8.15	43.80	5.23	<1.0	5.77	<1.00	1.67	<1.00	1.60	<1.00	1.10	<1.00	8400.0	658.1
	~	Site: Purdalpur																				
47	FRA-PU-44	PUR-082	"soil salts"	TP	1.5196	cullet	38.80	95.10	9.50	53.20	8.19	<1.0	4.33	<1.00	5.93	1.32	3.38	<1.00	2.69	<1.00	2398.0	179.5
	•	CEYLON																				
7	VRL-CEY-11	Ceylon	bright navy	TP	1.5200	IIa	3.92	5.27	<1.00	6.88	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	869.2	46.7
8	VRL-CEY-13	Ceylon	shadow blue	TP	1.5081	cullet	11.40	83.00	2.90	12.60	2.48	<1.0	1.90	<1.00	<1.00	<1.00	2.01	<1.00	<1.00	<1.00	1169.0	187.9
9	VRL-CEY-9	Ceylon	dirty yellow	OP	1.8517	cullet	8.55	17.70	2.11	6.36	<1.00	<1.0	1.32	<1.00	1.05	<1.00	<1.00	<1.00	<1.00	<1.00	1334.0	212.8
10	VRL-CEY-10	Ceylon	apple green	OP	1.5148	cullet	28.50	51.80	4.51	15.00	2.42	1.53	3.95	<1.00	2.35	<1.00	1.28	<1.00	1.50	<1.00	3084.0	431.3
12	VRL-CEY-12	Ceylon	peacock blue	TL	1.5093	IIa	37.10	77.40	7.60	37.40	7.98	1.45	9.40	1.14	5.94	1.13	3.80	<1.00	3.09	<1.00	5682.0	952.9
11	VRL-CEY-14	Ceylon	"Indian" red	OP	1.5108	cullet	25.40	47.60	4.99	23.90	1.66	1.69	3.42	<1.00	1.36	<1.00	1.01	<1.00	2.17	<1.00	6142.0	669.2
		INDONESIA																				
		Java																				
Bag Q	~	Site: Gunang Wingo																				
48	FRA-Q-50	JAV: V-Y 3	dark green blue	TL	1.5026	IIa	15.30	76.30	1.51	16.20	2.28	1.33	<1.00	<1.00	3.92	<1.00	<1.00	<1.00	2.30	<1.00	1063.0	365.2
		Sumatra																				
Bag K	~	Site: Kambang Unglen (Palembang)																				
49	FRA-K-97	KAM-068 (surface)	turquoise & clear	TP	1.5247	WIIg	9.24	14.00	<1.00	2.90	2.44	<1.0	3.43	<1.00	<1.00	<1.00	<1.00	<1.00	1.03	<1.00	731.8	93.0
50	FRA-K-96	KAM-067 (surface)	black & white	OP	1.5353	WIIg	11.00	23.60	2.11	16.20	2.17	<1.0	2.19	<1.00	1.09	<1.00	1.88	<1.00	1.22	<1.00	1330.0	131.1
51	FRA-K-141	KAM-078 (surface)	"Indian" & olive	TL	1.5340	IIa	20.02	26.28	4.68	19.21	5.63	<1.0	6.52	<1.00	5.61	<1.00	1.14	<1.00	2.21	<1.00	1980.0	243.0
52	FRA-K-94	KAM-065 (surface)	pale citrus	OP	1.5000	IIa	53.70	84.10	9.50	50.20	7.21	1.61	6.85	<1.00	5.42	1.58	2.44	<1.00	1.53	<1.00	5161.0	979.1
53	FRA-K-95	KAM-066 (surface)	"Indian" red	OP	1.5197	IIa	91.10	142.20	18.40	81.90	16.80	3.76	11.00	1.59	7.37	2.86	5.63	1.02	8.64	2.04	7789.0	1361.0

Table 8.3.1.1. REE & trace-element (zircon & titanium) analyses of glass beads, bracelets, & wasters from (1) southern Africa (2) Egypt (3) Palestine (4) Syria (5) India (6) Ceylon (7) Indonesia (8) eastern Malaysia (9) western Malaysia & (10) Thailand (concentrations reported in pmm) (continued).

~ = Peter Francis Jr.

Sampl	UCT accession	Location	Colour	Diap	RI	Type	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ti	Zr
		EASTERN MALAYSIA																				
Bag I	~	Site: Gedong (Sarawak)																				
60	FRA-I-137	GED-053: N/E6 6-12" (SF No.12	blue green	TP	1.5645	IIa	1.20	<1.00	<1.00	5.35	1.39	<1.0	2.60	<1.00	1.88	<1.00	<1.00	<1.00	<1.00	<1.00	54.0	2.9
61	FRA-I-2	GED-048: N/E5 6-12" (SF No.13	yellow green	OP	1.5225	WIIk	18.30	33.80	4.12	20.20	2.60	1.51	3.01	<1.00	2.35	<1.00	1.33	<1.00	<1.00	<1.00	2134.0	336.7
62	FRA-I-1	GED-052: 69/H8 6-12" (Box 164)	"Indian" red	OP	1.5071	WIIk	6.40	93.30	10.30	45.10	7.07	1.01	6.79	<1.00	4.07	1.09	2.31	<1.00	<1.00	<1.00	2608.0	383.4
Bag P	~	Site: Bukit Sandong (Sarawak)																				
63	FRA-P-6	BUK-104: A/2 12-18"	clear crystal	TP	1.5195	WIb	1.48	2.54	<1.00	2.40	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	608.1	115.8
64	FRA-P-4	BUK-105: H/14 0-6"	aqua green	OP	1.5211	WIb	2.72	3.47	<1.00	3.54	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	677.8	126.7
65	FRA-P-5	BUK-106: H/H3 0-6"	sea green	TP	1.5211	WIb	2.30	2.94	<1.00	1.78	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	764.2	169.1
66	FRA-P-3	BUK-107: 0-6"	"Indian" red	OP	1.5560	WIb	13.20	28.40	3.34	14.70	1.71	<1.0	1.80	<1.00	1.03	<1.00	1.54	<1.00	<1.00	<1.00	1580.0	216.9
Bag V	~	Site: Bongkissam (Sarawak)																				
67	FRA-V-8	BON-156: I I 6-12" (1955)	yellow	OP	1.5449	WIIk	16.50	40.40	4.01	15.20	2.67	<1.0	2.28	<1.00	1.61	<1.00	1.99	<1.00	2.68	<1.00	1880.0	285.1
68	FRA-V-7	BON-161: J J 6-12" (1955)	"Indian" red	OP	1.5230	WIIk	67.40	105.00	12.40	57.80	8.31	1.37	5.70	<1.00	4.14	1.02	2.29	<1.00	1.68	<1.00	2283.0	435.2
		WESTERN MALAYSIA																				
	~	Site: Pulau Kelumpang (Kuala Selingsing)																				
71	FRA-PK-108	KS:1-Trench A:40-60cm Pk/5/90	grey blue	TL	1.5181	IIa	24.10	37.90	4.80	24.40	4.41	<1.0	6.89	<1.00	5.64	<1.00	3.43	<1.00	3.87	<1.00	1004.0	389.1
72	FRA-PK-138	KS:1-Trench I:200-220cm Pk/1/8	"Indian" red	OP	1.5193	IIa	14.26	16.90	3.33	16.40	4.20	<1.0	6.08	<1.00	4.87	<1.00	1.88	<1.00	2.29	<1.00	1846.0	409.0
73	FRA-PK-139	KS:1-Trench A:40-60cm Pk/5/90	bright orange	OP	1.5448	IIa	32.17	48.11	6.86	30.71	7.48	<1.0	7.97	<1.00	5.91	<1.00	1.33	<1.00	2.58	<1.00	2366.0	489.0
Bag O	~	Site: Sungai Mas																				
74	FRA-O-111a	SG-MAS-089 (surface finds)	blue mosaic	OP	1.5395	Mos	11.15	14.06	2.92	12.99	3.51	<1.0	4.02	<1.00	3.73	<1.00	<1.00	<1.00	1.59	<1.00	878.0	111.0
75	FRA-O-111	SG-MAS-090 (surface finds)	green mosaic	OP	1.5459	Mos	14.13	18.00	3.76	13.80	3.30	<1.0	4.27	<1.00	4.23	<1.00	<1.00	<1.00	1.81	<1.00	1161.0	122.0
		THAILAND																				
Bag B	~	Site: Klong Thom																				
128	FRA-B-142	KT-008-1 (surface)	light green	TP	1.5162	glass	4.66	5.12	1.58	9.00	2.80	<1.0	3.87	<1.00	3.24	<1.00	<1.00	<1.00	1.27	<1.00	378.0	61.0
129	FRA-B-144	KT-013 (surface)	blue green	TL	1.5275	IIa	20.48	29.60	4.26	21.60	6.58	<1.0	6.23	<1.00	4.66	<1.00	<1.00	<1.00	2.10	<1.00	1800.0	482.0
130	FRA-B-145	KT-014 (surface)	deep turquoise	TL	1.5285	IIa	21.11	34.04	5.02	24.17	6.55	<1.0	7.73	<1.00	5.41	<1.00	1.38	<1.00	3.62	<1.00	2156.0	449.0
131	FRA-B-143	KT-010 (surface)	"Indian" red	OP	1.5225	IIa	21.85	43.93	4.42	20.95	6.08	<1.0	4.81	<1.00	5.19	<1.00	1.51	<1.00	3.00	<1.00	2275.0	542.0
Bag N	~	Site: Takua Pa																				
132	FRA-N-147	TP-087 (surface)	dark green blue	TP	1.5197	IIa	6.45	7.27	1.85	9.71	3.03	<1.0	3.94	<1.00	3.25	<1.00	<1.00	<1.00	1.20	<1.00	459.0	67.0
133	FRA-N-146	TP-084 (surface)	black	OP	1.5532	cullet	1007.79	1633.70	280.00	1197.60	499.00	2.17	478.80	106.90	681.90	138.10	421.80	83.79	631.90	90.15	1907.0	8552.0

8.3.2. Trade implications of REE Chemical Characterisation

The pronounced Ce and Eu anomalies, plus the distinctive steep slope of the LREEs, have been used as indicators to confirm either contact or trading links between archaeological sites some of which are tens of thousands of miles apart. The REE patterns confirm the existence of trade and contact connections, either directly or indirectly, in southern Africa, Egypt, Palestine and Southeast Asia a thousand years ago. Graphs showing the results of selected samples are presented in Figs. 8.3.2.1.- 8.3.2.24.

Some of the beads from Schroda (*ca.* AD 800-900), Pont Drift (*ca.* AD 800-900) and Skutwater (*ca.* AD 1150) have comparable REE signatures (Fig. 8.3.2.5.). The chemistry of these beads is more similar to one another than it is to beads from other sites such as K2 and Mapungubwe. This is somewhat surprising, considering the fact that Van Ewyk (1987:114) showed Skutwater to have a definite inter-relationship with K2 and Mapungubwe. If we accept the argument of Davison (1972) that the same trade beads used in Africa were produced for hundreds of years, then we can explain the temporal disparity. If not, other possibilities should be considered.

The specimen from Takuapa, Thailand is unusual in many respects. It consists of a lump or 'blob' of black siliceous looking material. The REE and trace-elements (ppm) are relatively high (Tables 8.3.1. & Fig. 8.3.2.24). Except for the accessory phase and dilution factor, the chondrite-normalized REE diagrams for the heavy mineral monazite and sand from Richards Bay is almost identical (Fig. 7.6.1.1). If this were a glass, the high REE concentrations would have made the material too refractive to 'work'. This distinctiveness would suggest local provenance.

Sungai Mas in western Malaysia is considered to have been a glass beadmaking site (Francis, pers. comm.). This supposition may very well be correct for some of the beads. However, the REE patterns obtained from the two mosaic bead samples found there show unmistakable similarities to the glass manufactured at Fustat as well. Based on this evidence, and other published references to similar beads (Sherr Dubin 1987; Beck 1930:163-182; Lamb 1966:80-94), there is a strong possibility that either the primary glass used to make the beads originated in Fustat, or that the beads themselves were exported or traded to the site. This hypothesis is consistent with those of other researchers, such as Jacq-Hergoulalc'h (1992), although it does not totally exclude the possibilty that they could have been made locally, bearing in mind that the extent of Mediterranean trading links throughout the Indian Ocean does tend to obscure many of the issues.

Further evidence such as *type* site material or specimens within a firm archaeological context must be used to resolve issues such as these. Chondrite-normalized REE patterns provide definitive signatures for comparative studies on trade and contact for the pre-history period of southern Africa, and have tremendous potential for further research.

The combination of techniques and the results obtained in this study using glass beads is unique to the study of *Early* Islamic glass and the trade which connected southern Africa to Egypt and indeed the Muslim trading world more than a thousand years ago. This information could not have been obtained by any other means. These data have made a significant contribution to our knowledge of ancient glass technology and on glass beads that were in circulation during *ca.* AD 900-1250.

Fig 8.3.2.1. ***South Africa.*** **Chondrite-normalized REE patterns for beads from the Limpopo Basin & eastern Transvaal showing negative Ce anomaly.**

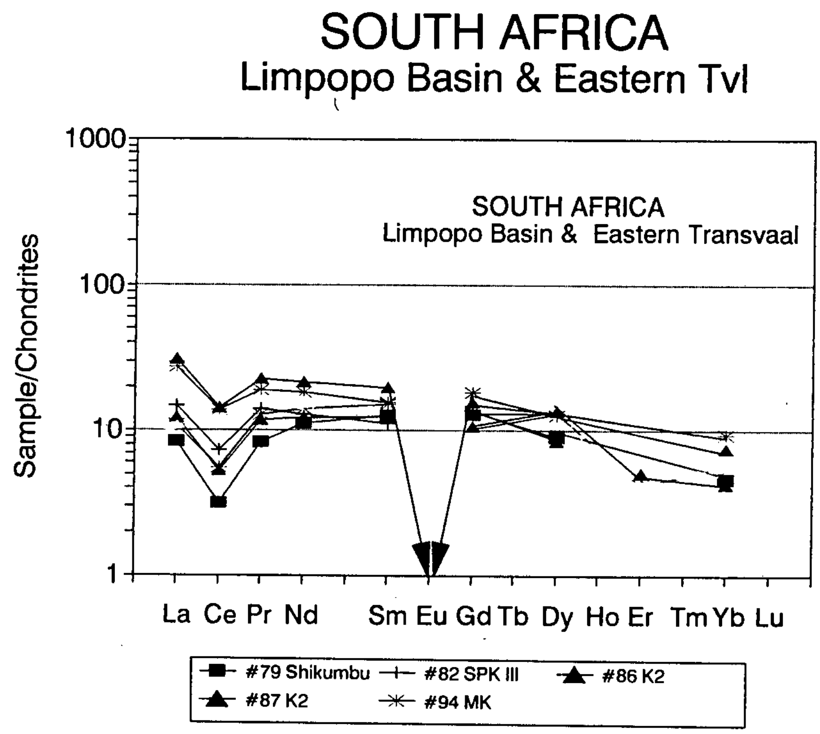


Fig 8.3.2.2. ***South Africa & Egypt.*** **Chondrite-normalized REE patterns of glass made in Fustat compared with beads made from similar glass found in southern Africa.**

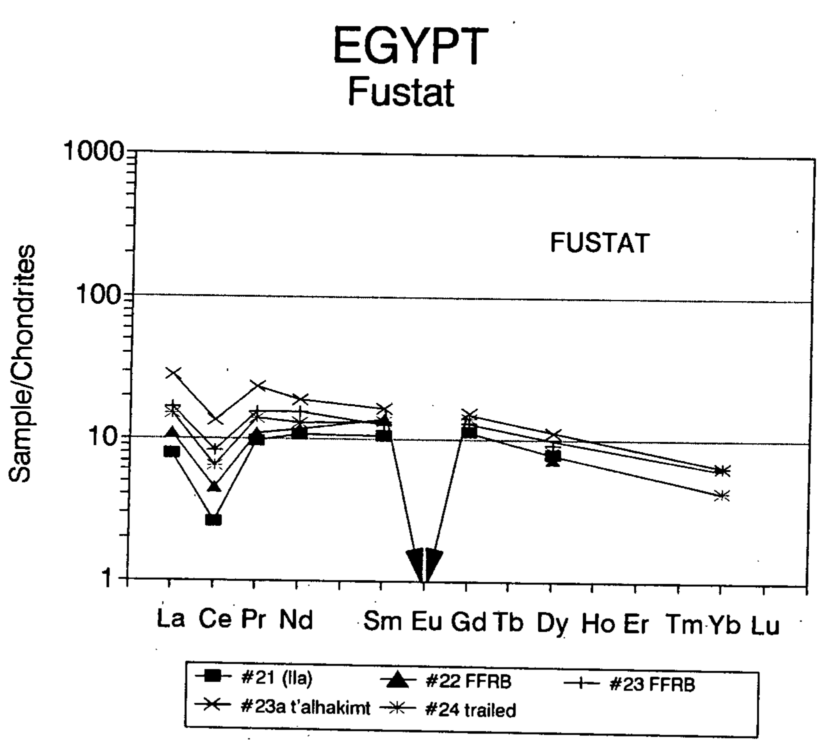


Fig 8.3.2.3. ***South Africa & Indonesia.*** **The chondrite-normalized REE patterns for sample #93 from MK. skeleton is almost identical to #51 from Kambang Unglen in Indonesia. Visually the beads are similar as well.**

NORTHERN TRANSVAAL

GREEFSWALD

MK skeletons

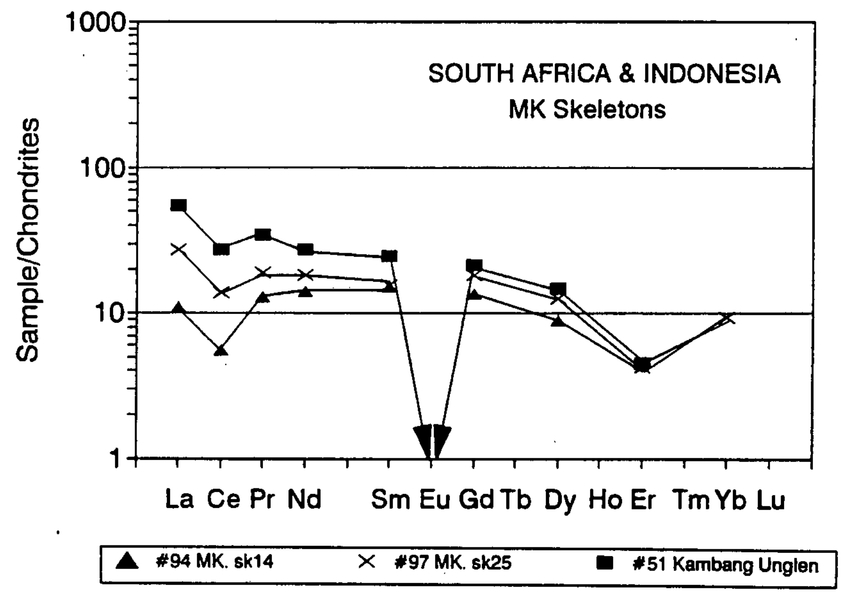


Fig 8.3.2.4. ***Mapungubwe & Makahane.*** **Chondrite-normalized REE for celedon green** ***wound*** **beads. The beads were probably furnace wound.**

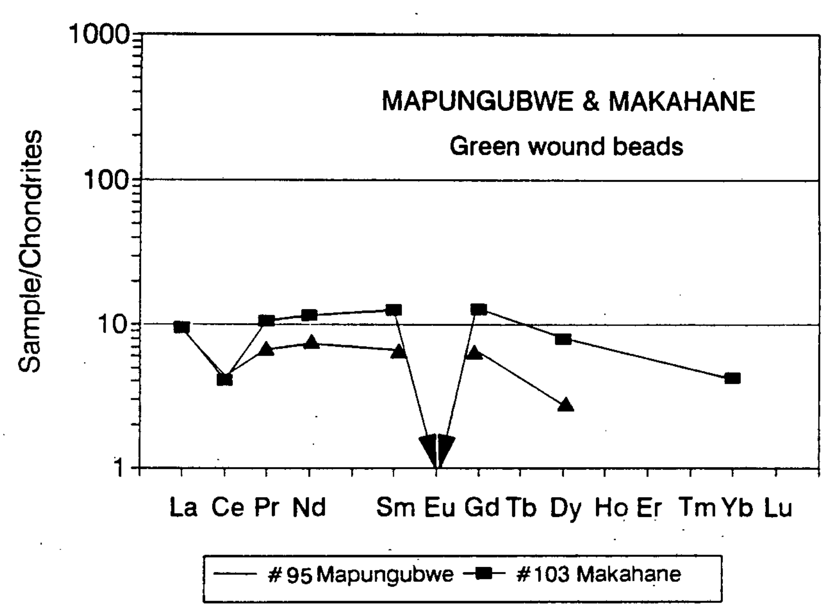


Fig 8.3.2.5. *K2 & Schroda*. Bead #s 88 & 89 are from K2. #110 &#114 are from Schroda. The similar chondrite-normalized REE patterns strongly suggest some type of contact.

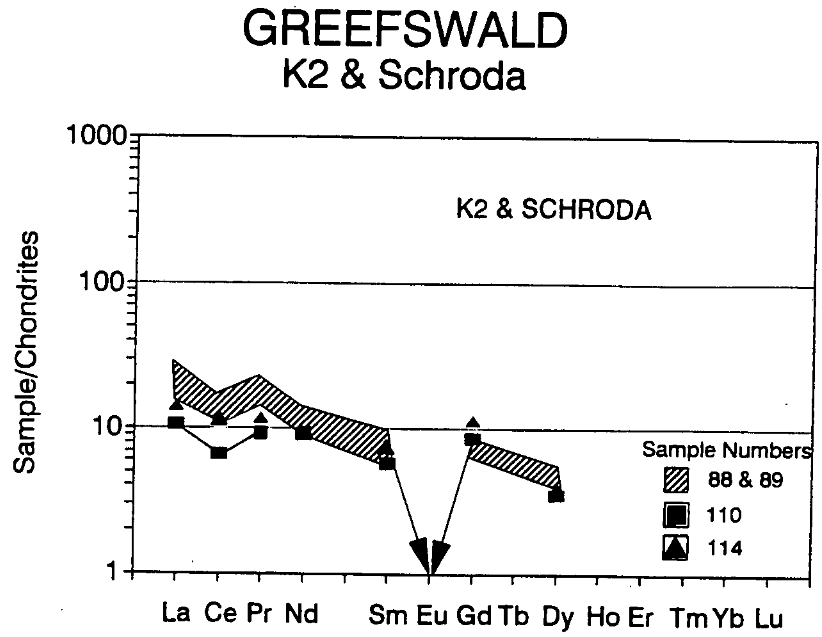


Fig 8.3.2.6. *South Africa and Indonesia*. #s 86, 87 & 91 are from K2. Similar Ce-depleted chondrite-normalized REE patterns were found in bead #51 from Kambang Unglen

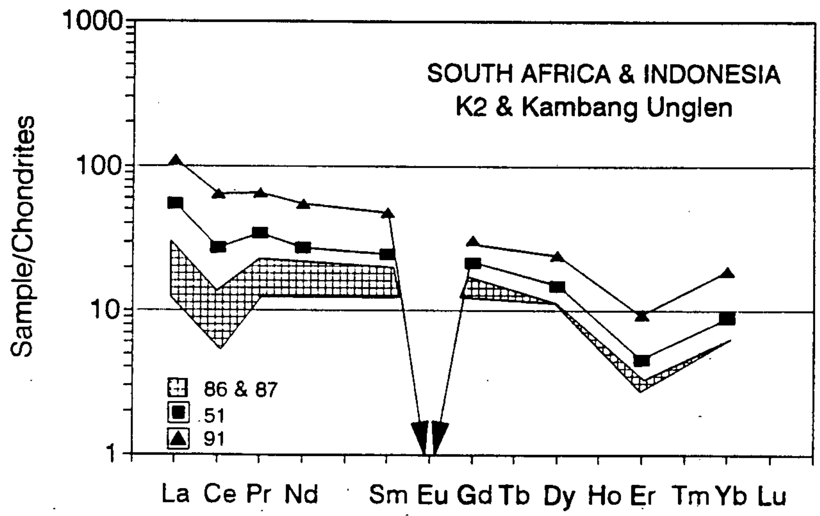


Fig 8.3.2.7. *Skutwater*. Chondrite-normalized REE patterns show that the beads from Skutwater are more similar to Schroda and Pont Drift than to K2 and Mapungubwe.

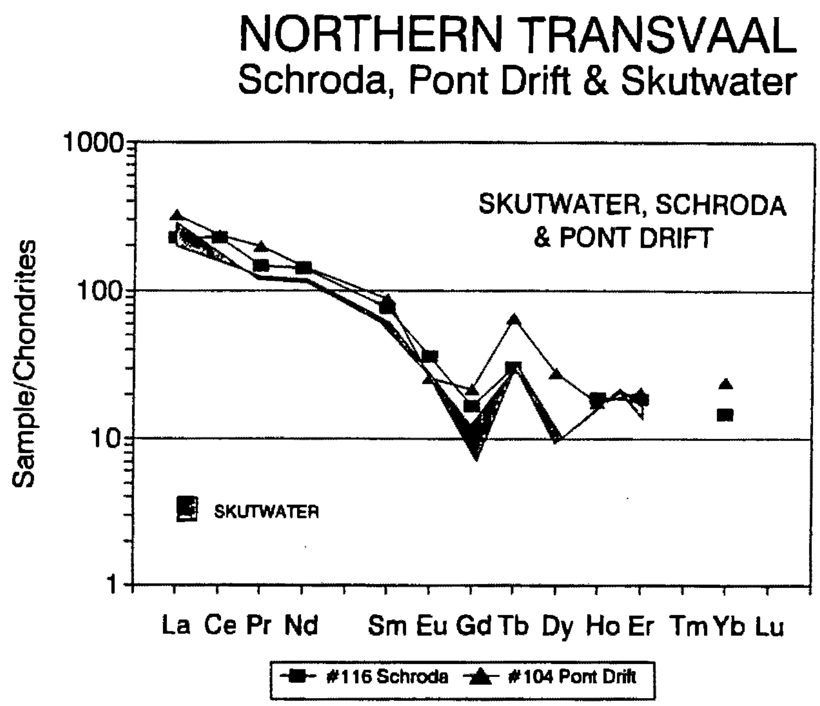


Fig 8.3.2.8. *Northern Transvaal, East Africa and Indonesia*. Chondrite-normalized REE abundances in beads from Pont Drift, Sofala & Kambang Unglen.

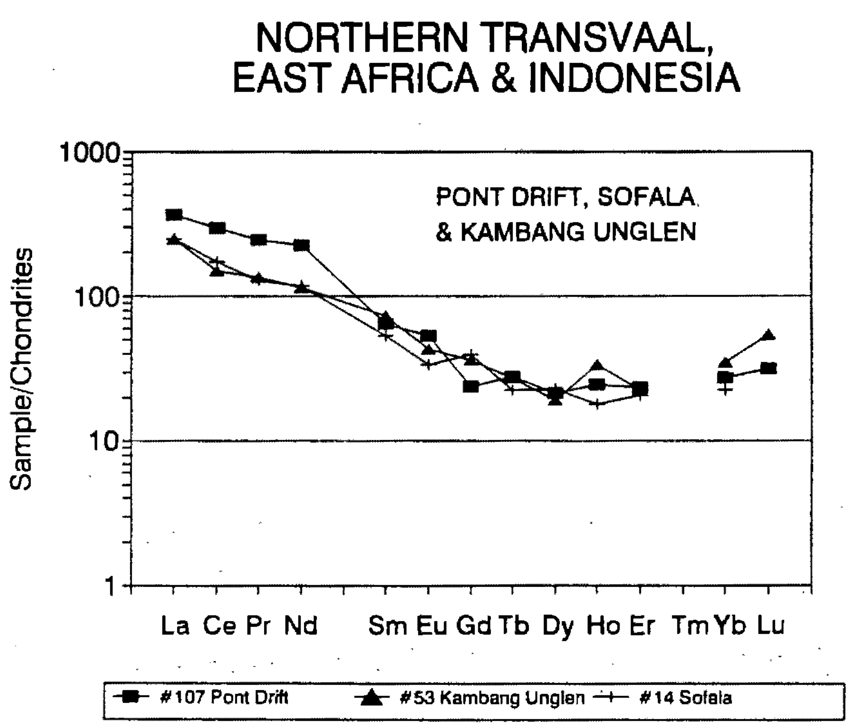


Fig. 8.3.2.9. ***Eastern Transvaal.*** **Similar chondrite-normalized REE patterns between beads found in the eastern Transvaal & Botswana.**

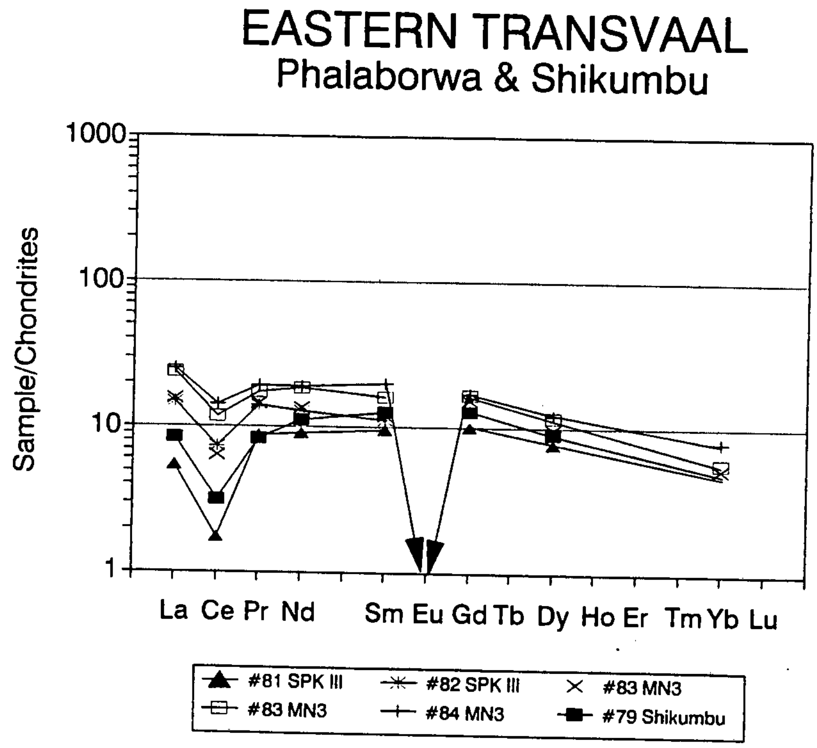


Fig. 8.3.2.10. ***Eastern Transvaal & Botswana.*** **Chondrite-normalized REE abundances in beads from eastern Transvaal & Botswana.**

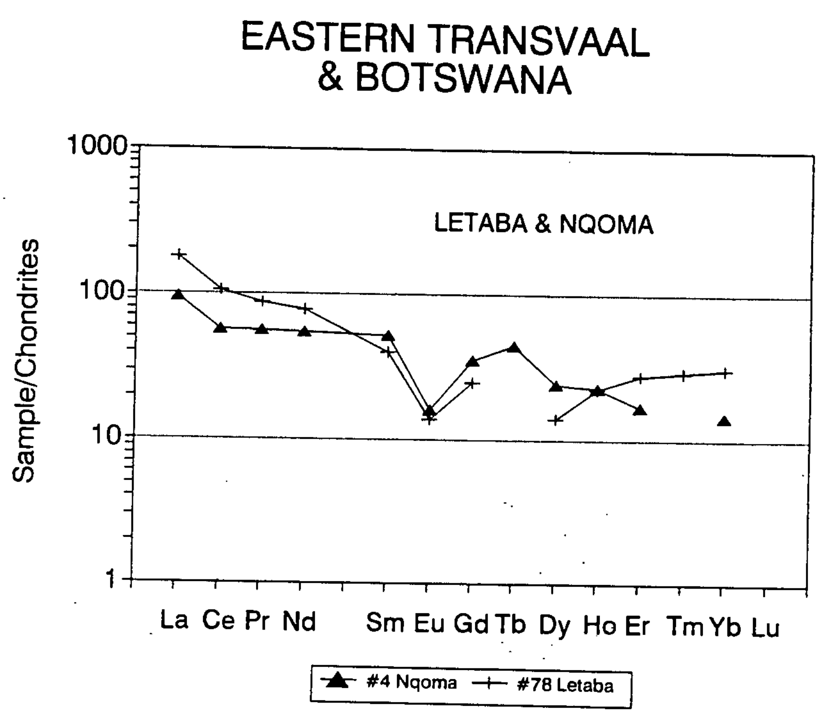


Fig 8.3.2.11. ***Botswana, Eastern Transvaal and Ceylon.*** **Bead #12 is from Ceylon, #4 from Nqoma in Botswana, and #78 is from Letaba in the eastern Transvaal All have similar chondrite-normalized REE patterns.**

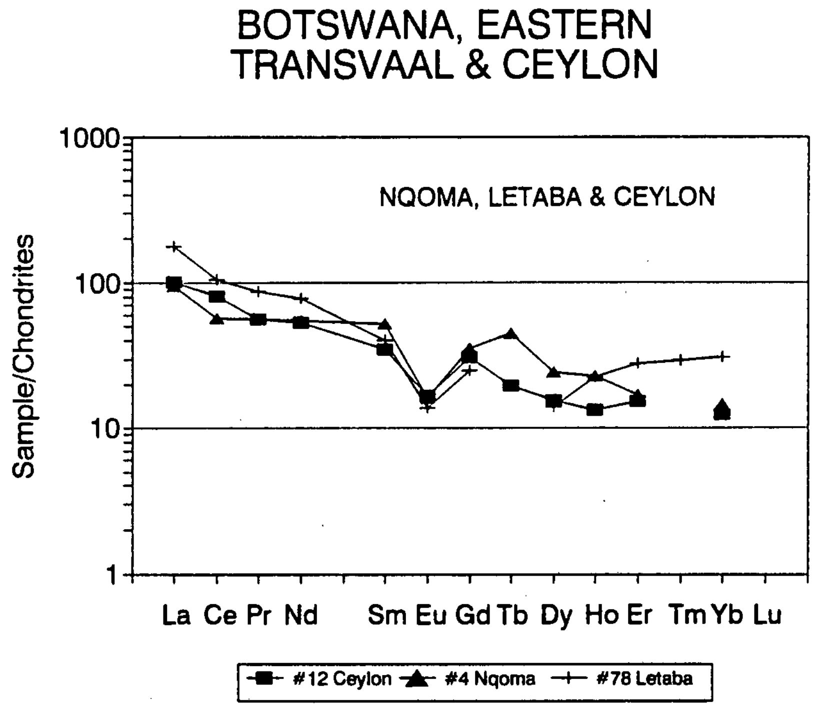


Fig 8.3.2.12. ***Botswana & Egypt.*** **Chondrite-normalized REE patterns in beads #1 & 2 from Kgaswe in Botswana are compared with #27 from Fustat.**

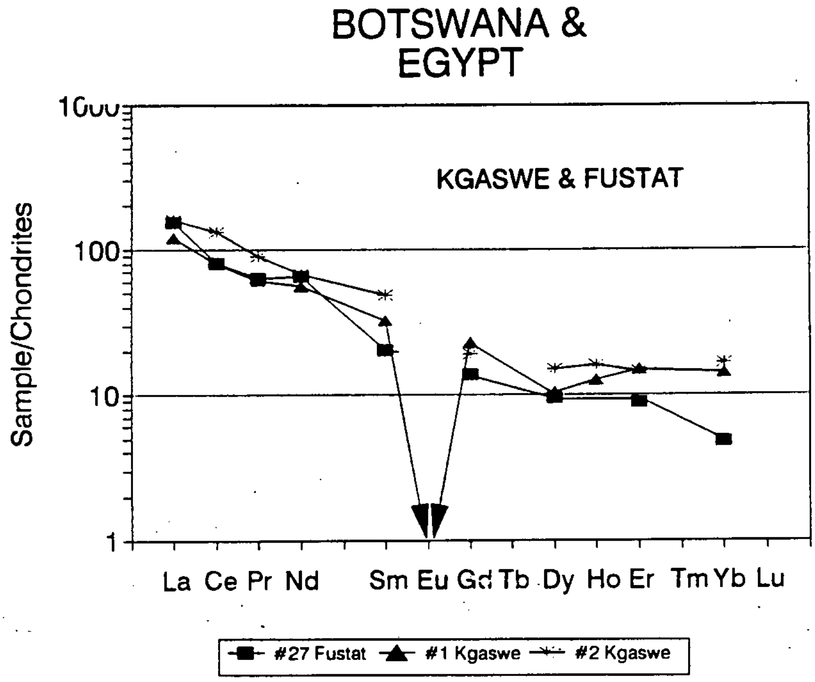


Fig 8.3.2.13. ***India.*** **Chondrite-normalized REE patterns of glass 'waste' material from Arikamedu and Purdalpur have no Ce-depletion.**

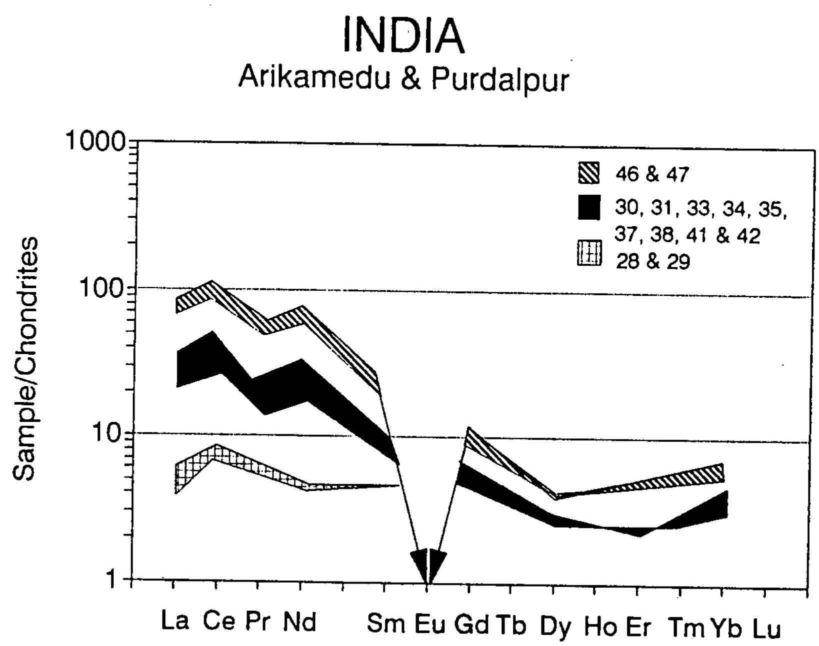


Fig 8.3.2.14. ***Arikamedu.*** **The chondrite-normalized REE patterns for sample #s 40, 43 & 45 are different from those illustrated above.**

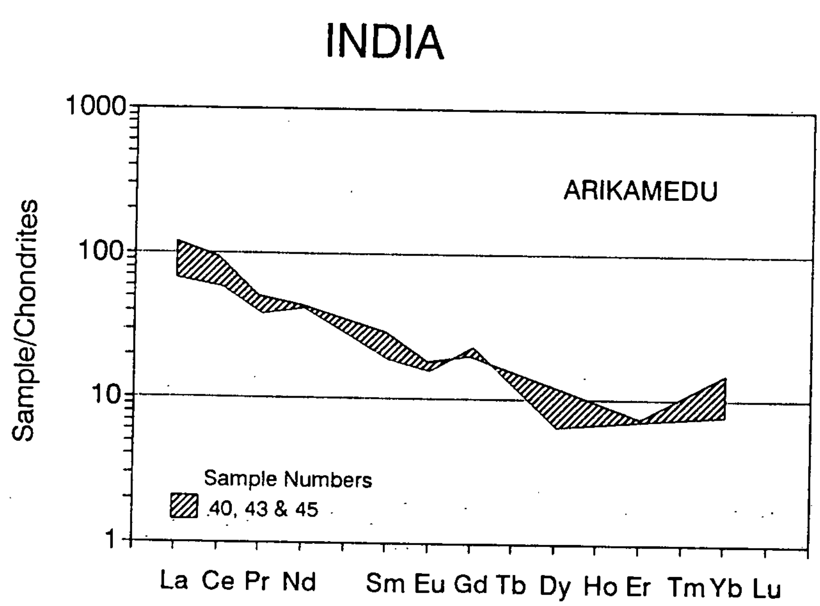


Fig. 8.3.2.15. *Palestine, Malaysia & South Africa.* Chondrite-normalized REE abundances in beads from Kibbutz Ginosar, Gedong and Makahane.

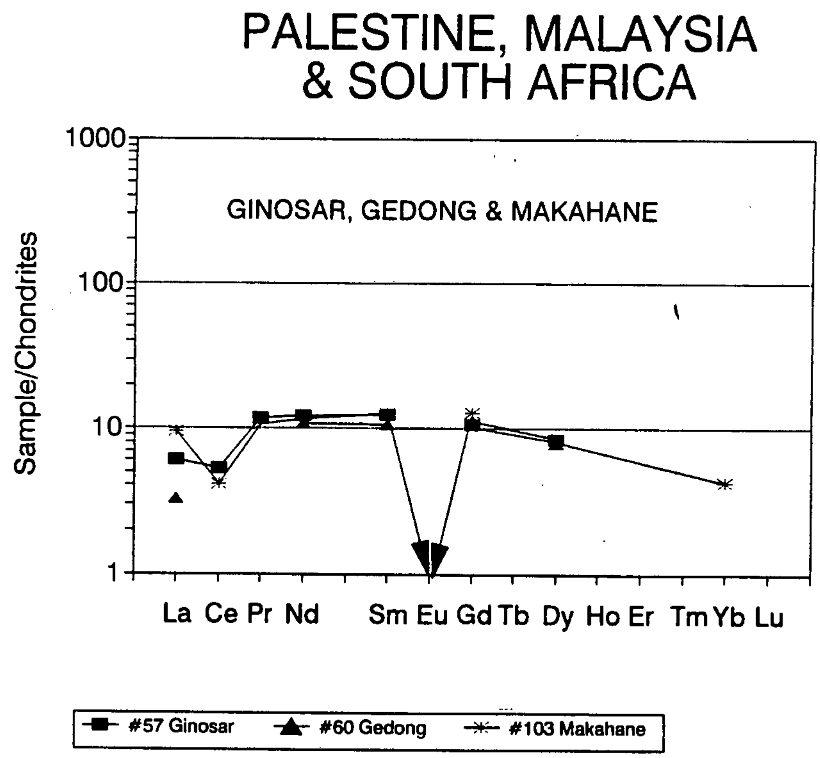


Fig. 8.3.2.16. *Indonesia and eastern Malaysia.* The chondrite-normalized REE abundances for beads from these sites are so similar that they could have been made from the same batch of glass.

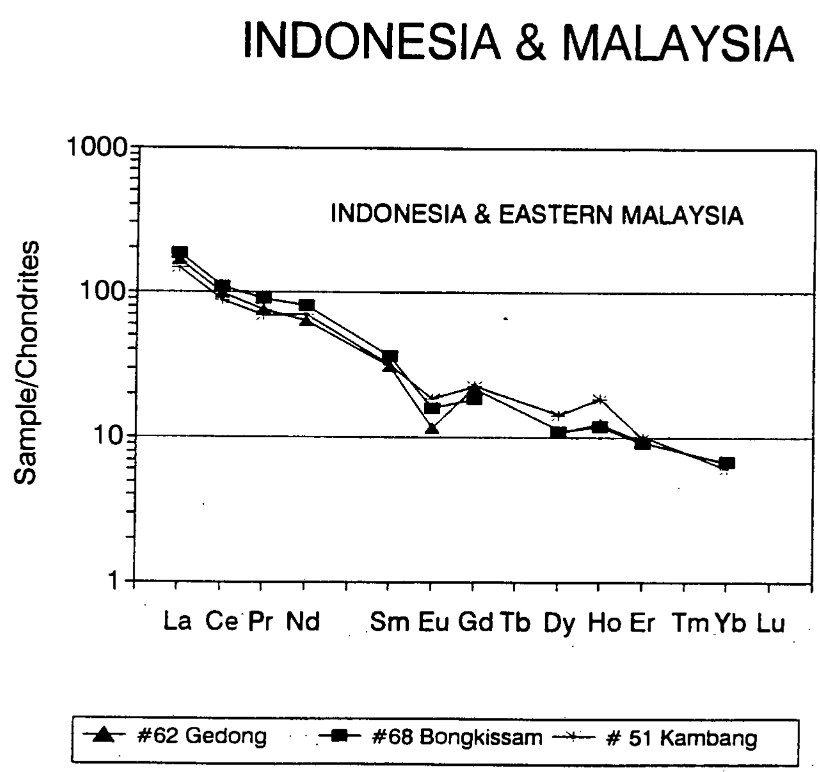


Fig.8.3.2.17. ***Western Malaysia.*** **Chondrite-normalized REE abundances for beads from Pulau Kelumpang (Kuala Selingsing) & Sungai Mas. Sample #s 74 (blue) & 75 (green) are 'mosaic' glass beads**

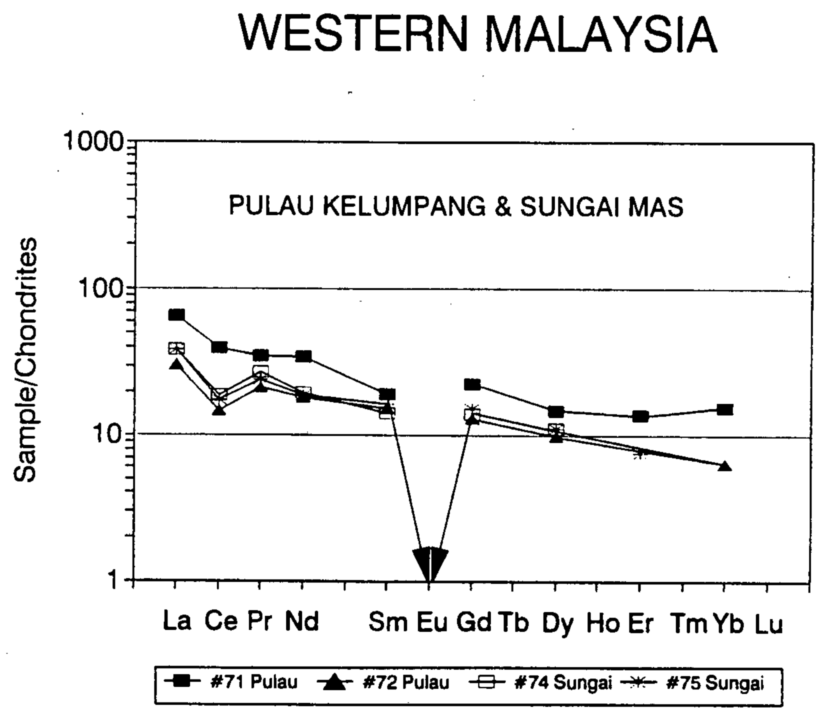


Fig.8.3.2.18. ***Western Malaysia.*** **Chondrite-normalized REE pattern of the distinctive bright orange** ***seed*** **bead, widespread in Southeast Asia but not in southern Africa.**

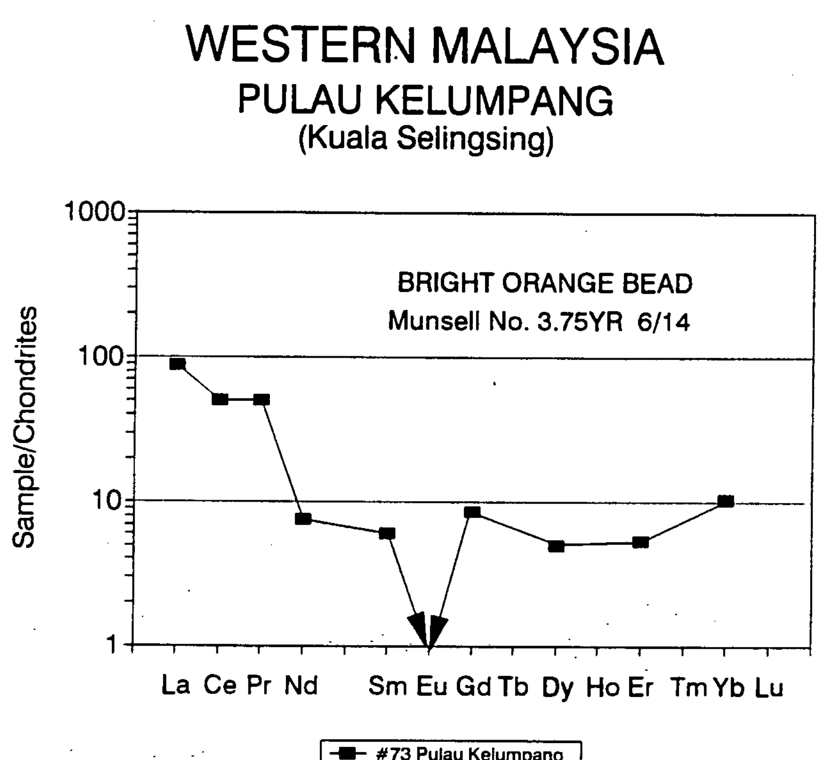


Fig. 8.3.2.19. ***Eastern Malaysia & Ceylon.*** **Chondrite-normalized REE patterns for glass beads from Gedong, Bongkissam & Ceylon.**

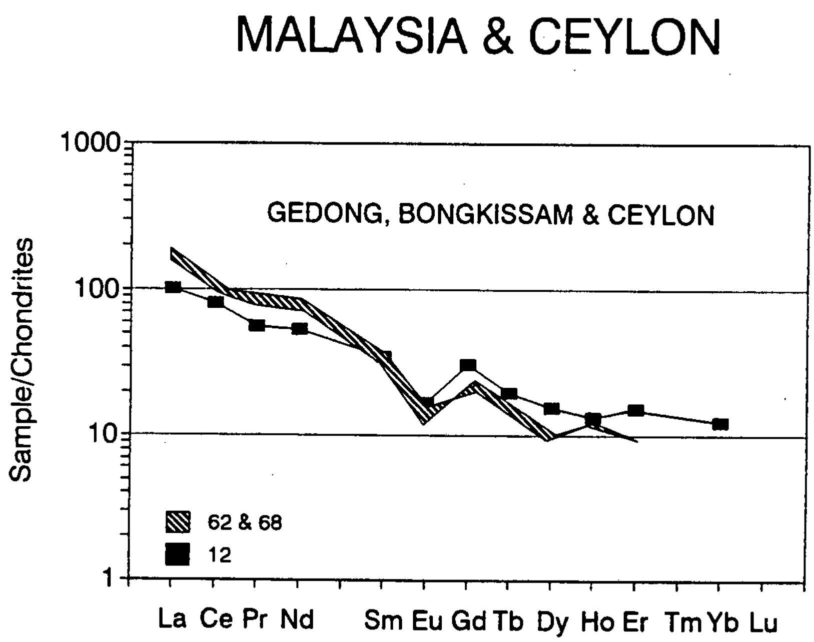


Fig. 8.3.2.20. ***Eastern Malaysia & Ceylon.*** **Chondrite-normalized REE patterns for glass beads from Gedong & Ceylon. These three samples have positive Eu anomalies while those illustrated above do not.**

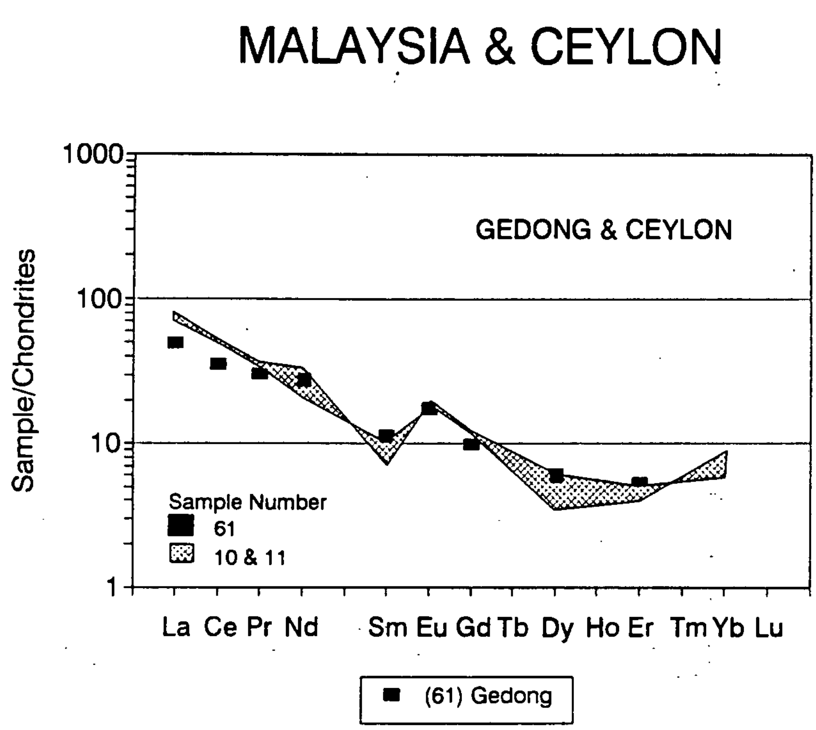


Fig 8.3.2.21. *Thailand & Fustat.* Chondrite-normalized REE patterns for beads from Klong Thom & Takuapa have negative Ce-anomaly.

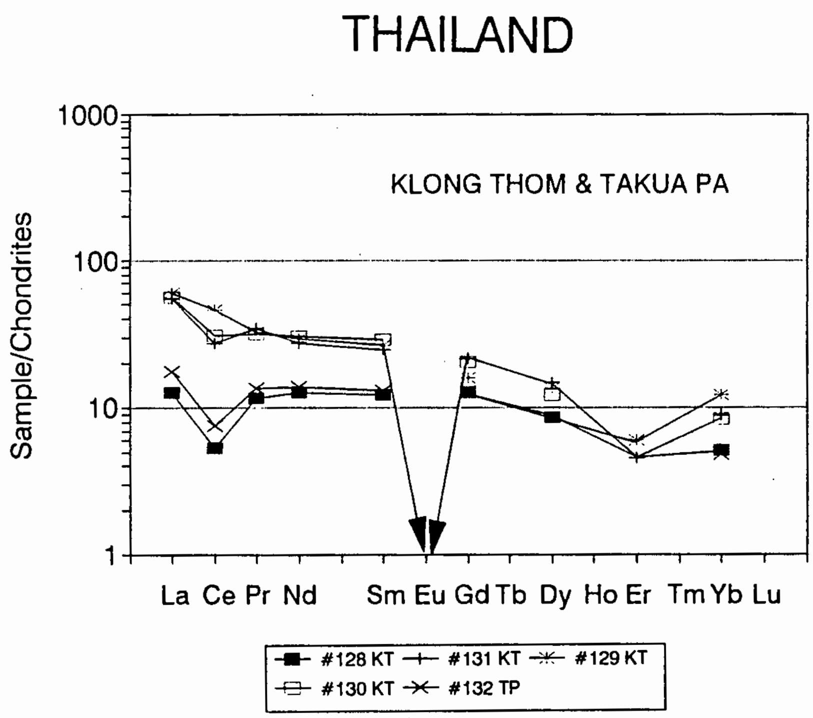
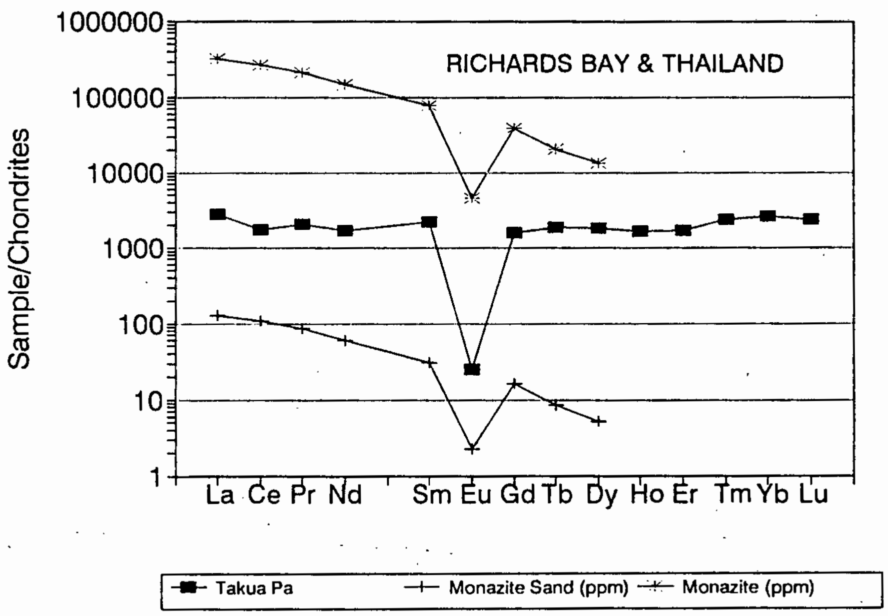
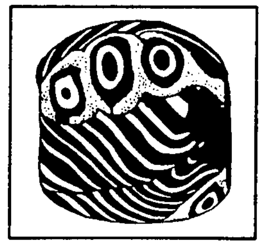


Fig 8.3.2.22. *Thailand & Richards Bay (South Africa).* The Takuapa specimen (sample #133), is a small, dark blackish/brown 'lump' of glass. The chondrite-normalized REE signature is very similar to monazite (see Chapter 7.6.2).



9



CONCLUSIONS

The bead trade, it would seem, deserves a larger place in the history of glass than has generally been assigned to it.
(Lamb 1966:94).

THE HISTORICAL AND ARCAEOLOGICAL CONTEXT OF THE BEADS

The archaeological evidence for contact and trade in southern Africa,, between *ca.* AD 900 - AD 1250, in the form of imported luxury goods is substantial: gold, ivory and other products were exported in exchange for glass beads, ceramics, and metals (slaving and cloth would probably also have been involved in this trade, but no "hard proof" has been found to support this assumption).

During this period, similar trading activities were taking place at coeval sites throughout Southeast Asia, as Muslim maritime trading networks expanded in the Mediterranean, and on the route linking the Red Sea with India and China. Merchants and traders crossed the Indian Ocean to India, South Asia and China. By the 11th century, Islamic influences had spread southward along the East African coast and several heterodox communities were founded. From the 12th century, the evidence for Arab control of trade and influence along the coast of East Africa is well established. However, the long period in between, and the effects of trade into the interior, remain essentially unknown.

Evidence about the identity of seafaring traders who visited the southeast coast of Africa and the source of the beads is at best fragmentary, and at worst unbelievable. Past investigations into the origin of the beads have generally favoured India and the Middle East as manufacturing sources.

Several attempts at tracing the trading routes have been made. The most satisfactory explanation is the development of the Swahili merchants using coastal Mtepe sailing boats and making use of shore winds and currents which were often difficult to navigate. These experienced seafarers became the middlemen in the transport of gold and possibly ivory to the Lamu archipelago, collecting in return quantities of trade goods for exchange in the south. Much later, the Portuguese conquered this trade, and established forts along the coast.

The Iron Age sites situated near the confluence of the Shashi and Limpopo Rivers, particularly Mapungubwe, provide archaeological evidence for the establishment, by the 13th century, of a large scale polity which has variously been called a kingdom or a state. The sites of K2 and Mapungubwe have been investigated since the 1930s by the University of Pretoria and have yielded rich archaeological finds, including gold objects and foreign imports, especially glass beads. Mapungubwe has deep, stratified deposits at the base of the hill, suggesting dense settlement of commoners. At the peak of its power (*ca.* 1220-1270 A.D.), its wealthy rulers occupied the summit.

This period coincided with the beginning of an important event in Islamic history when the Fatimid Caliphate conquered Egypt in AD 969, and built their new capital at al-Qahira (Cairo), next to the flourishing commercial city of Fustat. Archaeological evidence and historical sources show that Fustat was an important and well established *Early* Islamic glassmaking centre, by the time the Fatimids gained control of Egypt. It was also a clearing and forwarding centre for exotic trade goods and glassware from other glasshouses within the Islamic world. High-quality glassware has been excavated from within the city of Fustat, including factory material; distinctive bead types, termed *Fustat Fused Rod Beads*; and glass coin weights used for accurate gold weighing and useful temporal markers.

When the Fatimids came into power their expansionary political and economic policies promoted commercialism and trade. Their powerful position would have been able to influence, if not control, most trading activities from the Mediterranean through the Red Sea and ultimately, trade around the Indian Ocean rim.

In sum, the external trade relations of southern Africa during *ca.* AD 900- AD 1250 were most likely to have been associated with the emergence of the powerful Islamic Fatimid caliphate in Egypt; the seat of sovereignty established at the new capital of Cairo; flourishing prosperity and trade in Egypt; culmination of *Early* Islamic glassmaking at Fustat; expansion of international commerce and trade in the Mediterranean and on the route linking the Red Sea with India and China, and south along the east coast of Africa; the introduction of the gold standard and the discontinuation of gold sources in West Africa used to mint Fatimid coinage, and Muslim trade extending along the East Coast of Africa.

All the beads found at sites in southern Africa were imported, except for the *Garden Roller* beads and one calcite bead (which at first was misidentified as beaing made of glass). The *Garden Rollers* were probably made by the *cire perdue* casting process. This method has not been reported previously for South Africa. Considering that they were made by this very labour intensive technique, the numbers retrieved in the archaeological record is impressive. The *Garden Roller* beads were produced over a relatively short time period, and most of them, and the pottery moulds used to make them, were found at K2 or Bambandyanalo. Judging from the archaeological record, *Garden Rollers* were not replaced with similar imported replicas, and were, therefore, probably made for exclusivity.

The majority of the beads, other than glass, were made of gold and shell. More uncommon beads and pendants were made from soapstone and bone. These, plus the distinctively rounded and uniformly shaped *seed* beads found on some of the skeletons, are particularly discriminating.

ANALYTICAL TECHNIQUES FOR GLASS ANALYSIS

The glass beads and 'waste' material analysed for this thesis include a representative collection from twelve major sites in India, Ceylon, eastern and western Malaysia, Thailand, and Indonesia, where beads were produced at various times in what is thought to have been an unbroken sequence from the 3rd century BC until the present. In addition, glass beads and bracelets excavated at sites in Egypt, Palestine and Syria were also available. At the consumer end, the complete excavated collections from all the major sites in the Limpopo Valley and Lowveld regions of the Transvaal and Botswana, which span the period *ca.* AD 900 - 1250, including the massive collections of Bambandyanalo and Mapungubwe have been included. Approximately 150 000 beads were examined.

The glass beads imported into southern Africa *ca.* AD 800 onwards were mostly, small, monochrome, *seed* beads, manufactured by the *drawn* technique. Until later European contact, other varieties of beads, particularly decorated beads were rarely found. The few that have been reported in earlier works (MacIver 1906; Beck 1937) are discussed in Chapter 4.7.

The limited diversity of the bead types plus the fact that many of them 'look' identical, although they may have been made in different places, presents a challenging problem. to extract more information from the beads several analytical techniques were investigated for this purpose of this study. The goals were to

(1) chemically differentiate or *fingerprint* either a number of elements peculiar to the sample or to distinguish diagnostic variables between the glasses; and
(2) investigate possible sources from where the glass beads could have originated, which in turn could provide information on temporal and spatial distribution, and external commercial contact and trade links.

The obvious procedure for determining glass composition is chemical analysis, but this is not a practical approach when working with very large assemblages. Alternate procedures, such as visual inspection and measurements of refractive index (R.I.) were used as initial screening techniques. The chemical composition of selected beads was then more fully analysed.

Pioneers in this field have contributed definitive works. Amongst them are Emeritus Professor W. E. S. Turner, University of Sheffield, United Kingdom; E. V. Sayre, Brookhaven National Laboratory; A. Lamb; R. W. Smith of the International Committee on Ancient Glass, and R. H. Brill, Corning Museum of Glass. Since 1955, research has tended to concentrate on specific components of the glass composition (Sayre & Smith 1961; Henderson 1985 & 1988 and Djingova & Kuleff 1992. Davison (1972) followed in their footsteps and although she incorporated a few of the rare earth elements in her analysis they were not seen to be significant.

H. Beck, C. van Riet Lowe, J. R Schofield, W. G. N. van der Sleen and C. Davison have all made signficant contributions to the study of glass beads found in southern Africa.

The variety of techniques used for systematic chemical analyses for this dissertation includes: Electron microprobe analysis (EPMA), atomic absorption spectrometry (AAS), laser ablation inductively coupled mass spectrometry (LA-ICP-MS) and scanning electron electron microscopy (SEM). Laser (ICP-MS) offers two important advantages over other techniques. Firstly, in small samples such as beads it is practically non-destructive, and secondly minimal sample preparation is required. This instrument is particularly suitable for multi-element analysis of rare earth elements (REEs) and has excellent precision and low detection limits.

Methodology

Visual inspection utilized in this study followed standardized classification procedures that are internationally recognised and used by other glass bead analysts. The method is based primarily on visual observation to determine method of manufacture and appearance, followed by selective chemical analysis. The physical attributes, coupled with with additional elemental analyses, characterise the glass in sufficient detail to make unequivocal comparisons possible. Extensive colour photography is used a swell. The combination of all these techniques, representing a new approach to the study of glass beads in southern Africa, provides an explicit taxonomy which can be repeated by other researchers.

Visual classification

Visual classification of glass beads relies upon a number of criteria which provide a complete physical description. It consists of a series of componential analysis which, as far as can be determined by visual inspection, produces a sequence of subtypes arranged in a taxonomic hierarchy (Saitowitz 1990:40).

The strategy of processing the beads using the non-technical, but yet objective standardised visual classification procedures was adapted from Kidd & Kidd 1970; Karklins 1985 & Sprague (1985). The methodology is based primarily on determining (1) method of manufacture (2) colour (3) size (4) clarity of the glass (5) and shape.

This intial stage of bead processing provides useful information on the availability or choice of particular types of beads; specific colour preferences and continuity of certain popular beads. Some of the more modern collections can be placed within specific time periods by comparing them to dated sample bead cards (when available) of known origin or well provenanced and dated sites.

Refractive index (R.I.).

Beads that appear identical may have different origins and chemical compositions. Over time many popular types were imitated by various manufacturers to satisfy demand. Differences in the 'recipes' of manufacturers can be detected chemically, but chemical analysis is too costly to apply to large numbers of beads. A simple measurement of R.I. helps as a screening device, by providing useful information on the bulk chemical composition. (The speed of light in glass is related to density, which is related to composition). In this study, R.I. measurements were determined to select representative glass bead specimens for chemical characterisation.

__Chemical analysis.__

The relative amounts of major elements may be characteristic of a glass; alternatively, the colouring trace elements may be uniquely diagnostic, or unintentional trace elements may reveal its origin. In this pilot study the major and minor elemental components of glassmakers ingredients determined were SiO_2, Na_2O, K_2O, MgO, Al_2O_3, Fe_2O_3, TiO_2, MnO, CaO, P_2O_3, CoO, SbO and PbO. The rare earth elements (REE) or Lanthanides, zirconium and titanium (usually associated with REE) were used for trace element characterisation. This is a hardrock geochemistry technique which has proved to be highly successful in many geochemical studies (Taylor & McLennon 1985; Henderson 1984). The analytical instrument used for the REE analyses is ideal for multi-element analyses of small glass samples. The LA-ICP-MS *fingerprinting* provides a visual comparisson of patterns, associations of elements and isotopes, unique to the samples. Sample dilution, blending or processing may reduce the element concentrations, but will not remove or change the fingerprint so the gross pattern remains unaltered. The procedure is essentially non destructive. This technique is not new. What ***is*** new is the way in which it has been applied as a sourcing technique for glass beads.

Other analytical techniques used to investigate the major and minor constituents of the glass have provided useful information on the composition or 'recipe' which could not have been obtained by any other method. REE analysis by means of LA-ICP-MS is by far the most accurate technique available.

REE analysis

I have contended that Fustat is a primary candidate for the production of glass beads found in southern Africa. To test this connection, the rare earth elements (REE) or Lanthanides proved to be the best elemental variables for comparing the glass samples. One of the salient features is the pronounced negative Cerium (Ce) anomaly, attributed to the fluxing component of the glass. The Ce-depleted REE pattern is unique to seawater and its derivatives (marine organisms and certain precipitates) as found on the desert coasts of Egypt.

REE analyses of the provenanced and distinctive *Fustat Fused Rod Beads*, show that a particular type of glass with the Ce-depleted seawater pattern (flux) used to make these beads is the same as that used to make some of the beads found at five sites in southern Africa, as well as sites in western Malaysia and Thailand. Specimens from two Indian manufacturing sites do not show the same seawater pattern.

Either the glass specimens found with Ce anomaly at some of the other sites in Southeast Asia were made *in situ* with similar fluxing agent or else the glass from which they were made, or even the beads themselves were imported from Fustat. Except for the characteristic bright orange bead from Pulau Kelumpa I find the latter of the two explanations more acceptable.

Combined bulk and trace elemental analyses of selected *seed* beads show distinctive differences in the composition used to make some of the beads, which are visually so similar that it is difficult to distinguish between them. This applies particularly to 'Indian red', yellow and blue green beads. This evidence contradicts the conclusions of some other analysts, that *seed* beads found in southern Africa are of limited diagnostic value due to their manufacturing similarities and seemingly long temporal ranges.

The chemical data described in this thesis provide precise information on the beads, which reflect the extent of long distance trade which links geographical areas as far afield as Egypt, western Malaysia and South Africa. The data also show either direct or indirect trade or contact links between Iron Age sites in the northern and eastern Transvaal, and Botswana. Almost identical beads were found at K2, Mapungubwe, Makahane, Shikumbu, Mahlangeni and Letaba in South Africa.

These results confirm the existence of a trade link between Egypt and Malaysia, and between Egypt and South Africa *ca.* 1000 years ago. This information does not exclude he possibility that glass beads from other sources are also present.

In the absence of authoritative written sources about the early period of trade in the Limpopo basin, it remains for archaeologists to identify the sources of foreign imports. Until now, the lack of comparative material from possible source areas and imprecise scientific evidence has defeated all attempts at identification. This problem has now been overcome, making it possible to attempt such identification with renewed confidence.

9.1 SCOPE FOR FUTURE WORK

Information derived from this work promises to increase our knowledge of the origins of one of the most important components of material culture found in southern Africa; to document and broaden our understanding of the complexities involved in coastal maritime and inland trade; and to provide definitive 'fingerprints' for sourcing studies, using the rare earth element components in the raw material used to produce the beads.

For many years the origin of external trade and contact of southern Africa has been blandly lumped together by Iron Age archaeologists as originating in the Indian Ocean, controlled by Arab traders along the African East coast. Little attention has been paid to the complexities involved in that trade or with the nucleus of power which must have controlled it, in this case the Fatimid rulers in Egypt. Great play has been made on the development of Arab or Swahili coastal towns such as Malinde, Zanzibar and Kilwa but relatively little attention has been paid to the presence of glass trade beads found at inland sites.

The entrepôt ports need to be studied more in the context of their hinterland instead of in isolation, as they were often no more than intermediate stages in the transmission of goods. The ultimate destination of imports, like glass beads, was more than likely have been the capitals of the kingdoms and other destinations that the ports served. These could have been situated far inland, such as the Iron Age settlements in the Limpopo Valley and Botswana, where evidence of long distance trade was found.

In addition, the scope of this research can be extended to include beads introduced into southern Africa directly or indirectly through more modern European sources AD 1600 - 1900. We know that the Portuguese brought vast numbers of beads to Africa. Whether they were all of European manufacture is not known. Later, the Dutch, French, English and Germans also inundated southern Africa with glass trade beads.

In the longer term, glass beads from sites such as Thulamela (AD 1600) in the northern Transvaal, the Zulu capital at Mgungundlovu (1829-1838), and a Tswana site in Thabazimbi in the south-western Transvaal (AD 1872 - 1879) can be used to trace European contact with indigenous communities. Tightly dated sites such as these can be used for ethnographic studies by comparing the beads with beaded work of unknown provenance, as found in museums and art galleries, both in southern Africa and abroad.

....

REFERENCES

ABUNGU, G. H. O. & MUTORO, H. W. 1993. Coast-interior settlements and social relations in the Kenya coastal hinterland. *In* Shaw, T., Sinclair, P., Andah, B. & Okpoko, A. (eds), *The Archaeology of Africa.* London: Routledge.

ABUNGU, L. L. 1992. Beads on the East African coast: an outline. *In* Sinclair P. J. J & Juma, A. (eds), *Proceedings of the 1991 Workshop in Zanzibar.* Stockholm: Swedish Central Board of National Antiquities.

ADU BOAHEN, A. 1962. The caravan trade in the nineteenth century. *Journal of African History* **3(2)**: 349-59.

ALDRED, C. 1978. *Jewels of the Pharaohs.* New York: Ballantine Books.

AL-JANABI, T. 1983. Islamic archaeology in Iraq: recent excavations at Samarra. *World Archaeology* **14(3)**: 305-27.

ALLEGRE, C. J. & MINSTER, J. F. 1978. Quantitaive models of trace element behaviour in magmatic processes. *In* Allegre, C.J. & Hart, S. R. (eds), *Trace Elements in Igneous Petrology.* New York: Elsevier Scientific.

ALLEN, DE VERE, J. 1993. *Swahili Origins.* London: Villiers Publications.

ALLEN, J. 1993. The Nordic glass bead seminar. *Bead Forum* No.23: 4-10.

ALLEN, J. W., LLEWELLYN, L. R. & SCHWEIZER, F. 1973. The history of so-called Egyptian faience in Islamic Persia: Investigations into Abu'L-Quasim's Treatise. *Archaeometry* **15(2)**: 165-73.

ARKELL, A. J. 1936. Cambay and the bead trade. *Antiquity* **10(39)**: 292-305).

ANDAYA, B. W. & ANDAYA, L. 1994. *History of Malaysia.* Hong Kong: Macmillan.

ASPINALL, A. E., WARREN, S. E., CRUMMETT, J.G. & NEWTON, R.G 1972. Neutron activation analysis of faience beads. *Archaeometry* **14**: 27-40.

AUTH, S. 1991. Glass, Coptic. *The Coptic Encyclopedia.* Vol. 4. New York: Macmillan. 1142-47.

BALSAN, F. 1970. Ancient gold routes of the Monomotapa Kingdom. *Geographical Journal* **136**: 240-46.

BASS, G. F. 1987. Oldest known shipwreck. *National Geographic* **172(6)**: 693-732.

BASS, G. F. 1984. The nature of the Serçe Limani glass. *Journal of Glass Studies* **26**: 64-9.

BAXTER, M. J. 1991. Principal component and correspondence analyses of glass compositions: an empirical study. *Archaeometry* **33(1):** 29-41.

BEACHEY, R. W. 1976. *The Slave Trade of East Africa.* London: Rex Collings.

BECK, H. C. 1928. Classification and nomenclature of beads and pendants. *Archaeologia* **77:** 1-76.

BECK, H. C. 1930. Notes on sundry Asiatic beads. *Man* **30**: 163-82.

BECK, H. C. 1931. Rhodesian beads from the 1929 excavations. *In*: Caton-Thompson, *Zimbabwe Culture, Ruins and Reactions*: 229-42. Oxford: Clarendon Press.

BECK, H. C. 1937. The Beads of the Mapungubwe District. *In:* Fouche, L. *Mapungubwe Vol I.* pp. 104-113. Cambridge CUP.

BEGLEY, V. 1983. Arikamedu reconsidered. *American Journal of Archaeology* **87(4):** 460-81.

BELL-CROSS, G. 1987. The occurrence of cornelian and agate beads at shipwreck sites on the southern African coast. *Coelacanth: the Journal of the Border Historical Society* **25(1):** 20-35.

BENT, J. T. 1969. *The Ruined Cities of Mashonaland.* Bulawayo: Books of Rhodesia.

BHARDWA, H. C. 1991. A note on some lead-barium glasses from India. *In*: Brill, R. & Martin, H. (eds), *Scientific Research in Early Chinese Glass.* New York: Elmira Quality Printers.

BIMSON, M. & FREESTONE, I. C. 1988. Some Egyptian glasses dated by Royal Inscription. *Journal of Glass Studies* **30**: 11-15.

BINSON, W. 1981. *First Aid for Marine finds.* Basildon: Trustees of the National Maritime Museum.

BIRMINGHAM, D. 1981. *Central Africa to 1870.* Cambridge: Cambridge University Press.

BLOMQVIST, J. 1979-1980. The date and origin of the Greek version of *Hanno's Periplus. Studier utgivna av Kungl. Humanistiska Vetenskapssamfundet i Lund.* Scripta Minora, Studier: 3.

BORAX CONSOLIDATED LIMITED 1977. *Glasses.* Surrey: Unwin Brothers.

BOVILL, E. W. 1968. *The Golden Trade of the Moors.* London: Oxford University Press.

BRILL, R. H., TONG, S. S. C., & DOHRENWEND, D. 1991. chemical analyses of some early Chinese glasses. *In*: Brill, R., & Martin, H. (eds), *Scientific Research in Early Chinese Glass.* New York: Elmira Quality Printers.

BRILL, R. H., TONG, S. S. S. & FUKANG, Z. 1989. The chemical composition of a faience bead from China. *Journal of Glass Studies* **31**: 11-15.

BRILL, R. H. & CAHILL, N. 1988. A red opaque glass from Sardis and some thoughts on red opaques in general. *Journal of Glass Studies* **30**: 16-27.

BRILL, R. H. 1963. Ancient glass. *Scientific American* **209** (Nov): 120-30.

BRILL, R. H. 1972. A chemical analytical round-robin on four synthetic ancient glasses. *Proceedings of the 9th Int. Congr. on Glass, Versailles*, pp. 93-110.

BRILL, R. H. 1986. Chemical analyses of some early Indian glasses. *In* Bhardwaj, H. C.(ed), *Archaeometry of Glass.* Calcutta: Indian Ceramic Society.

BROOKS, J. A. n.d. *Glass.* London: Purnell.

CAIGER-SMITH, A. 1973. *Tin-Glaze Pottery in Europe and the Islamic World.* London: Faber & Faber.

CAMPBELL, J. 1822. *Travels in South Africa.* Vol.I. London: Francis Westley.

CARSWELL, J. 1979. China and Islam. *Transactions of the Oriental Ceramic Society* v. 42. (The Third George de Menasche Memorial Lecture).

CARSWELL, J. 1977. China and Islam. *Transactions of the Oriental Ceramic Society* v. 41.

CARTER, G. F. 1978. *Archaeological Chemistry II*. Washington, D.C.: American Chemical Society.

CASANOVA, P. 1919. Essai de reconstitution topographique de las ville d' al Foustât ou Misr. Mémoire 35. Cairo: Institut Français d'Archéologie Orientale.

CATON-THOMPSON, G. 1931. *The Zimbabwe Culture*. Oxford: Clarendon Press.

CHAFE, A., HANCOCK, R. & KENYON, I. 1986. A preliminary report on the neutron activation analysis of early historic blue glass trade beads. Unpublished manuscript, on file Rochester Museum and Science Center. Rochester: New York

CHAKRABARTI, D. K. 1991. The External trade of the Indus civilization. Review. *Antiquity* **65**: 406.

CHARLESTON, R. J. 1978. Glass furnaces through the ages. *Journal of Glass Studies* 20: 9-31.

CHARLESTON, R. J. 1963. Glass "cakes" as raw material and articles of commerce. *Journal of Glass Studies* **5**: 54-67.

CHAUDHURI, K. N. 1985. *Trade and Civilization in the Indian Ocean: An Economic History from the Rise of Islam to 1750*. Cambridge: Cambridge University Press.

CHITTICK, H. N. 1982. Mediaeval Mogadishu. *Paideuma* **28**: 47-61.

CHITTICK, H. N. 1974. *Kilwa: An Islamic Trading City on the East African Coast.* Volume I & Volume II. Nairobi: British Institute in Eastern Africa, Memoir 5.

CHITTICK, H. N. & ROTBERG, R. I. 1975. *East Africa and the Orient.* New York: African Publishing Company.

CLAIRMONT, C. W. 1977. *Catalogue of Ancient and Islamic Glass.* Athens: Benaki Museum.

CLARK, D. 1962. The spread of food production in Sub-Saharan Africa. *Journal of African History* 3(2): 211-28.

CLIST, B. 1987. Early Bantu settlements in West-Central Africa: a review of recent research. *Current Anthropology* **280**: 380-82.

CLOSE, A. 1988. Current research and recent radiocarbon dates from Northern Africa. *Journal of African History* **3(29)**: 145-76.

COHN, J. C. 1959. The bead collection of the Archaeological Survey, Johannesburg. *The South African Archaeological Bulletin* **14(54)**: 75-7.

CONNAH, G. 1987. *African Civilizations.* Cambridge: Cambridge University Press.

COTTERILL, R. 1985. *The Cambridge Guide to the Material World.* Cambridge: Cambridge University Press.

COUPLAND, R. 1965. *East Africa and its Invaders.* New York: Russel & Russel.

CUMMINGS, K. 1980. *The Technique of Glass Forming*. Essex: Anchor Press.

DATOO, B. A. 1970. Rhapta: the location and importance of East Africa's first port. *Azania* **5**: 65-75.

DAVISON, C. C. 1972. Glass beads in African Archaeology. Berkeley: Lawrence Berkeley Laboratory, U.S.A.E.C. (Report No.1240).

DAVISON, C. C. & CLARK, D. 1976. Transvaal heirloom beads and Rhodesian archaeological sites. *African Studies* **35(2):** 123-37.

DAY, L. 1990. The chemical and allied industries. *In* Neil, I. (ed), *An Encyclopedia of the History of Technology.* London: Routledge.

DENBOW, J. R. & WILMSEN, E. D. 1986. Advent and course of pastoralism in the Kalahari. *Science* **234**: 1509-15.

DEVISSE, J. 1992. Trade and trade routes in West Africa. *In* Hrbeck, I (ed), *UNESCO General History of Africa* v. 3. California: James Curry.

DICKINSON, R. W. 1975. The archaeology of the Sofala coast. *South African Archaeological Bulletin* **30**: 84-104.

DIKSHIT, M. G. 1969. *History of Indian Glass.* Bombay: University of Bombay.

DILLON, E. 1907. *Glass.* London: Methuen.

DJINGOVA, R. & KULEFF, I. 1992. An archaeometric study of medieval glass from the first Bulgarian capital, Pliska (ninth to tenth century AD). *Archaeometry* **34**: 53-61.

DODSWORTH, R. 1984. *Glass and Glassmaking.* Aylesbury: Shire Publications.

DONLEY-REID, L. W. 1990. The power of Swahili porcelain, beads and pottery. *Archaeological Papers of the American Anthropoligical Association* no.2: 47-59.

DROOKER, P. B. 1993. Chemical analysis of blue glass beads from the Madisonville site. *Unpublished report*, Cambridge: Harvard University Peabody Museum.

DU TOIT, A. 1961. Krale as 'n daterinsmiddel in die proto- geskiedkundige argeologie van Suidelike Afrika. MA Thesis. University of South Africa.

ELLIS, W. S. 1993. Glass. *National Geographic* **184(6):** 37-69.

ELOFF, J. F. 1979. *Die Kulture van Greefswald.* Vols. I-V. Unpublished report. University of Pretoria.

ELOFF, J. F. & MEYER, 1981. The Greefswald sites. *In* Voight, E. A. (ed), *Guide to Archaeological Sites in the Northern and Eastern Transvaal.* Pretoria: Kopie-Rite.

ERDMANN, K. 1951. ``Fatimid" rock crystals. *Oriental Art* **3**: 142-46.

EVANS, I. H. N. 1928. On ancient remains from Kuala Selinsing, Perak. *Journal of the Federated Malaya States Museums* **12(5)**: 121-31.

EVANS, I. H. N. 1929. Further notes on a find of stone implements with pottery. *Journal of the Federated Malaya States Museums* **12(7):** 175-6.

EVANS, I. H. N. 1932. Excavations at Tanjong Rawa, Kuala Selinsing, Perak. *Journal of the Federated Malaya States Museums* **15(3):** 79-133.

EVERS, T. M. 1979. Salt and soapstone bowl factories at Harmony, Letaba district, northeast Transvaal. *South African Archaeological Society* (Goodwin Series) **3**: 94-107.

EVERS, T. M. & VAN DER MERWE, N. J. 1987. Iron age ceramics from Phalaborwa north eastern Transvaal Lowveld, South Africa. *South African Archaeological Society* **42:** 87-106.

FAGAN, B. 1964. The Greefswald sequence: Bambandyanalo and Mapungubwe. *Journal of African History* **5(3):** 337-61.

FAGE, J. 1978. *A History of Africa*. London: Hutchinson.

FAGG, W. B. & WILLET, F. 1960. Ancient life: an ethnographical summary. *Journal of Yoruba & Related Studies* No. 8.

FLEET, A.J. 1984. Aqueous and sedimentary geochemistry of the Rare Earth Elements. *In* Henderson, P. (ed), *Rare Earth Geochemistry.* Oxford: Elsevier.

FORBES, R. J. 1957. *Studies in Ancient Technology.* Vol. 5. Leiden: E. J. Brill.

FORNEAU, J. 1955. Search for the origins of the Zanaga beads. *South African Archaeological Bulletin* **38**: 55-9.

FOUCHÉ, L. 1937. *Mapungubwe*. Vol.1. Cambridge: Cambridge University Press.

FRANCIS, P. Jr. 1984. Untitled note. *Journal of Glass Studies* **26**: 152-53.

FRANCIS, P. Jr. 1988. *The Glass Trade Beads of Europe*. Lake Placid: Lapis Route Books.

FRANCIS, P. Jr. 1989. Beads of the early Islamic period. *In* Karklins, K. (ed), *Beads* **1**: 21-39.

FRANCIS, P. Jr. 1990. Glass beads in Asia, Part II. Indo-Pacific beads. *Asian Perspectives* **29(1):** 1-24.

FRANCIS, P. Jr. 1990. Beadmaking in Islam: the African trade and the rise of Hebron. *In* Karklins, K. (ed), *Beads* **2**: 15-28.

FRANCIS, P. Jr. 1991. Beadmaking at Arikamedu and beyond. *World Archaeology* **23(1)**: 28-43.

FRANCIS, P. Jr. 1993. More on Fustat Fused Rod Beads. *The Bead Forum*. **23**: 3-4.

FRANCIS, P. Jr. 1995. The beads from Fustat in the Awad Collection. *The Margaretologist* **8(1)**: 7-10.

FREEMAN-GRENVILLE, G. S. P. 1962. *The East African Coast*. London: Oxford University Press.

FREESTONE, I. 1991. Looking into glass. *In* Bowman, S. (ed), *Science and the Past.* London: British Museum Press.

FRIPP, C. E. 1941. Chinese mediaeval trade with Africa. *N.A.D.A.* (Native Affairs Department Annual, Southern Rhodesia) **18**: 12-22.

FRYER, B. J. & TAYLOR R. P. 1987. Rare-earth element distribution in uraninites: Implications for ore genesis. *Chemical Geology* **63:** 101-108.

GARDNER, G. A. 1963. *Mapungubwe*. Vol.2. Pretoria: van Schaik.

GOFFER, Z. 1980. *Archaeological Chemistry.* New York: John Wiley.

GOITEIN, S. D. 1967. *A Mediterranean Society: The Jewish Communities of the Arab World as Portrayed in the Documents of the Cairo Geniza.* Vol.1. Berkeley: University of California Press.

GOITEIN, S. D. 1983. *A Mediterranean Society: The Jewish Communities of the Arab World as Portrayed in the Documents of the Cairo Geniza.* Vol.4. Berkeley: University of California Press.

GRABAR, O. 1977. Kirbet el-Minya. 875-876. *In* Avi-Yonah, M. & Stern, E. (eds), *Encyclopedia of Archaeological Excavations in the Holy Land.* Vol. 3. Jerusalem.

GRAY, R. & BIRMINGHAM, D. 1970. Some economic and political consequences of trade in central and eastern Africa in the Pre-colonial Period. *In* Gray, R. & Birmingham, D. (eds), *Pre-colonial African Trade.* London: Oxford University Press.

GWINNETT, A. J. & GORELICK, L. 1986. Evidence for the use of a diamond drill for bead making in Sri-Lanka c. 700-1000 A.D. *Scanning Electron Microscopy* **2**: 473-77.

HAAS, J. 1982. *The Evolution of the Prehistoric State.* New York: Columbia University Press.

HALL, M. 1987. *The Changing Past: Farmers, Kings and Traders in southern Africa, 200 - 1860.* Cape Town: David Philip.

HALL, R. N. 1905. *Great Zimbabwe*. London: Methuen.

HANCOCK, R. G. V., CHAFE, A. & KENYON, I. 1994. Neutron activation analysis of sixteenth - and seventeenth - century European blue glass trade beads from the eastern Great Lakes area of North America. *Archaeometry* **36(2)**: 253-66.

HANISCH, E. O. M. 1980. An archaeological interpretation of certain Iron Age sites in the Limpopo/Sashi valley. Unpublished MA thesis, University of Pretoria.

HANISCH, E. O. M. 1981. Schroda: a Zhizo site in the northern Transvaal. *In* Voight, E. A. (ed), *Guide to Archaeological Sites in the Northern and Eastern Transvaal.* Pretoria: Kopie-Rite.

HARDEN, D. B. 1956. A History of Technology. Vol.6. *In* Singer, C., Holmyard E. J., Hall, A. R. & Williams, T. I. (eds), *A History of Technology.* Oxford: Clarendon Press.

HARDER, H. 1993. Possible prehistoric glasses in the gem trade of Sri Lanka. *Journal of Gemmology* **23(5):** 267-73.

HARGER, H. S. 1941. A stone bead industry of the western Transvaal. *Transactions of the Royal Society of South Africa* **28**: 129-42.

HARRISON, T. 1964. Monochrome glass from Malaysia and elsewhere. *Man* **50**: 37-41.

HARRISON, T. 1962. Translucent glass rings from Borneo. *Asian Perspectives* no.6: 236-38.

HASSON, R. 1983. Islamic glass from excavations in Jerusalem. *Journal of Glass Studies* 25: 109-11.

HATCHER, H., TITE, M. S. & WALSH, J. N. 1995. A comparison of inductively-coupled plasma emission spectrometry and atomic absorption spectrometry analysis on standard reference silicate materials and ceramics. *Archaeometry* **37(1)**: 83-94.

HECKROODT, R. O. & SAITOWITZ, S. J. 1985. Characterization of bottles manufactured at the Cape Glass Company, Glencairn, circa 1904. *South African Archaeological Bulletin* **142**: 94-5.

HENDERSON, J. 1985. The raw materials of early glass production. *Oxford Journal of Archaeology* **4(3)**: 267-91.

HENDERSON, J. 1988. Glass production and Bronze Age Europe. *Antiquity* **62**: 435-51.

HENDERSON, J. 1988. Electron probe microanalysis of mixed-alkali glasses. *Archaeometry* **30(1):** 77-91.

HENDERSON, J., & IVENS, R. 1992. Dunmisk and glass-making in Early Christian Ireland. *Antiquity* **66**: 55-64.

HENDERSON, P. 1984. *Rare Earth Elemental Geochemistry*. Amsterdam: Elsevier.

HERBERT, E. W. 1984. *Red Gold of Africa*. Madison: University of Wisconsin Press.

HICKMAN, D. A., HARBOTTLE, G. & SAYRE, E. V. 1983. The selection of the best elemental variables for the classification of glass samples. *Forensic Science International* 23: 189-212.

HISKETT, M. 1984. *The Development of Islam in West Africa*. London & New York: Longman.

HODDER, I. 1977. The distribution of material culture items in the Baringo district, western Kenya. *Man* **12**: 239-69.

HODKIN, F. W. & COUSEN, A. 1925. *A Textbook of Glass Technology*. London: Constable.

HOFMEYER, G. 1982. Admiralty jurisdiction in South Africa. *In Aeta Juridica*. Cape Town: Juta.

HOLLOWAY, D. G. 1973. *The Physical Properties of Glass*. London: Wykeham.

HORNELL, J. 1941. Sea-trade in early times. *Antiquity* **15**: 233-55.

HORTON, M. C. & CLARK, C. M. 1985. Archaeological survey of Zanzibar. *Azania* **20**: 167-71.

HORTON, M. C. 1987. Early Muslim trading settlements on the East African coast: New evidence from Shanga. *Antiquaries Journal* **67(2)**: 291-323.

HORTON, M. C. 1987. The Swahili corridor. *Scientific American* **257** (Sept): 76-84.

HORTON, M. C. & BLURTON T. R. 1988. 'Indian' metalwork in East Africa: the Bronze lion statuette from Shanga. *Antiquity* **62**: 11-23.

HOURANI, G. F. 1963. *Arab Seafaring in the Indian Ocean in Ancient and Early Times*. Beirut: Khayats.

HROMNIK, C. A. 1981. *Indo-Africa*. Cape Town: Juta.

HROMNIK, C. A. 1991. Dravidian gold mining and trade in ancient Komatiland. *Journal of Asian & African Studies* **26(3/4):** 283-90.

HUFFMAN, T. N. & HANISCH, E. O. M. 1987. Settlement hierarchies in the northern Transvaal: Zimbabwe ruins and Venda history. *African Studies* **46(1)**: 79-115.

HUFFMAN, T.N. 1982. Archaeology and ethnohistory of the African Iron Age. *Annual Review of Archaeology* (11):133-150

HUFFMAN, T.N. 1992. Southern Africa to the south of the Zambesi. *In* Hrbeck, I (ed) *UNESCO General History of Africa* Vol. III. California: James Curry.

JACQ-HERGOUALC'H, M. 1992. *La Civilisation de Ports-Entrepôts du Sud Kedah (Malaysia)*. Paris: L'Harmattan.

JENKINS, M. 1986. *Islamic Glass.* Vol. 44 No. 2. New York: Metropolitan Museum of Art Bulletin.

JIAYAO, A. 1991. The early glass of China. *In* Brill, R & Martin, H. (eds), *Scientific Research in Early Chinese Glass*. New York: Elmira Quality Printers.

JOHNSON, M. 1970. The cowrie currencies of West Africa. *Journal of African History* **11(1):** 17-49.

JUTA, C. J. 1956. Beads and pottery from Lourenco Marques. *South African Archaeological Bulletin* **21**: 9-11.

KARKLINS, K. 1994. A classification system for drawn glass beads. *Conference Proceedings, Historical Archaeology, Vancouver B. C.*

KARKLINS, K. 1985. *Glass Beads*. Studies in Archaeology, Architecture and History. Ontario: Parks Canada.

KATZEV, M. L. 1970. Resurrecting the oldest known Greek ship. *National Geographic* **137**: 841-57.

KENYON, I., HANCOCK, R. G. V. & AUFREITER, S. 1995. Neutron activation analysis of AD 1660-1930 European copper-coloured blue glass trade beads from Ontario, Canada. *Archaeometry* **37(2):** 323-37.

KIDD, K. & KIDD, M. 1970. A classification system for glass beads for the use of field archaeologists. *Canadian Historic Sites: Occasional Papers in Archaeology and History* 1: 45-89. Ottawa: National Historic Sites Service.

KILLICK, D. 1987. European trade beads in South Africa. *Bead Forum* No.10: 3-9.

KILLICK, D. J. 1991. Technology in its social setting: Bloomery iron smelting at Kasungu, Malawi, 1860-1940 (Unpublished PhD thesis, Yale University).

KIRK, W. 1962. The N.E. Monsoon and some aspects of African history. *Journal of African History* **3(2):** 263-7.

KIRKMAN, J. S. 1974. *Fort Jesus*. Oxford: Clarendon Press.

KLEMP, E. 1968. *Maps on Africa dating from the Twelfth to the Eighteenth century*. Leipzig: Edition Leipzig.

KOBISHCHANOW, Y. M. 1965. On the problems of sea voyages of ancient Africans in the Indian Ocean. *Journal of African History* **6(2):** 137-41.

KOLBAS, J. 1983. A color chronology of Islamic glass. *Journal of Glass Studies* **25**: 95-100.

KRAMER, J. H. 1931. Geography and commerce. *In* Arnold, T. & Guillaume, A (eds), *The Legacy of Islam*. London: Oxford University Press.

KRUEGER, H. C. 1933. The routine of commerce between Genoa and North-West Africa during the later twelfth century. *Mariner's Mirror* **19**: 417-38.

KUBIAK, W. B. 1987. *Al-Fustat.* Cairo: American University in Cairo Press.

KUBIAK, W. B. & SCANLON, G, T. 1979. Fustat expedition: preliminary report, 1972: Part I. *Journal of the American Research Center in Egypt* Vol.16: 103-24.

KURINSKY, S. 1991. *The Glassmakers.* New York: Hippocrene Books.

KÜSEL, M. M. 1992. A preliminary report on settlement layout and gold melting at Thula Mela, a Late Iron Age site in the Kruger National Park. *Koedoe* **35(1)**: 55-64.

LAIDLER, P. W. 1934. Beads in Africa south of the Zambezi. *Proceedings of the Rhodesian Scientific Association* **34:** 1-27

LAL, B. B. 1958. Examination of rods of glass-like material from Arikamedu. *Ancient India* **14**: 139-43.

LAMB, A. 1970. Some observations on glass beads in Ghana, West Africa. *Annales du 5eme Congrès de l'Assoc. Internationale pour l'Histoire du Verre.* Prague, pp.247-50.

LAMB, A. 1966. A note on glass beads from the Malay Peninsula. *Journal of Glass Studies* **8:** 80-94.

LAMB, A. 1965. Some glass beads from the Malay Peninsula. *Man* **30**: 36-8.

LAMM, C. J. 1929. *Mittelalterliche Glaser und Steinschnittarbeit aus dem nahen Osten*, 2 vols. Berlin: D. Reiner.

LAMM, C. J. 1941. *Oriental Glass*. Stockholm: Wahström and Widstrand.

LANE, A. 1937. Medieval finds at Al Mina in North Syria. *Archaeologia* **87**: 61-78.

LAWTON, J. 1984. Shards of history. *Aramco World Magazine*. **35(4)**: 4-11.

LEHRER-JACOBSON, 1983. Hebron, city of glass. *In* Zeevy, R. (ed), *Israel - People and Land.* Tel Aviv: Haaretz Museum.

LEWIS, A. B. 1951. *Naval Power and Trade*. Princeton University Press.

LEWIS, B. 1958. *The Arabs in History.* Essex: Anchor Press.

LEWIS, B. 1970. Egypt and Syria. *In* Holt, P., Lambton, A, & Lewis, B. (eds), *The Cambridge History of Islam*. Cambridge University Press.

LEWIS, B. 1984. *The Jews of Islam*. Princeton University Press.

LUBIS, M. 1987. *Indonesia: Land Under the Rainbow.* Singapore: Oxford University Press.

LIESEGANG, G. 1972. Archaeological sites on the bay of Sofala. *Azania* **7:** 147-59.

LIU, R. K. 1977. T'alhakimt (Talhatana), a Tuareg ornament: its origins, derivatives, copies and distribution. *The Bead Journal* **13(2)**: 18-22.

MACDOUGALL, E. A. 1985. The view from Awdaghust: war, trade and social change in the southwestern Sahara from the eighth to the fifteenth century. *Journal of African History* **26**: 1-31.

MACDOUGALL, E. A. 1986. The economics of Islam in the southern Sahara: The rise of the Kunta clan. *Asian and African Studies* **20:** 45-60.

MACIVER, D. R. 1906. *Medieval Rhodesia*. London: Macmillan.

MACKINNON, E. E. & BRILL, R. H. 1986. Chemical analysis of some glasses from Sumatra. *In* Bhardwaj H. C. (ed), *Archaeometry of Glass*. Calcutta: Indian Ceramic Society.

MALAN, B.D. & COOK, H. 1962. C. van Riet Lowe: Biographical sketch. *South African Archaeological Bulletin*. Suppl.17 of **65**: 38-67.

MALLOWS, W. 1985. *The Mystery of the Great Zimbabwe.* Bury: St. Edmundsbury Press.

MANGUIN, P-Y. 1993. Trading ships of the South China Sea. *Journal of the Economic and Social History of the Orient* **36(3)**: 253-79.

MARÇAIS, G. 1946. *La Berbérie Musulmane et l'Orient au Moyen Age*. Alger: La Typo-Litho et Jules Carbonel Réunies.

MAYNARD, J. B., RITGER, S. D. & SUTTON, S. J. 1991. Chemistry of sands from the modern Indus River and the Archean Witwatersrand basin: Implications for the composition of the Archean atmosphere. *Geology* **19**: 265-68.

MEHLMAN, F. 1982. *Phaidon Guide to Glass.* Oxford: Phaidon Press.

MEIGUANG, S., OULI, H., ZONGDAO, W. & FUZHENG, Z. 1991. Investigations of some ancient Chinese lead glasses. *In* Brill, R & Martin, H. (eds), *Scientific Research in Early Chinese Glass.* New York: Elmira Quality Printers.

MEYER, A. 1980. 'n Interpretasie van die Greefswald Potwerk. Unpublished MA thesis, University of Pretoria.

MILES, G. 1948. Early Arabic glass weights and stamps. *American Numismatic Society* **3**: 31-69.

MITCHELL, S. 1994. Foreign contact and indigenous exchange networks on the Cobourg Peninsular, northwestern Arnheim Land. *Conference Proceedings, World Archaeological Congress-3.* New Delhi: Academic Committee of WAC-3.

MORAIS, J. 1984. Mozambican archaeology: past and present. *The African Archaeological Review* **2**: 113-28.

MOHD OTMAN, Y. 1981. *Chinese Islamic Wares.* Kuala Lumpur: Terusan Selatan Sd. Bhd.

MORRISON, H. 1983. Glass and trade of the Kingdom of the ancient Aksumite kingdom. *Annales du 9e Congrès de l'Association Internationale pour l'Histoire du Verre*. Liege: Centre de Publications de l'A.I.H.V.

MORRISON, H. 1984. The glass. *In* Chittick, H. N., *Manda: Excavations at an Island Port on the Kenya Coast.* Nairobi: British Institute in Eastern Africa, Memoir **9:** 159-80.

MUCKELROY, K. 1980. *Archaeology under Water.* London: McGraw-Hill Book.

MUNSELL COLOR. 1976. *Munsell Book of Color, Gloss Finish Collection.* Baltimore: Macbeth Division, Kollmorgen Corporation.

NEWTON, R. G. 1971. A preliminary examination of a suggestion that pieces of strongly coloured glass were articles of trade in the Iron Age in Britain. *Archaeometry* **13(1):** 11-16.

NEWTON, R. G. 1979. British faience beads reconsidered. *In* Renfrew, C., *Problems in European Prehistory*. Edinburgh: Edinburgh University Press.

ODDY, A. 1984. Gold in the Southern African Iron Age. *Gold Bulletin* **17(2)**: 70-8.

OPPER, M. J. & OPPER, H. 1993. Powdered-glass beads and bead trade in Mauritania. *In* Karklins, K. (ed), *Beads* **5**: 37-44.

OLIVER, R. & FAGAN, B. 1975. *Africa in the Iron Age.* Cambridge: Cambridge University Press.

PHILLIPS, W. 1967. *Oman.* London: Longmans.

PILDITCH, J. 1992. The glass beads of Ban Bon Noen, Central Thailand. *Asian Perspectives* **31(2):** 171-181.

PINDER-WILSON, R. H. 1991. The Islamic Lands and China. *In* Tait, H. (ed), *Five Thousand Years of Glass.* London: British Museum Press.

PINDER-WILSON, R. H. & SCANLON, G. 1973. Glass finds from Fustat: 1964-1971. *Journal of Glass Studies* **15**: 12-30.

PINDER-WILSON, R. H. & SCANLON, G. 1987. Glass finds from Fustat: 1972-1980. *Journal of Glass Studies* **29**: 60-71.

PISTORIUS, J. C. 1995. Iron Age metal working in Phalaborwa: and ideographic perspective. *Proceedings of the 10th Congress of the Pan African Association for the Prehistory and Related Studies - Harare, Zimbabwe.*

PISTORIUS, J. C. C. 1989. Die metaalbewerkers van Phalaborwa. Unpublished PhD thesis. University of Pretoria.

POLANYI, K. 1964. "Sortings and *ounce trade* in the West African slave trade". *Journal of African History* **3**: 381-93.

PRICE, W. J. 1985. *Spectrochemical Analysis by Atomic Absorption.* Cambridge: Wiley.

PULAK, C. 1988. The Bronze Age shipwreck at Ulu Burun, Turkey: 1985 Campaign. *American Journal of Science* **92**: 1-37.

QUARCOOPOME, N. O. 1993. Notse's ancient kingship: some archaeological and art-historical considerations. *In* Goucher, C. L., Phillipson, D. W. & Schoenbrum, D. L. (eds), *African Archaeological Review* **11**: 109-129.

RABINOWITZ, L. 1948. *Jewish Merchant Adventurers: A Study of the Radanites.* Altrincham: St Ann's Press.

RANDALL-MACIVER, D. 1906. *Medieval Rhodesia.* London: Macmillan.

READ, H. H. 1962. *Rutley's Elements of Mineralogy.* London: Thomas Murby.

REDMAN, C. L. 1983. Comparative urbanism in the Islamic Far West. *World Archaeology* **14(3)**: 355-92.

REED, S. J. 1975. *Electron Microprobe Analysis.* Cambridge: Cambridge University Press.

RICE, D. S. 1956. Dateable Islamic rock crystal. *Oriental Art* **2**: 85-93.

RICE, D. S. 1958. Early signed Islamic glass. *Journal of the Royal Asiatic Society* Parts 1 & **2**: 1-16.

RIGHTMIRE, G. P. & VAN DER MERWE, N. J. 1976. Two burials from Phalaborwa and the association of race and culture in the Iron Age of southern Africa. *South African Archaeological Bulletin* **30**: 147-52.

SAITOWITZ, S. J. 1988. Classification of glass trade beads. *South African Museums Association* **18(2)**: 41-5.

SAITOWITZ, S.J. 1990. 19th Century glass trade beads from two Zulu Royal residences (Unpublished MA thesis, University of Cape Town).

SAITOWITZ, S. J. & SAMPSON, C. G. 1992. Glass trade beads from rock shelters in the Upper Karroo. *South African Archaeological Bulletin* **47**: 94-103.

SAITOWITZ, S. J., VAN DER MERWE, N. J. & KAUFMANN, C. 1994. Chevron beads in an Iron Age context: a unique find from central Angola. *Muntu* **9**: 125-56.

SAITOWITZ, S. J. 1994. The archaeometry of glass beads between southern Africa, Egypt and India AD 900-1250: a pilot study. *Conference Proceedings, World Archaeological Congress-3*. New Delhi: Academic Committee of WAC-3.

SAITOWITZ, S. J. 1995. Glass bead trade from Islamic Egypt to South Africa *ca.* AD 900 - 1250. *South African Journal of Science* (in press).

SAITOWITZ, S. J. n.d. *Bold Vision: the History and Archaeology of the Cape Glass Company 1903-1906* (in prep.).

SAYRE, E. V., & SMITH, R. W. 1961. Compositional categories of ancient glass. *Science* **133**: 1824-26.

SCANLON, G, T. 1968. Fustat and the Islamic Art of Egypt. *Archaeology* **21**: 188-95.

SCANLON, G, T. 1976. Fustat expedition: Preliminary report, 1968: Part I. *Journal of the American Research Center in Egypt* **13**: 69-89.

SCANLON, G, T. 1981. Fustat expedition: Preliminary report, 1972: Part I. *Journal of the American Research Center in Egypt* **18**: 57-84.

SCANLON, G. T. 1990. The archaeology of Al-Fustat: Some novelties. *Bulletin de l'Institut d'Egypte* 58/59: 1-15.

SCHOFIELD, J. R. 1938. A preliminary study of the prehistoric beads of the northern Transvaal and Natal. *Transactions of the Royal Society of South Africa* **26**: 341-71.

SCHOFIELD, J. R. 1943. A study of the old trade beads of Nyasaland. *Transactions of the Royal Society of South Africa* **30:** 17-34.

SCHOFIELD, J. R. 1955. The city of Gedi. *South African Archaeological Society*: Presidential Address.

SCHOFIELD, J. R. 1958. The beads of southern Africa. *In* Summers, R. *Inyanga*: 180-229. Cambridge University Press.

SEN, S. N. & CHAUDHURI, M. 1985. *Ancient Glass and India.* Calcutta: Eastland Printers.

SHAW, K. 1968. *Ceramic Colours and Pottery Decoration.* London: Maclaren.

SHAW, T. 1978. *Nigeria: Its Archaeology and Early History.* London: Thames and Hudson.

SHAW, T. 1985. Always something new from Africa. *Antiquity* **10**: 209-13.

SHEPERD, G. 1982. The making of the Swahili. *Paiduema* **28**: 129-47.

SHERIFF, A. 1987. *Slaves, Spices and Ivory in Zanzibar*. London: James Currey.

SHERR DUBIN, L. 1987 *The History of Beads.* London: Thames and Hudson.

SINCLAIR, P. 1982. Chibuene - an early trading site in southern Mozambique. *Paideuma* **28**: 150-64.

SINGER, C., HOMYARD, A. R., & HALL, A. R. 1956. *A History of Technology* Vol.6. Oxford: Clarendon Press.

SINGH, R. N. 1989. *Ancient Indian Glass.* Delhi: Parimal Publications.

SMITH, A. 1970. *Pre-colonial African Trade. In* Gray, R. & Birmingham, D. (eds), *Pre-colonial African Trade.* Oxford: Oxford University Press.

SMITH, R. W. 1957. New finds of ancient glass in North Africa. *Ars Orientalis* **2**: 91-117.

SPAER, M. 1984. On some of our earliest glass finds. *Israel Museum Journal* **3**: 14-6.

SPAER, M. 1985. Some observations on the stratified Mediterranean eye-beads of the first millennium BC. *Annales du 10e Congres de l'Association Internationale pour l'histoire du Verre*. Madrid-Segovie, pp.1-14.

SPAER, M. 1987. Some egg-shaped glass vessels and reflections on early glassblowing. *Israel Museum Journal* **6**: 51-8.

SPAER, M. 1988. The pre-Islamic glass bracelets of Palestine. *Journal of Glass Studies* **30:** 51-61.

SPAER, M. 1992. Glass bracelets of Palestine: preliminary findings. *Journal* of Glass Studies **34**: 44-62.

SPAER, M. 1993. Gold-glass beads: a review of the evidence. *In* Karklins, K (ed), *Beads* **5**: 9-25.

SPAER, M. 1993. Some observations on "Fustat" beads. *In*: Karklins, K (ed), *The Bead Forum* No.22: 4-11.

SPENCER TRIMMINGHAM, I. 1949. *Islam in the Sudan.* Oxford: Oxford University Press.

SPRAGUE, R. 1985. Glass trade beads: a progress report. *Historical Archaeology* **19(1)**: 87-105.

STEYN, M. 1994. An assessment of the health status and physical characteristics of the prehistoric population from Mapungubwe. Unpublished PhD thesis, University of the Witwatersrand.

SUMMERS, R. 1958. *Inyanga.* Cambridge: Cambridge University Press.

SUMMERS, R. 1969. *Ancient Mining in Rhodesia.* Museum Memoir No 3. Salisbury: Mardon Printers.

SUN, K-H. 1947. Calculation of refractive index of a glass as a direct function of its composition. *Journal of The American Ceramic Society* **30(9):** 282-87.

TAMPOE, M. 1989. Maritime trade between China and the West. *BAR International Series 555*.

TATTON-BROWN, V. & ANDREWS, C. 1991. Before the invention of glassblowing. *In* Tait, H. (ed), *Five Thousand Years of Glass*. London: British Museum Press.

TAYLOR, S. R. & MCLENNAN, S. M. 1985. *The Continental Crust: its Composition and Evolution*. Oxford: Blackwell Scientific Publications.

THORBAHN. P. F. 1979. The pre-colonial ivory trade of East Africa: reconstruction of a human-elephant ecosystem. University of Massachusetts PhD. London: University Microfilms International.

THROCKMORTON, P. (ed) 1987. *History from the Sea.* London: Mitchell Beazley.

TITE, M. S., FREESTONE, I. C., & BIMSON, M. 1986. Egyptian faience: an investigation of the methods of production. *Archaeometry* **25(1)**: 17-27.

TORRENCE, R. 1994. Just another trader? An archaeological perspective on European 'contact' with Admiralty Islanders, Papua New Guinea. *Archaeology as an Indicator of Trade & Contact: Conference Proceedings, World Archaeological Congress-3.* New Delhi: Academic Committee of WAC-3.

TRACEY, H. 1963. The Hakata of southern Rhodesia. *Southern Rhodesia Native Affairs Department (*NADA) **40**: 105-107.

Transvaal Archives, July 1940-February 1950. Director Archaeological Survey. SAB. ASW. Vols 32-33. Ref: B11/5.

Transvaal Archives, 1952. C. van Riet Lowe - Personal. SAB. UOD. Vol.2. Ref: E3/1/639.

TRIMMINGHAM, J. S. 1949. *Islam in the Sudan.* Oxford: Oxford University Press.

TRIMMINGHAM, J. S. 1962. *History of Islam in West Africa.* Oxford: Oxford University Press.

TURNER, W. E. S. 1954. Studies of ancient glasses and glass-making processes. Part I. Crucible and melting temperatures employed in ancient Egypt at about 1370 B.C. *Journal of the Society of Glass Technology* **38:** 436T-56T.

TURNER, W. E. S. 1955. Studies of ancient glasses and glass-making processes. Part V. Raw materials and melting processes. *Journal of the Society of Glass Technology* **36**: 277T-370T.

TURNER, W. E. S. 1956a. Studies of ancient glasses and glass-making processes. Part III. The chronology of the glassmaking constituents. *Journal of the Society of Glass Technology* **40**: 39T-52T.

TURNER, W. E. S. 1956b. Studies of ancient glasses and glass-making processes. Part IV. The chemical composition of ancient glasses. *Journal of the Society of Glass Technology* **40**: 163T-86T.

UNDERHILL, L. G. & PEISACH, M. 1985. Correspondence analysis and its application to multi-elemental trace analysis. *Journal of Trace Microprobe Techniques* **3**: 41-65.

UNESCO. 1981. *Protection of the Underwater Heritage.* Switzerland: UNESCO.

VAN DER MERWE, N. J. & SCULLY, R. T. K. 1971. The Phalaborwa story: archaeological and ethnographic investigation of a South African Iron Age group. *World Archaeology* **3**: 178-96.

VAN DER SLEEN, W. 1967. *A Handbook on Beads.* Liege: Musee du Verre.

VAN DER SLEEN, W. G. N. 1958. Ancient glass beads with special reference to the beads of East and Central Africa and the Indian Ocean. *Journal of the Royal Anthropological Institute of Great Britain and Ireland* **88(2)**: 203-16.

VAN DER SLEEN. W. G. N. 1956. Trade-wind beads. *Man* **56**: 27-9.

VAN DER SLEEN, W. G. N. 1955. Zimbabwe beads and ribbed ware. *South African Archaeological Bulletin* **10(38)**: 60.

VAN RIET LOWE, C. 1955. The glass beads of Mapungubwe. *South African Archaeological Survey.* Archaeological Series **9**: 1-22.

VAN RIET LOWE, C. 1936. Mapungubwe. *Antiquity* **10(39)**: 282-91.

VELGUS, V. A. 1993. Chinese voyaging to Africa and to the Persian Gulf: hypothesis and sources. *St. Petersburg Journal of African Studies* **1**: 104-12.

VERAPRASERT, M. 1987. Khlong Thom: an ancient bead manufacturing location and an ancient entrepôt. *Conference Proceedings, SPAFA Seminar in Prehistory of Southeast Asia (T-W11) Bangkok, Surat Thani, Phangnga, Phuket and Krabi, Thailand*, pp. 323-31.

VERIN, P. 1986. *The History of Civilization in North Madagascar*. Rotterdam: Balkema.

VINCENT, W. 1800. *The Periplus of the Erythrean Sea.* Part I. London: T. Cadell & W. Davies.

VINCENT, W. 1805. *The Periplus of the Erythrean Sea.* Part II. London: T. Cadell & W. Davies.

VINCENT, W. 1807. *The Commerce & Navigation of the Ancients in the Indian Ocean*. Part II. London: T. Cadell & W. Davies.

VLASOV, K. A. 1966. *Geochemistry of Rare Elements.* Vol.1. Jerusalem: S. Monson.

VOGEL, H. U. 1993. Cowrie trade and its role in the economy of Yünnan: from the ninth to the mid-seventeenth century. Part III. *Journal of the Economic and Social History of the Orient* **36**: 211-51.

VOIGHT, E.A. 1983. Mapungubwe. *Transvaal Museum Monograph* no.1. Pretoria: Transvaal Museum.

VOSE, R. 1980. *Glass.* London: William Collins Sons & Co Ltd.

WATSON ANDAYA, B. & ANDAYA, L. Y. 1994. *A History of Malaysia.* London: Macmillan.

WACE, A. J. B. 1932. Chamber tombs at Mycenae. *Archaeologia* v. 82. London: Society of Antiquaries.

WEEDMAN, K. J. 1993. Foragers, Pastro-foragers, and Agro-pastoralist: Lithic Use in Botswana from the 2nd millennium BC Through the 19th century AD. Unpublished MA thesis, The University of Texas at Austin.

WEINBERG, G. L. 1971. Glass manufacture in Hellenistic Rhodes. *ANATYPON. APXAIOKOCIKON DEKTION* **24**: 143-64.

WHITCOMB, D. S. 1983. Islamic glass from Al-Qadim, Egypt. *Journal of Glass Studies* **25**: 101-8.

WHITEHOUSE, D. 1983. Maritime trade in the Gulf: the 11th and 12th centuries. *World Archaeology* **14(3)**: 328-34.

WILLETT, F. 1960. Ife and its archaeology. *Journal of African History* **1(2)**: 231-48.

WILLIAMSON, A. 1974. Harvard archaeological survey in Oman, 1973: III - Sohar and the sea trade of Oman in the tenth century A.D. *Proceedings of the Seminar for Arabian Studies* **4**: 78-96.

WILLIAMS-THORPE, O. & THORPE, R. S. 1990. Millstone provenancing used in tracing the route of a fourth-century BC Greek merchant ship. *Archaeometry* **32(2)**: 115-37.

WILLIS, J. P. 1986. Instrumental analytical techniques in geochemistry: Requirements and applications. *Fresenius' Zeitchrift für analytische Chemie* **324**:855-864.

WILLIS, J. P. 1993. Rare earth elements in the sedimentary environment. *Geological Sciences Honours Course*. University of Cape Town.

WILMSEN, E. N. 1989. *Land Filled with Flies.* Chicago University Press.

WRIGHT. H. T. 1984. Early seafarers of the Comoro Islands: the Dembeni Phase of the IXth-Xth centuries AD. *Azania* **19**: 13-60.

WRIGLEY, C. 1960. Speculations on the economic prehistory of Africa. *Journal of African History* **1(2):** 189-203.

YAJIMA, H. 1976. The Arab Dhow trade in the Indian Ocean. *Institute for the Study of Languages and Cultures of Asia and Africa.* Studia Culturae Islamicae No. 3.

YE'OR, BAT. 1985. *The Dhimmi: Jews and Christians under Islam.* Cranbury: Associated University Presses.

APPENDIX I

EARLY CONTACT AND TRADE BEFORE THE RISE OF ISLAM

Early Trade History in the Mediterranean

The Mediterranean Sea has been used for the passage of trade goods and contact since antiquity. While it is a matter of conjecture who was the first trader to establish external contact with his neighbour, it is likely that once trade routes were established they were used by various participants throughout time. The chronological sequence for many of these events is sometimes difficult to ascertain because of scant documentation, but the discoveries of ancient shipwrecks carrying goods provide useful time capsules.

Trade routes throughout the Mediterranean were used by sea-faring Canaanites more than 3000 years ago. According to Klemp (1968:9), they were considered the sea lords of the Mediterranean with established trading centres at Gadir or Gades [Cadiz] (BC 1100), Carthage (BC 814) and at Lixus [present day Morocco]. They had access to silver deposits on the Iberian peninsula and even explored beyond the Straits of Gibraltar, discovering the Canary Isles and Madeira (Klemp 1968:9).

Ancient Trade Routes

Evidence of early trade in the Mediterranean has been found in a shipwreck dated to *ca* BC 1200. The ship, approximately 13m long, was found in 30m of water off Cape Gelidonya, the southernmost part of Asia Minor, opposite the northern coast of Cyprus (Throckmorton 1987:31). In all probability the ship was Canaanite, and carried a cargo of iron and copper ingots, bronze 'bun' ingots, tin ingots, wicker baskets full of bronze scrap and broken bronze tools, metal working tools and a jar of coloured glass beads. The glass beads seemed strong and well preserved whilst still under water, but exploded into particles of dust when they were left to dry out (Throckmorton 1987:102).

Egyptian vessels sailed to the land of Punt, probably situated on the northern Somali coast, as early as BC 2470 (Hourani 1963:7). Numerous reliefs and inscriptions found on Egyptian tombs testify to a trade in spices and African animals. Funerary and worship rites led to the development of the incense trade. The 14th century Mediterranean shipwreck at Ulu Burun yielded numerous items which were indications of trade, amongst which were a number of dark logs thought to be ebony (Bass 1987:729). Analysis of this wood showed it to be African blackwood (*Dalbergia melanoxylon*) which grows in the Sudan and occurs as far south as Mozambique and Angola. Voyages which departed from Mediterranean ports included -

(1) The voyage of Himilco sailing from Cadiz, *ca.* BC 450, who journeyed to Cornwall in search of tin and Ireland for gold (Throckmorton 1987:52).

(2) The voyage of Hanno. (see below).

(3) Around BC 300 Pytheas sailed to the far north, possibly as far as Iceland where the sea was 'congealed' [frozen] (Throckmorton 1987:54).

As early as BC 800 the Phoenicians (Canaanites) obtained gold from West Africa through Berber middlemen (Hall 1987:26-30). It seems likely that an extensive trading network existed within west Africa before the Arab trade across the Sahara was developed (Connah

1987:120). Further trading lines extended from Tripoli via Fezzan to Timbuktu, and from Tripoli to Lake Chad (Hisket 1984:59).

In BC 450, Herodotus recorded that Carthaginians were trading for gold on the Atlantic coast, and that Phoenician (Canaanite) cities were trading extensively with the Berbers in the Sahara, bartering cloth, beads and metal goods for ivory, gold and slaves; other merchandise included wild animals for the circuses of Rome (Oliver & Fagan 1975:9). He also reported that the Garamantes [North African nomads] travelled in horse drawn iron chariots along a western route in Mauritania and a central route to Fezzan (Spencer Trimingham 1962:12).

Five years later, in BC 425 King Hanno of Carthage, with 30 000 people and sixty ships, undertook his legendary voyage along the shores of North Africa, through the Straits of Gibraltar to Senegal, the Guinea Coast and Mount Cameroon, establishing cities named as Thymiaterion, Soloeis, Karikon Teichos, Gytte, Akra, Melitta, Arambys and Kerne (Blomqvist 1979-80:12)[1]. Hanno's expedition was a complete failure and the only recorded objects he brought back to Carthage were three dead

> *...(w)ild hairy women called Gorillas (*Blomqvist *op cit*:63).

....

Throckmorton (1987:60) compiled and computerised almost 600 Roman shipwrecks from the Hebrides to the Red Sea ranging in sizes from small up to 600 tonnes. Cargoes included glass, glass beads, copper, lead, tin, wine, fish sauce, olive oil, pottery, building materials, marble and a host of foodstuffs to feed the Empire. Rome became the centre of a trade network stretching from Wales to China.

During the time of the Roman Empire, trade was already being carried on in Africa where caravans moved northwards from Chad to Numidia and Mauritania [an extension of the old Carthage trade], and to the Upper Nile region in the east (Lubis 1991:30). Macedonia became a link between the Mediterranean, the Middle East and India. Roman trade extended along the silk route to the Pamirs, Turkistan and China under the Han Dynasty. Shipping was extended to India, Ceylon, Indonesia and Malaysia. Southern Arabia also participated in early port entrepôt trade and shipping, involving Egyptians, Greeks, Romans, Indians and Indonesians.
The wide frontiers of the Roman Empire were continually threatened by barbarian people who disrupted the delivery of foodstuffs and trade goods. It is interesting to note that there were about 1000 active harbours in the Mediterranean and Black Sea areas during the Roman period (Muckelroy 1980:176). The final collapse of the Roman Empire in AD 476 brought about major changes in shipping, and control of the sea-borne traffic passed into the hands of independent merchants and traders who travelled on their own ships.

Political factors were the main reasons which led to the increase, decrease or even abandonment of early trade routes. Early trade northwards and eastwards across the Sahara is certainly evident, but the west coast was not destined to be a great external trading network until the advent of the European sea traders from the 14th century onwards. This was brought

---

[1] The interpretational problems associated with Hanno's voyage are well known, but technically it was possible. A replica ship currently sailing in the Mediterranean demonstrated that long voyages were possible. (Throckmorton 1987:69).

about by political constraints resulting in an upsurge of exploration for new routes to the coast[2]

The camel was introduced into the desert regions about AD 100. Following ancient established trade routes, camel caravans transporting merchandise between settlements, carried trade items such as gold, ivory, salt and gum (Adu Boahen 1962: 349). Increased trade led to the establishment of the Roman cities of North Africa - Tumgad, Djemila and Sabratha. It has been suggested that sub-Saharan Africa is separated from the rest of the world by two seas: the sea of salt water that surrounds its coasts and the sea of sand which forms the Sahara (Davison 1972:38). The introduction of the 'ship of the desert', the camel and the development of suitable sea-going ships were responsible for the opening of many trade routes and centres.

North Africa (Including Egypt) and East Africa

Egypt and North Africa were central to the interpretation of trade and trading and there is little reason to segregate the North from the rest of Africa. Oliver & Fagan (1975:4), state categorically that dynastic Egypt had a culture and a sense of values quite different from anything found in eastern Europe and the western Asian Bronze Age world to the north. Direct caravan routes via North Africa linking Egypt with the gold and copper producing areas of West Africa were evident from the earliest times. Rock art chariot drawings, found close to the copper deposits in southern Mauritania, and artefacts dated to the 5th century BC indicated that the miners were Berbers who traded their goods northwards toward the coast (Oliver & Fagan 1975:60).

The shift of power eastwards, resulting in the establishment of Byzantium as a second capital to Rome, led to a decrease in trade in North Africa.

In the East African region it is relevant to include the Red Sea, Nubia, a portion of the Sudan, Ethiopia and Somalia, in examining early trading contact. The Red Sea and the river Nile provided a natural link with the Mediterranean basin. A possible trading route based on the spread of the iron trade along the East Coast is from the Red Sea port of Adulis, which became prominent between the 1st to the 6th centuries AD. Adulis controlled the lower reaches of the Red Sea and was a link between the Mediterranean and the Far East (Morrison 1983:124). The capital of this Sudanic kingdom was Meroe, which had been producing iron since the 7th century BC: Research indicated that in the early centuries AD furnaces used in Meroe were of Roman design (Hall 1987:27). With the demise of Meroe, circa 2nd century AD, an alternative source of iron as a trading commodity was required. Early Iron Age sites have been located near the coast; for example, Kwale (30km south of present day Mombasa) had a good anchorage and fresh water.

The inhabitants of the East coast have been described by Freeman-Grenville (1962:2) as Negroid, of great stature, living under a tribal system with servant chiefs for each place. Slaves were in great demand as trading commodities and attracted a duty upon sale. A

[2] Thiel (1969:9), notes that there was a general lack of interest in exploring the west coast sea routes. He believed that one of the principal factors attributing to this was the expansion of the sea-borne trade between Egypt and India.

reference was made to glass and crystal imports into East Africa in the *Periplus of the Erythrean Sea* (a guide to the ports of Arabia, East Africa and India) (Vincent 1800:104).

Evidence of the identity of seafaring traders who visited the southeast coast of Africa during the 1st millennium AD is fragmentary, although we know that maritime trade on the Indian Ocean developed much earlier than it did on the Atlantic. The earliest evidence for this trade comes from the accounts of explorers and geographers, although it is not really known how far their knowledge was based on personal observation or how far they actually went on their voyages. The often quoted *Periplus of the Erythrean Sea* depicts Arab traders in the Indian Ocean from India to Tanzania in the 1st century AD (Vincent 1800:Vol.I). The *Periplus* was compiled when Egypt was a colony of Rome *ca.*AD 80[3], and contained an account of the navigation of the ancients from the sea of Suez to the coast of Zanzibar. Detailed descriptions were recorded of promontories, river mouths, harbours, coastal towns and voyages involved with trading activities. However, the authenticity of this document has frequently been questioned. There are no further accounts of sea-travel for many years until the first half of the 12th century when Mohammed al-Idrisi (1099-1164) compiled a book based on his own travels and those of other writers and informers (Klemp 1968:14-15).

During Dynastic Egyptian, Roman and Byzantium times the Sudan was regularly raided for slaves. Slaves were subject to high duties and were regarded as commodity trade. The *Periplus* mentioned that the south western Arab trade had been ongoing for a long time among ship captains and agents

> *...(w)ho are familiar with the natives and intermarry with them and who know the whole coast and understand the language* (Mallows 1984:93).

Whether or not there was direct contact between the East Coast of Africa and India remains conjectural because of the lack of direct evidence. However, the interpretation of available evidence for early trade on the East coast seems to point to two distinct trading patterns linked by emergent Swahili coastal traders. The first consists of Arab influence from the north with 'coastal hopping' from Arabia and the Persian Gulf regularly reaching as far south as Zanzibar. In the second pattern, long distance ocean going merchants sailed from Southeast Asia via the Laccadive, Maldive and Chagos archipelago to Madagascar and the Comores (Verin 1986).

The Indian Ocean, Pre-Islam

The Indian Ocean comprises a complex of seas (from east to west): - the China Sea; the Java Sea; the Bay of Bengal; the Arabian Sea; the Persian Gulf and the Red Sea. It is possible to distinguish two types of passage within the infrastructure of the Indian Ocean trade. The first took place between the commercial cities of the Red Sea and the Persian Gulf, united after the 7th century by the common bond of Islam; the second type was the long trans-regional trip to India, the Indonesian islands and China (Chaudhuri 1985:15).

India played a pivotal role in the Indian Ocean commercial trade network not only in geographical terms but also in the volume and value of the merchandise exchanged. It is noteworthy that although the coastal rulers of South India and Malabar occasionally emerged

[3] Now revised to AD 120-130 (Datoo 1970:73).

as sea-powers capable of naval expeditions to the Indonesian archipelago, India lacked sea-power in the pre-modern period (Chaudhuri 1985:15).

Two cities in Arabia founded by Alexander the Great (Charax and Apologus), traded with India exporting pearls, purples (dyed cloth), wine, dates, gold and slaves to Barygaza on the Gulf of Cambay in return for copper, ebony and timber of various kinds (Hourani 1963:16). According to Hornell (1941:248), sources of Indian timbers were discovered in Babylonian ruins dated between BC 604-BC 538 which he considered sufficient evidence to indicate sea trade between India and the Euphrates .

Thiel (1969:17) claims that *Eudoxus* of *Cyzicus* used the monsoon winds for his voyages to and from India and undertook direct expeditions by sea from Egypt to India in *ca*. BC 110. The Kings of Egypt commissioned several voyages during this time as well, one during which a Greek navigator [named Hippalus] learned of, and recorded, the art of sailing between Arabia and India, using the southwest monsoon which blows in summer (Hourani 1963 :240).

Shepherd (1982:130) noted that various factors pointed to South Indian based Indonesian traders settling in Madagascar *ca*. BC 230 - AD 300, suggesting that the occupation of Madagascar originated as a by-product of trade with east Africa, stock-piling goods for the next international monsoon season. A study of food crops of South East Asian origin lists 10 which are found in Madagascar; 9 in the Comores; and 5 on the east African mainland, suggesting a northwards diffusion of these crops from Madagascar. A similar path northwards is noted with the incidence of outrigger canoes. Outriggers are found in Southeast Asia, southwest and south India and the Maldives, Laccadives and Chagos Islands; and Madagascar, Comores and East African coast as far north as Mogadishu.

By AD 150 - 160 Greeks were sailing to Ceylon and a few adventurers had sailed as far as the Malay peninsula (Hourani 1963:35). With the fall of the Roman Empire trade decreased and recorded sources are scant. A gradual expansion of the Gulf trade by the Sasanians during the 3rd - 5th centuries AD greatly facilitated trade between China and the West, complementing the long established *Silk Route* overland. Siraf which became an important entrepôt with the rise of Islam, was emerging as a military settlement at this time (Tampoe 1989:82). However, trade routes were kept open, with the ports of Ceylon emerging as the places where interchange of goods took place. A writer in the 6th century, reported that the island of Ceylon was frequently visited by ships from India, Persia and Ethiopia (Kobishchanow 1965:139). By the 6th century AD westward trade was in the hands of the Persians and Axumites and eastern trade consisted of Chinese and Far Eastern nations. On the western side of the Red Sea Adulis became the prominent port of interchange. Another writer in the 6th century described fleets of ships travelling from Adulis to north India and Ceylon carrying goods which included emeralds (Kobishchanow 1965:140).

Regular trade took place in wine, bronze, tin, gold, manufactured goods to the east, returning from India with silk, cotton, jewels, pepper, sandalwood and various kinds of perfume. Rice, cloves, nutmegs, mace and cinnamon (from Ceylon) were exported to the Persian Gulf and the Red Sea.

Chinese Voyages To Africa

Different groups of researchers have contended that Chinese ships visited the coasts of East Africa in the 8th-9th centuries, others that the Chinese actually sailed to Africa in the 12th - 13th centuries, and that whole flotillas of Chinese vessels, and Chinese nationals flooded the mainland. Others hold the opinion that the Chinese had sailed to Africa in their own ships, reaching the Cape of Good Hope. Joseph Needham, for example, suggested that the Chinese rounded the Cape of Good Hope from east to west much earlier than the Portuguese (Norwich 1983:15-17). Snow (1988:9) reported that Chinese merchants travelled in ships

> *...(l)ike houses with five to six decks, provisioned for ocean voyages with a years grain supply. Their navigators possessed magnetic compasses and their cartographers produced world maps showing the correct shape of Africa*

Fripp (1941:17) once again wrote about the gift of a giraffe presented to the Emperor of China by an envoy from Malindi in AD 1415, and Freeman-Grenville (1962:21-22), recorded that during the latter part of the Song period, (1127-1279) when China became a maritime nation, every year Chinese ships from the Huchala and Tashi areas travelled to Zanzibar to trade with white and red cotton cloth, porcelain and copper.

However, in view of the availability in scientific literature of data on the period of direct Chinese-maritime relations, Velgus (1993:104-112) examines and actually questions whether in fact Chinese ships could have visited the coasts of Africa before the 9th century by first considering the problem of bringing any Chinese ships to the Persian Gulf in the pre-Islamic period. The results of this discourse are discussed in Chapter 5.2.4

The Caravan trade

Well established sea routes between the major cities with regular sailings together with overland caravan routes served to distribute the goods. Caravans connecting the Muslim West - Morocco, Algeria, Tunisia, and Libya with Egypt were of special importance and had a special name - 'mawsim' which meant, literally - fixed, fixed date or season (Goitein 1967: 277)[4] .

Travel overland (until the development of modern roads and railways) was slower and more expensive than sea journeys. During the 2nd half of the 11th century, for example, to transport a camel load of paper from Damascus to Cairo cost from 5½ to 6 gold coins. Couriers utilized regular caravan routes and their charges were relatively inexpensive. Regular sailing voyages were developed in addition to overland caravan routes to carry and distribute goods.

Of great importance to the merchant, businessman and traveller was the ability to communicate regularly and the Geniza papers attested to the existence of a regular overland mail service. Circa 1030, a communal leader in Fustat wrote to a friend in Tunisia *...I regularly send you every Monday two letters* (Goitein 1967:287).

---

[4] Incidentally, this same word is used for the seasonal winds of the Indian Ocean and enters the English language as *monsoon*.

The Geniza Documents

A unique source of historical documents is the Cairo Geniza, unearthed in Fustat, with many of the texts translated by Goitein (1967, 1971, 1973 & 1983). It substantiates the existence of international trade between Islamic countries in the Mediterranean including most of Spain, Sicily and North Africa between AD 1000-1200. At least 80% of the business correspondence of the Geniza papers originated from Tunisia and Sicily. Much also came from Lebanon and Syria. Probably the Geniza originally served the Maghrebi merchants who commuted from the western to the eastern part of the Mediterranean where they partially settled.

The documents contain references to thousands of items including copies of receipts, bills of lading, promissory notes and orders of payment. The Geniza papers were not orderly archival material. They comprised a collection of legal deeds, court records, business letters, personal letters, bills of divorce, trading documents and scrap paper. Paper was an expensive luxury at the time, so that any unused space on a document was filled with all sorts of writing such as drafts, short notes, accounts or even merely trying out a pen. It was not uncommon to find a receipt dated, for example, 26 April 987 AD with the reverse side used to test a pen dated 21 December 1085 AD.

Business letters comprise the largest group of documents. These collections represent a unique resource of knowledge on commerce, industry, overland travel and seafaring. Details recorded receipt and despatch of goods, lists of market prices, orders for new commodities, action taken for and against third persons as well as references to private and public affairs. Inventories of stores, workshops and pawnbrokers, bills of lading, promissory notes and orders of payment were all notated accurately. One example amongst them reported on approximately 45 individual payments or disbursements that were required to transport 1 bale of purple cloth from Fustat to Tunisia.

In addition, the Geniza documents also provide information on a well developed, commercially operated overland mail service that was used by the population at large, as early as the beginning of the eleventh century. Numerous Geniza letters were written from Aden and India, and throughout the Muslim world, including Palestine, Syria, Persia and Europe.

....

WORLD TRADE BEFORE THE RISE OF ISLAM

Summary of chronological events relevant to the text

Date BC	*Event*	*Notes of interest*
6000	Sumerians discover formula for glazes.	
4000	Early glazed pottery.	
4000-3000	Glassmaking at Akkadia.	
ca. 4000	Beads, amulets and scarabs made	Egyptian craftsmen.
3000-2000	Trade between Mesopotamia and Pakistan	Swat mountain middlemen.
3000	Maritime trade between Mesopotamia and the Persian Gulf	
3000	Contact between Africa & India by Arab seafarers	Cotton introduced to the Indus valley from Ethiopia.
3000	Sea faring Canaanites	Consolidation of sea-routes in the Mediterranean.
2500	Intercontinental sea voyages in the Indian Ocean	Coastwise voyages by Sinhalese Indian and southern Arabs.
2470	Egyptian vessels sail to the land of Punt	Punt is probably North Somalia.
2000	Glass beads recovered from Nuzi, East Iraq	
2000-1000	Indian Dravidian seafarers familiar with ocean patterns	Possessed ocean going ships and were familiar with navigation.
2000	Native copper melted in bellows assisted furnaces.	Niger
2000	Occupation of Madagascar	Early date disputed
1728-1686	Laws of King Hammurabi	Trading profit identified.
1559-1531	Glassmaking in Egypt	Coloured glass rods for beads.
1473-1458	Glass beads from Deir el Bahri	Identified as early glass.
ca. 1375	Tel el-Amarna (Akhenaten)	Faience beads & glass rods.
ca. 1300	Shipwreck at Ulu Burun	Dark logs identified as African blackwood.
1200	Shipwreck off Cape Gelidonya	Canaanite ship carrying glass trade beads.
1100-400	Iron chariots in use in North Africa	Early trade in salt, gold and slaves.
1100	Canaanites established Gadir or Gades (Cadiz)	Access to Iberian peninsula silver mines.
974-932	Trading activities of King Solomon, Egypt & India	Recorded in the Bible.
950	Copper refinery at Tel-al-Khulayfah	Built by King Solomon.
900	Ife terra cotta figures radio carbon dated	Continued production until after AD 200.
ca. 900	Possible evidence for glass making at Ife	Blue beads made from secondary worked glass.
814	Canaanites establish Carthage	Extensive system of docks excavated.
ca. 800	Canaanites sail beyond Straits of Gibraltar	Discovery of Canary Islands.
800	Canaanite trade in gold from West Africa	Obtained from Berber middlemen.
604-538	Indian timbers dated in Babylonian ruins	Evidence of sea trade between India and Euphrates.
600	East/west circumnavigation of Africa	Commissioned by King Necho but only reported in 5th century by Herodotus.
ca. 680	King Necho linked Nile to Suez.	
521-485	Canal link between Nile and Suez	Darius the Great.
ca. 500	Hindu contact with East Africa	Introduction of coconut palm.
500	Regular trade routes between Africa and India.	Motivated by quest for gold.

Date BC	*Event*	*Notes of interest*
ca. 500	Merchants from Carthage trading in Tibesti region North of Lake Chad & Bodele depression.	
450	Carthaginians trading for gold on Atlantic	Barter with Berbers exchanging cloth, beads and metal for gold and slaves.
450	Herodotus describes Ethiopian gold	
450	Voyage of Himilco from Cadiz	Journey to Cornwall for tin and Ireland for gold.
400	Copper deposits in southern Mauretania exploited by Berber miners.	
ca. 300	Exploration of Red Sea & East Africa by Ptolomy I	
285-221	Explorations of Ptolomies II & III	Voyages to Cape Gardafui
ca. 100	Hipplaus records the winds and currents in the Indian Ocean & the monsoon wind patterns.	

Date AD	*Event*	*Notes of interest*
96	Strabo reports ships sailing to India.	
100	Camel introduced into Saharan region	Results in increased trade.
ca. 100	Development of iron trade along East coast of Africa	Close affinity with Indian smelting technology.
ca. 100	Early Indo-Indonesian contact with south East Africa.	
100	Seafaring Swahili society established	East coast coastal traders.
100-600	Rise of Adulis as a sea port	Adulis controlled by lower reaches of the Red Sea.
100-700	Colonising Indians emigrated to Java, Sumatra & Cambodia. Possibly Madagascar as well.	
120	Periplus of the Erythreaen Sea.	
150-160	Greeks sailing to Ceylon	Visits to Malay peninsula also recorded.
ca. 200	Demise of Meroe	Important iron producer since 300 BC.
324	Byzantium founded by Emperor Constantine	Shifted seat of government towards the east.
337	Important glassmaking industry	Constantine exempted 'vitriartii' (glassmakers) & 'diatretiarii' (glass carvers) from public levies.
300-500	Gulf sea trade to China increases	Complements the long established Silk route overland.
476	Collapse of Roman Empire	Control of sea borne shipping passed into hands of merchants.
600	Ceylon visited by ships from India, Persia & Ethiopia	Westward trade in hands of Persians & Axumites; eastern trade in hands of the Chinese & Far Eastern nations.
618-907	T'ang dynasty	China ruled as a united Empire.
639	Egypt falls to Arabs.	
647	Tunisia occupied by the Muslims.	

APPENDIX IIa
Catalogue of beads from Greefswald and allied sites

GREEFSWALD BEADS

		MAPK	MAPST	BAM	K2	K2B	E2	ASI	NOL	TOTAL
NEUTRAL WHITE	N9.5/90.0%R			96				55		151
OYSTER WHITE	5GY 9/1	2		22	1		1	85		111
LIGHT GREY	N 8.25/63.65R	1	42		4			5		52
GREEN GREY	10G 6/2	1								1
DOVE GREY	7.5B 6/2									0
BLACK	N0.5/0.6%R	85620	2497	81	8554	14	279	43	2282	99370
TRANSPARENT TURQUOISE	10BG 6/8	306	81	855	2504	394	8	4	20	4172
DEEP TURQUOISE	10BG 5/6	128	14	205	376	201	1	71	14	1010
BRIGHT TURQUOISE	7.5B 6/10	1			31					32
MEDIUM TURQUOISE	5B 6/8	6			344					350
PALE TURQUOISE			2							2
CELEDON TURQUOISE	5BG 5/6	319	159	22	361	26	20	5	410	1322
LIGHT CELEDON	5BG 6/6	4								4
DEEP CELEDON	5BG 4/4									0
CELEDON ON WHITE CORE			1							1
BLUE GREEN	5BG 6/4	3178	224	72	468	153	41	7	69	4212
DARK JADE GREEN	10G 4/6									0
SAGE GREEN	7.5GY 4/4	7			5					12
GREEN	5GY 5/6	272	50	182	133	32	6	22	171	868
MEDIUM BRIGHT GREEN	2.5G 5/6	416	12	13	46	19	3	51	1	561
LIGHT BRIGHT GREEN	2.5G 6/6	3			2					5
NASTURTIUM GREEN	10BG 6/6									0
INDIAN RED	2.5YR 3/8	1129	687	543	1097	79	133	33	331	4032
INDIAN RED ON GREEN CORE	7.5R 3/8	37	1	736	2			99		875
BROWN INDIAN RED	5YR 3/8	5	1							6
INDIAN RED ON BLACK CORE		1								1
BLACK & INDIAN RED STRIPES		1								1
YELLOW	7.5Y 8.5/10	1549	10	15	394	108	12	30	424	2542
VASELINE YELLOW (TP)	7.5Y 8/8	104	13		9	2	1	11		140
OLIVE YELLOW*	7.5Y 7/6	35	3	12	17					67
LEMON YELLOW	10Y 8.5/6				1					1
DEEP LEMON YELLOW	10Y 8/6				1					1
BRIGHT DUSTY YELLOW	5Y 8.5/10	15			9					24
LIGHT MARIGOLD	2.5Y 6/10	248	13		10			33	8	312
DARK MARIGOLD*	7.5YR 6/10	1114	31		279		3	4		1431
BRIGHT NAVY	7.5PB 2/8	9008	68	14	616		11	96	37	9849
BRIGHT NAVY (FACETTED)	7.5PB 2/8	1								1
BRIGHT NAVY (ANNULAR)	7.5PB 2/8			24	11					35
MID BLUE	5PB 4/6	326	1	17				37		381
MEDIUM COPEN BLUE	5PB 6/8	3		96	43			26		168
SHADOW BLUE	2.5PB 5/4									0
DARK SHADOW BLUE	10B 4/4	49	12	36	5	1		22		125
LIGHT BLUE	10B 7/4			161			7	4		172
PALE PINK ON WHITE CORE	10RP 8/4	1		101	4			5		111
MAUVE PINK	5RP 6/8	23		1074	1			40		1138
DARK MAUVE HEATHER	10P 3/4	132	8		154			2	4	300
OSTRICH EGG SHELL		1770	1136	857	179	2		79	140	4163
GARDEN ROLLER BEAD		4			248	49				301
RUBY ON WHITE CORE	2.5R 3/10	18		40				27		85
COPPER BEAD		1			2			3		6
STRIPED BEADS				1			1	17		19
GOLD		1	1							2
POTTERY BEAD					14					14
PIECES OF BONE				1						1
RUBY								2		2
BLOWN BEAD								6		6
HELIX			2							2
SEA SHELL		4		2	3	2				11
MOLLUSC		4								4
SOAPSTONE BEAD		2	1		2		2			7
METAL BEAD		4	19		1			7		31
BONE BEAD		1	3	1	1					6
ACHATINA DISCS					265					265
PATINATED BEAD										0
UNUSUAL COLOUR BEAD		26				6				32
WEATHERED BEAD		71	3	3	37	11		6		131
Total number of beads (n):		105951	5095	5282	16234	1099	529	937	3911	139038

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
JONES LIST	MK. skeleton No. M1 Origional Gold skeleton. Grave area. No.266 AREF F.E.G.A Ex No 1	MAP	15	INDIAN RED	2.5YR 3/8	111		44	67				111			111			111		111
				YELLOW (BRIGHT)	7.5Y 8.5/10	37		2	35				37			37			37		37
				BLACK	N0.5/0.6%R	24808			24808				24808			24808			24808		24726
				TRANSPARENT TURQUOISE	10BG 6/8	4			4			1	3					4			4
				CELEDON TURQUOISE	5BG 5/6	1			1			1				1					1
				BLUE GREEN	5BG 6/4	1			1							1					1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1			1						1			1
				LIGHT MARIGOLD	2.5Y 6/10	171		11	160					171		171					171
				DARK MARIGOLD	7.5YR 6/10	634			634				159	475		634					634
				BRIGHT NAVY	7.5PB 2/8	234			234			16	218					234			234
				DARK MAUVE HEATHER	10P 3/4	1			1				1					1			1
				OLIVE YELLOW	7.5Y 7/6	33			33							33					33
				BLACK/INDIAN RED STRIPE		1							1			1					1
	MK. skeleton - No.5. Baby skeleton. No.16. Grave area. No.5.34.05	MAP	16	BLACK	N0.5/0.6%R	34		18	16				34			34			34		34
				CELEDON TURQUOISE	5BG 5/6	1			1				1				1		1		1
				BRIGHT NAVY	7.5PB 2/8	990		30	960				990					990	990		990
				OSTRICH EGG SHELL																	1071
				MOLLUSCS																	4
				OSTRICH EGG SHELL																	32
				SEA SHELL																	3
				TRANSPARENT TURQUOISE	10BG 6/8	37		18	19				37				35	2	37		37
				INDIAN RED	2.5YR 3/8	32		19	13				32			32			32		32
	MK. skeleton - No.7. No. 272.	MAP	17	BLACK	N0.5/0.6%R	2621			2621				2621			2621			2621		2621
				TRANSPARENT TURQUOISE	10BG 6/8	9		9					9					9	9		9
				DEEP TURQUOISE	10BG 5/6	31		2	29				31			29		2	31		31
				CELEDON TURQUOISE	5BG 5/6	54			54				54			54			54		54
				BLUE GREEN	5BG 6/4	228			228				228			228			228		228
				GREEN	5GY 5/6	83			83				83			83			83		83
				MEDIUM BRIGHT GREEN	2.5G 5/6	402			402				402			268		134	402		402
				INDIAN RED	2.5YR 3/8	120		120					120			120			120		120
				YELLOW	7.5Y 8.5/10	459		23	436				459			455	1	3	459		459
				VASELINE YELLOW (TP)	7.5Y 8/8	36			36				36			36			36		36
				DARK MARIGOLD	7.5YR 6/10	16		1	15				16			16			16		16
				BRIGHT NAVY	7.5PB 2/8	38			38				38					38	38		38
				DARK MAUVE HEATHER	10P 3/4	1			1				1				1		1		1
				BROWN	2.5YR 3/4	1			1				1			1			1		1
				GOLD BEAD																	1
				WEATHERED BEADS																	70
JONES LIST	MK. skeleton - No.14. Grave area	MAP	18	BLACK	N0.5/0.6%R	63		11	50				61	2		63			63		63
				TRANSPARENT TURQUOISE	10BG 6/8	57		18	39				17	3		9	9	4	20		20
				DEEP TURQUOISE	10BG 5/6	34		1	33				17	17		34			24	10	34
				BLUE GREEN	5BG 6/4	2			2				2				2		2		2
				GREEN	5GY 5/6	32			32				30	2		32			23	19	32
				INDIAN RED	2.5YR 3/8	34		17	17				34			34			34		34

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
				YELLOW	7.5Y 8.5/10	58		4	54				58				58		58		58
				OLIVE YELLOW	7.5Y 7/6	2			2				2			2			2		2
				DARK MARIGOLD	7.5YR 6/10	3			3				3			3			3		3
				LIGHT MARIGOLD	2.5Y 6/10	8			8				8			8				8	8
	MK. skeleton No.15.		19	BLACK	N0.5/0.6%R	2135			2135				2135			2135			2135		2135
	No.133.			CELEDON TURQUOISE	5BG 5/6	2			2				2				2		2		2
	Grave area.			GREEN	5GY 5/6	1			1			1					1		1		1
				INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
				YELLOW	7.5Y 8.5/10	11			11			10	1			11			11		11
				BRIGHT NAVY	7.5PB 2/8	36			36				36				36		36		36
				DARK MAUVE HEATHER	10P 3/4	125			125				125					125	125		125
				OSTRICH EGG SHELL																	210
MK (G/S	MK. skeleton - No.16.	MAP	20	BLACK	N0.5/0.6%R	9180			9180				9180			9180			9180		9180
	No. 283. F.O.G.G			BLUE GREEN	5BG 6/4	1724			1724				1724			1724			1724		1724
				GREEN	5GY 5/6	2			2				2			2			2		2
				MEDIUM BRIGHT GREEN	2.5G 5/6	10			10				10				10		10		10
				INDIAN RED	2.5YR 3/8	2		2					2			2			2		2
				VASELINE YELLOW (TP)	7.5Y 8/8	33			33				33			33			33		33
	MK. skeleton - No.19.		21	BLACK	N0.5/0.6%R	7745			7745				7745			7745			7745		7745
	No. 281. F.O.G.G.			TRANSPARENT TURQUOISE	10BG 6/8	3		3					3					3			3
				CELEDON TURQUOISE	5BG 5/6	15			15				15			15					15
				INDIAN RED	2.5YR 3/8	12		3	9				12			12					12
				YELLOW	7.5Y 8.5/10	3			3				3			3					3
				VASELINE YELLOW (TP)	7.5Y 8/8	1		1					1					1			1
				LIGHT MARIGOLD	2.5Y 6/10	59			59					59		59					59
				DARK MARIGOLD	7.5YR 6/10	101		4	97					101		101					101
				BRIGHT NAVY	7.5PB 2/8	1			1				1					1			1
	MK. skeleton - No.22.		22	BLACK	N0.5/0.6%R	714		56	658				714			714			714		714
	Exposed in 1934 but not removed			TRANSPARENT TURQUOISE	10BG 6/8	105		22	83				105			57	20	28	105		105
				DEEP TURQUOISE	10BG 5/6	4		1	3				4					4	4		4
				CELEDON TURQUOISE	5BG 5/6	20		1	19				20			19		1	20		20
				BLUE GREEN	5BG 6/4	62		13	49				62			46		16	62		62
				GREEN	5GY 5/6	28			28				28			28			28		28
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1				1					1	1		1
				YELLOW	7.5Y 8.5/10	39		7	32				39			39			39		39
				LIGHT MARIGOLD	2.5Y 6/10	1			1				1			1			1		1
				SOAPSTONE BEAD																	1
	MK. skeleton - No. 23.	MAP	23	BLACK	N0.5/0.6%R	15570			15570				15570			15570				15570	15570
	No. 304.			GREEN	5GY 5/6	39			39				39			39				39	39
				BLUE GREEN	5BG 6/4	900			900				900			900					900
				INDIAN RED	2.5YR 3/8	7			7				7			7				7	7
				YELLOW	7.5Y 8.5/10	817			817				817			817				817	817
				DARK MARIGOLD	7.5YR 6/10	343			343				235	108		343			343		343
				BRIGHT NAVY	7.5PB 2/8	7639			7639				7639			7639			7639		7639
				OSTRICH EGG SHELL																	2
	MK. skeleton - No. 25.	MAP	24	BLACK	N0.5/0.6%R	15997			15997				15997			15997			15997		15997
	(no more info.).			BLUE GREEN	5BG 6/4	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	4		3	1				4			4			4		4
				"INDIAN RED & OLIVE"		1			1				1								
				SOAPSTONE BEAD		1											1			1	1

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	MK. skeleton - No. 26.	MAP	25	TRANSPARENT TURQUOISE	10BG 6/8	48		36	12				48			11	7	30	48		48
	(no more info.).			INDIAN RED	2.5YR 3/8	6		1	5				6			6			6		6
				YELLOW	7.5Y 8.5/10	2			2				2				2		2		2
	Mapungubwe C.Js 2a	MAP	26	BLACK	N0.5/0.6%R	23		8	15				23			23			23		23
	below top cement floor 34.5.N			TRANSPARENT TURQUOISE	10BG 6/8	2		1	1				2				1	1	2		2
				BLUE GREEN	5BG 6/4	4		2	2				4				4		4		4
				INDIAN RED	2.5YR 3/8	24		11	13				24			24			24		24
				LIGHT MARIGOLD	2.5Y 6/10	1		1					1			1			1		1
				DARK MAUVE HEATHER	10P 3/4	1			1				1				1		1		1
				OSTRICH EGG SHELL																	67
	Map. N 34.5.N Western 1(IIIf	MAP	26a	BRIGHT NAVY	7.5PB 2/8	1				1					1	1			1		1
	Talus (West) N.			BLACK	N0.5/0.6%R	14		4	10				14			14			14		14
				TRANSPARENT TURQUOISE	10BG 6/8	11		11					11					11	11		11
				DEEP TURQUOISE	10BG 5/6	9		8	1				9				1	8	9		9
				CELEDON TURQUOISE	5BG 5/6	36			36				36			36			36		36
				BLUE GREEN	5BG 6/4	32			32				32			32			32		32
				GREEN	5GY 5/6	9		2	7				9			7		2	9		9
				INDIAN RED	2.5YR 3/8	22		12	10				22			22			22		22
				YELLOW	7.5Y 8.5/10	22			22				22			20		2	22		22
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1					1	1		1
				LIGHT MARIGOLD	2.5Y 6/10	2			2				2			2			2		2
				DARK MARIGOLD	7.5YR 6/10	6			6				6			6			6		6
				BRIGHT NAVY	7.5PB 2/8	18			18				18				18		18		18
				DARK MAUVE HEATHER	10P 3/4	1			1				1				1		1		1
				OSTRICH EGG SHELL																	16
MK (G)	Found in large pot	MAP	27	BLACK	N0.5/0.6%R	2			2				2			2			2		2
	A.10'R13'D6"			CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
				YELLOW	7.5Y 8.5/10	2			2				2			2			2		2
				BRIGHT NAVY	7.5PB 2/8	2			2				2				2		2		2
	From pot M/37.4	MAP	27a	BLACK	N0.5/0.6%R	65		3	62				65			65			65		65
	M B.1.S.I A0'.R10'.D2.			BLUE GREEN	5BG 6/4	2			2				2			2			2		2
				YELLOW	7.5Y 8.5/10	11		1	10				11			11			11		11
				OSTRICH EGG SHELL																	2
	M.5.1. 11'20'5'X 1939	MAP	28	BLACK	N0.5/0.6%R	55		17	38				55			55			55		55
	Contaminated			BLUE GREEN	5BG 6/4		1				1				1	1			1		1
				RUBY ON WHITE CORE	2.5R 3/10		1		1				1				1		1		1
				OSTRICH EGG SHELL																	2
	M. B.2.S.4 13'19'3' 1939	MAP	28a	BLACK	N0.5/0.6%R	39		7	32				39				39		39		39
	From debris 1ft above hut floor			CELEDON TURQUOISE	5BG 5/6	1		1					1					1	1		1
	Contaminated			BLUE GREEN	5BG 6/4	2		2					2			2			2		2
				INDIAN RED	2.5YR 3/8	4		1	3				4			4			4		4
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
				LIGHT MARIGOLD	2.5Y 6/10	1			1				1			1			1		1
	M1940 S-2, 12-6-8 (no more in	MAP	29	GARDEN ROLLER																	1
	B6/2 (no more info).	MAP	30	MEDIUM COPEN BLUE	5PB 6/8		3				3				3	3			3		3
	No 16 (no more info.).	MAP	31	RUBY ON WHITE CORE	2.5R 3/10	5			5				5				5		5		5
	No 17 (no more info.).	MAP	32	CELEDON TURQUOISE	5BG 5/6	7		7					7			7			7		7

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	No 18 B7 (no more info.).	MAP	33	BLACK	N0.5/0.6%R	10			10				10			10			10		10
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				OSTRICH EGG SHELL																	6
	No 23 (no more info.).	MAP	34	BLACK	N0.5/0.6%R	20		8	12				20			20			20		20
	No 34 (no more info.).	MAP	35	BLACK	N0.5/0.6%R	5			5				5			5			5		5
				TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
				BLUE GREEN	5BG 6/4	2			2				2			2			2		2
				GREEN	5GY 5/6	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	16		8	8				16			16			16		16
				YELLOW	7.5Y 8.5/10	11			11				11			11			11		11
				BRIGHT NAVY	7.5PB 2/8	2			2				2				2		2		2
				OSTRICH EGG SHELL																	3
				SEA SHELL (with hole)																	1
	No 38 (no more info.).	MAP	36	OSTRICH EGG SHELL																	108
	No 174 (no more info.)	MAP	37	DEEP TURQUOISE	10BG 5/6	47		11	36				47			47			47		47
				INDIAN RED	2.5YR 3/8	24		7	17				24			24			24		24
				MAUVE PINK	5RP 6/8	23			23				23			23			23		23
				PINK ON WHITE CORE																	1
				RUBY ON WHITE CORE	2.5R 3/10	12			12				12			12			12		12
				INDIAN RED ON GREEN CORE	7.5R 3/8	36		5	31				36			36			36		36
				UNKNOWN BEADS (all dark)																	24
	1531 (no more info).	MAP	39	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				MID BLUE	5PB 4/6	326		126	200				326			325		1	326		326
	Mapungubwe D3 (no more info.)	MAP	41	BLACK	N0.5/0.6%R	78		1	77				78			78			78		78
				DEEP TURQUOISE	10BG 5/6	1			1				1			1			1		1
				GREEN	5GY 5/6	37			37				37			37			37		37
Schofield	Map. Hill (later layer)	MAP	42	BLACK	N0.5/0.6%R	4245			4245				4245			4245			4245		4245
	Skeleton S.O.S uitstalkas (no more info.).	MAP	50	BLACK	N0.5/0.6%R	266		93	173				266			266			266		266
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	4			4				4			4			4		4
				LIGHT MARIGOLD	2.5Y 6/10	3			3				3			3			3		3
				BRIGHT NAVY	7.5PB 2/8	2			2				2					2	2		2
MK1 A3 (E&M)	B1 Lg	MAP	51	BLACK	N0.5/0.6%R	22			22				22			22			22		22
				TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
				BLUE GREEN	5BG 6/4	3			3				3			3			3		3
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
	B10 Lg 2	MAP	52	BLACK	N0.5/0.6%R	25			25				25			25			25		25
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				DARK MARIGOLD	7.5YR 6/10	1			1				1			1			1		1
	B18 Lg 3	MAP	53	BLACK	N0.5/0.6%R	5			5				5			5			5		5
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
	B22 Lg 4	MAP	54	BLACK	N0.5/0.6%R	33		2	31				33			33			33		33
				BLUE GREEN	5BG 6/4	4			4				4			4			4		4
				LIGHT BRIGHT GREEN	2.5G 6/6	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	8		2	6				8			8			8		8
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				DARK MARIGOLD	7.5YR 6/10											1					1
	B26 Lg 5	MAP	55	BLACK	N0.5/0.6%R	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	B31 Lg 6	MAP	56	BLACK	N0.5/0.6%R	13		2	11				13			13			13		13
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
	B42 Lg 7	MAP	57	BLACK	N0.5/0.6%R	6		1	5				6			6			6		6
				DARK SHADOW BLUE	10B 4/4	2			2				2				1	1	2		2
				BLUE GREEN	5BG 6/4	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
	B52 Lg 8	MAP	58	BLACK	N0.5/0.6%R	2			2				2			2			2		2
	Lg 8	MAP	59	BLACK	N0.5/0.6%R	6		2	4				6			6			6		6
				TRANSPARENT TURQUOISE	10BG 6/8	2		2				2						2	2		2
				INDIAN RED	2.5YR 3/8	1			1			1				1			1		1
	B66 Lg 9	MAP	60	BLACK	N0.5/0.6%R	16		16					16			16			16		16
				DARK SHADOW BLUE	10B 4/4	1			1				1					1	1		1
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				CELEDON TURQUOISE	5BG 5/6	2			2				2			2			2		2
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
	B67 Lg 9	MAP	61	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	B77 Lg 9(i)	MAP	62	BLACK	N0.5/0.6%R	5			5				5			5			5		5
				INDIAN RED	2.5YR 3/8	2		2					2			2			2		2
	Lg 9(ii)	MAP	63	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	B85 Lg 10	MAP	64	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 10	MAP	65	BLACK	N0.5/0.6%R	5			5				5			5			5		5
				INDIAN RED	2.5YR 3/8	5		2	3				5			5			5		5
	B100 Lg 10(i)	MAP	66	BLACK	N0.5/0.6%R	3		2	1				3			3			3		3
				TRANSPARENT TURQUOISE	10BG 6/8	5		3	2				5					5	5		5
				BLUE GREEN	5BG 6/4	5			5				5			5			5		5
				GREEN	5GY 5/6	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	11			11				11			11			11		11
	B102 Lg 10(ii)	MAP	67	TRANSPARENT TURQUOISE	10BG 6/8	1		1				1						1	1		1
	B110 Lg 10(ii)	MAP	68	BLACK	N0.5/0.6%R	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
	B112 Lg 10(iii)	MAP	69	BLACK	N0.5/0.6%R	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	7			7				7			7			7		7
	B124 Lg 11	MAP	70	TRANSPARENT TURQUOISE	10BG 6/8	1			1			1						1	1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	B125 Lg 11	MAP	71	BLACK	N0.5/0.6%R	1		1					1			1			1		1
				TRANSPARENT TURQUOISE	10BG 6/8	3		3				2	1					3	3		3
				BLUE GREEN	5BG 6/4	1			1			1				1			1		1
				INDIAN RED	2.5YR 3/8	20			20			7	13			20			20		20
	B126 Lg 11	MAP	72	INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
	B138 Lg 11	MAP	73	TRANSPARENT TURQUOISE	10BG 6/8	1		1				1						1	1		1
				INDIAN RED	2.5YR 3/8	7		2	5			2	5			7			7		7
	a3.1. Lg 11	MAP	74	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
MK1 A4 (E&M)	B4 Lg 1	MAP	75	BLACK	N0.5/0.6%R	37			37				37			37			37		37
				BLUE GREEN	5BG 6/4	14			14				14			14			14		14
				SAGE GREEN	7.5GY 4/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	4		1	3				3	1		4			4		4
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
				DARK MARIGOLD	7.5YR 6/10				1												1

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	B13 Lg 2	MAP	76	BLACK	N0.5/0.6%R	34		1	33				34			34			34		34
				BLUE GREEN	5BG 6/4	7			7				7			7			7		7
				CELEDON TURQUOISE	5BG 5/6	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	5			5				5			5			5		5
	Lg 3 (missing)																				
	B24 Lg 4	MAP	77	BLACK	N0.5/0.6%R	35			35				35			35			35		35
				INDIAN RED	2.5YR 3/8	7		2	5				7			7			7		7
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
	B29 Lg 5	MAP	78	BLACK	N0.5/0.6%R	16		1	15				16			16			16		16
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	B24 Lg 6	MAP	79	BLACK	N0.5/0.6%R	8			8				8			8			8		8
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	B35 Lg 6	MAP	80	BLACK	N0.5/0.6%R	11			11				11			11			11		11
				BLUE GREEN	5BG 6/4	1		1					1			1			1		1
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
	B45 Lg 7	MAP	81	BLACK	N0.5/0.6%R	1			1				1			1			1		1
	B46 Lg 7	MAP	82	BLACK	N0.5/0.6%R	3			3				3			3			3		3
	B57 Lg 8	MAP	83	BLACK	N0.5/0.6%R	2			2				2			2			2		2
				MEDIUM TURQUOISE	5B 6/8	1			1					1				1	1		1
	B58 Lg 8	MAP	84	BLACK	N0.5/0.6%R	4		2	2				4			4			4		44
				INDIAN RED	2.5YR 3/8	3		1	2				3			3			3		3
	Lg 9 (missing)																				
	B90 Lg 10(ii)	MAP	85	BLACK	N0.5/0.6%R	4			4				4			4			4		4
				INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
	B106 Lg 10(ii)	MAP	86	BLACK	N0.5/0.6%R	6			6				6			6			6		6
				LIGHT CELEDON (GREEN)	2.5BG 5/6	1			1			1				1			1		1
				INDIAN RED	2.5YR 3/8	1		1				1				1			1		1
	B107 Lg 10(iii)	MAP	87	BLACK	N0.5/0.6%R	1			1				1			1			1		1
	B115 Lg 10(iii)	MAP	88	BLACK	N0.5/0.6%R	1			1			1				1			1		1
				BLUE GREEN	5BG 6/4	1			1			1				1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	B132 Lg 11	MAP	89	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	B133 Lg 11	MAP	90	INDIAN RED	2.5YR 3/8	10		1	9				10			10			10		10
	B134 Lg 11[11.A4.a]	MAP	91	INDIAN RED	2.5YR 3/8	2		2					2			2			2		2
MK1 A5 (E&M)	Lg 1	MAP	92	BLACK	N0.5/0.6%R	42			42				42			42			42		42
				CELEDON TURQUOISE	5BG 5/6	4			4				4			4			4		4
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
				BRIGHT NAVY	7.5PB 2/8																1
	Lg 2	MAP	93	BLACK	N0.5/0.6%R	46			46				46			46			46		46
				DARK SHADOW BLUE	10B 4/4	3			3				3					3	3		3
				BLUE GREEN	5BG 6/4	7			7				7			7			7		7
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
	Lg 6	MAP	94	BLACK	N0.5/0.6%R	104			104				104			104			104		104
				DARK SHADOW BLUE	10B 4/4	9			9				9					9	9		9
				TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
				BLUE GREEN	5BG 6/4	14			14				14			14			14		14
				CELEDON TURQUOISE	5BG 5/6	7			7				7			7			7		7
				GREEN	5GY 5/6	5			5				4	1			5		5		5
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				DARK MAUVE HEATHER														2			2

LOCATION: Greefswald
SITE: Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	Lg 7	MAP	95	BLACK	N0.5/0.6%R	30			30				30			30			30		30
				DARK SHADOW BLUE	10B 4/4	2			2				2				2		2		2
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				UNKNOWN BEAD													2				2
	Lg 8	MAP	96	BLACK	N0.5/0.6%R	5			5				5			5			5		5
				BLUE GREEN	5BG 6/4	2			2				2			2			2		2
	Lg 8	MAP	97	BLACK	N0.5/0.6%R	16			16				16			16			16		16
				CELEDON TURQUOISE	5BG 5/6	12			12				12			12			12		12
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	6		2	4				6			6			6		6
	Lg 8 (8.A5.2)	MAP	98	BLUE GREEN	5BG 6/4	13			13				13			13			13		13
				INDIAN RED	2.5YR 3/8	8			8				8			8			8		8
	Lg 9	MAP	99	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				OSTRICH EGG SHELL																	1
	Lg 9	MAP	100	BLACK	N0.5/0.6%R	2			2				2			2			2		2
	Lg 9	MAP	101	BLACK	N0.5/0.6%R	6			6				6			6			6		6
				BLUE GREEN	5BG 6/4	3			3				3			3			3		3
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				YELLOW	7.5Y 8.5/10	3			3				3			3			3		3
	Lg 10 B94	MAP	102	BLUE GREEN	5BG 6/4	1			1				1			1			1		1
	Lg 10	MAP	103	BLACK	N0.5/0.6%R	1			1				1			1			1		1
	Lg 10(iiii)	MAP	104	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				DARK SHADOW BLUE	10B 4/4	1															1
	Lg 11	MAP	105	INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
	Lg 11 (11.A5.1)	MAP	106	INDIAN RED	2.5YR 3/8	9		5	4				9			9			9		9
MK1 B3 (E&M)	Lg 1	MAP	107	BLACK	N0.5/0.6%R	24			24				24			24			24		24
				CELEDON TURQUOISE	5BG 5/6	5			5				5			5			5		5
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	Lg 1	MAP	108	BLACK	N0.5/0.6%R	80			80				80			80			80		80
				DARK SHADOW BLUE	10B 4/4	1			1				1					1	1		1
				TRANSPARENT TURQUOISE	10BG 6/8	3		3					3					3	3		3
				LIGHT CELEDON (GREEN)	2.5BG 5/6	3			3				3			3			3		3
				BLUE GREEN	5BG 6/4	8			8				8			8			8		8
				CELEDON TURQUOISE	5BG 5/6	5			5				5			5			5		5
				SAGE GREEN	7.5GY 4/4	4			4				4				4		4		4
				INDIAN RED	2.5YR 3/8	11			11				11			11			11		11
				YELLOW	7.5Y 8.5/10	3			3				3			3			3		3
				DARK MARIGOLD	7.5YR 6/10													1			1
	Lg 2	MAP	109	BLACK	N0.5/0.6%R	53			53				53			53			53		53
				CELEDON TURQUOISE	5BG 5/6	6			6				6			6			6		6
				INDIAN RED	2.5YR 3/8	7		1	6				7			7			7		7
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
	Lg 2	MAP	110	BLACK	N0.5/0.6%R	197		4	193				197			197			197		197
				DARK SHADOW BLUE	10B 4/4	5			5				5				5		5		5
				CELEDON TURQUOISE	5BG 5/6	25			25				25			25			25		25
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	9			9				9			9			9		9
				YELLOW	7.5Y 8.5/10	4			4				4			4			4		4
				DARK MARIGOLD	7.5YR 6/10																1

Heading	LOCATION Greefswald SITE Mapungubwe Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	Lg 3	MAP	111	BLACK	N0.5/0.6%R	21			21				21			21			21		21
				DARK SHADOW BLUE	10B 4/4	2			2				2				2		2		2
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
	Lg 3	MAP	112	BLACK	N0.5/0.6%R	24			24				24			24			24		24
				CELEDON TURQUOISE	5BG 5/6	4			4				4			4			4		4
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
	Lg 3	MAP	113	BLACK	N0.5/0.6%R	13		4	9				13			13			13		13
				INDIAN RED	2.5YR 3/8	4		3	1				4			4			4		4
				PLUM														1			1
				METAL BEAD																	1
	Lg 5	MAP	114	BLACK	N0.5/0.6%R	15			15				15			15			15		15
				CELEDON TURQUOISE	5BG 5/6	3			3				3			3			3		3
				GREEN	5GY 5/6	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
				OSTRICH EGG SHELL																	1
	Lg 5	MAP	115	BLACK	N0.5/0.6%R	11			11				11			11			11		11
				BLUE GREEN	5BG 6/4	1			1			1				1			1		1
				INDIAN RED	2.5YR 3/8	1			1			1				1			1		1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1			1				1			1		1
	Lg 6	MAP	116	BLACK	N0.5/0.6%R	10			10				10			10			10		10
				VASELINE YELLOW (TP)	7.5Y 8/8	2			2				2			2			2		2
	Lg 6	MAP	117	BLACK	N0.5/0.6%R	2			2				2			2			2		2
	Lg 7	MAP	118	BLACK	N0.5/0.6%R	5		1	4				5			5			5		5
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
				METAL BEAD																	1
	Lg 8 B54	MAP	119	INDIAN RED	2.5YR 3/8	1			1			1				1			1		1
	Lg 9 B68	MAP	120	BLACK	N0.5/0.6%R	1			1				1			1			1		1
	Lg 9	MAP	121	BLACK	N0.5/0.6%R	3		2	1				3			3			3		3
				DARK SHADOW BLUE	10B 4/4	1			1				1					1	1		1
				BLUE GREEN	5BG 6/4	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 9(ii) B79	MAP	122	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 9(ii) B80	MAP	123	BLACK	N0.5/0.6%R	4			4				4			4			4		4
				INDIAN RED	2.5YR 3/8	9		4	5			1	8			9			9		9
	Lg 10	MAP	124	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
	Lg 10 B88	MAP	125	GREEN GREY	10G 6/2	1		1					1					1	1		1
				INDIAN RED	2.5YR 3/8	27		25	2				27			27			27		27
	Lg 10(i) B101	MAP	126	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				MEDIUM TURQUOISE	5B 6/8	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	5		4	1				5			5			5		5
	Lg 10(ii) B103	MAP	127	BLACK	N0.5/0.6%R	1			1				1			1			1		1
	Lg 10(ii) B104	MAP	128	BLACK	N0.5/0.6%R	5			5				5			5			5		5
				TRANSPARENT TURQUOISE	10BG 6/8	1		1				1						1	1		1
				MEDIUM TURQUOISE	5B 6/8	2		2				2						2	2		2
				INDIAN RED	2.5YR 3/8	25			25				25			25			25		25
	Lg 10(ii) B105	MAP	129	BRIGHT TURQUOISE	7.5B 6/10	1		1					1					1	1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	5			5				5			5			5		5

Heading	LOCATION: Greefswald SITE: Mapungubwe Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	Lg 10(iii) B113	MAP	130	INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
	Lg 10(iii) B114	MAP	131	INDIAN RED	2.5YR 3/8	1		1					1			1			1		1
				GARDEN ROLLER															2		2
	Lg 11 B129	MAP	132	TRANSPARENT TURQUOISE	10BG 6/8	3			3				3					3	3		3
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	17		3	14				17			17			17		17
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1					1					1	1		1
	Lg 11 B130	MAP	133	CELEDON TURQUOISE	5BG 5/6	1			1			1				1			1		1
				INDIAN RED	2.5YR 3/8	17			17				17			17			17		17
	Lg 11 (11 B3.1) B131	MAP	134	BLACK	N0.5/0.6%R	1		1					1			1			1		1
				INDIAN RED	2.5YR 3/8	3		3					3			3			3		3
MK1 B4 (E&M)	Lg 2 B14	MAP	135	BLACK	N0.5/0.6%R	61			61				61			61			61		61
				BLUE GREEN	5BG 6/4	7			7				7			7			7		7
				INDIAN RED	2.5YR 3/8	4		2	2				4			4			4		4
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8																4
	Lg 2 B15	MAP	136	BLACK	N0.5/0.6%R	19		2	17				19			19			19		19
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				GREEN	5GY 5/6	1			1				1			1			1		1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1				1			1			1		1
				BROWN	2.5YR 3/4																1
				BLUE																	1
	Lg 4 B25	MAP	137	BLACK	N0.5/0.6%R	151			151				151			151			151		151
				DARK SHADOW BLUE	10B 4/4	2			2				2					2	2		2
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				CELEDON TURQUOISE	5BG 5/6	22			22				22			22			22		22
				SAGE GREEN	7.5GY 4/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	5			5				5			5			5		5
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8																4
				BROWN	2.5YR 3/4																1
	Lg 6 B36	MAP	138	TRANSPARENT TURQUOISE	10BG 6/8	1			1				1			1			1		1
	Lg 6 B37	MAP	139	BLACK	N0.5/0.6%R	54			54				54			54			54		54
				DARK SHADOW BLUE	10B 4/4	5			5				5				5		5		5
				CELEDON TURQUOISE	5BG 5/6	6			6				5	1		6			6		6
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	7		2	5				7			7			7		7
				VASELINE YELLOW (TP)	7.5Y 8/8	3			3				3			3			3		3
				BRIGHT NAVY	7.5PB 2/8																4
	Lg 7 B47	MAP	140	BLACK	N0.5/0.6%R	11			11				11			11			11		11
				BLUE GREEN	5BG 6/4	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 7 B48	MAP	141	BLACK	N0.5/0.6%R	32			32				32			32			32		32
				DARK SHADOW BLUE	10B 4/4	1			1					1				1	1		1
				BLUE GREEN	5BG 6/4	4			4				4			4			4		44
				INDIAN RED	2.5YR 3/8	8		4	4				8			8			8		8
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1					1		1			1		1
				BROWN	2.5YR 3/4																1
	Lg 8 B59	MAP	142	BLACK	N0.5/0.6%R	6			6				6			6			6		6
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1

Heading	LOCATION Greefswald SITE Mapungubwe Layer	Site	UCT No BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIF	WIb	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	Lg 9 B72	MAP	143	BLACK	N0.5/0.6%R	8		1	7				8			8			8		8
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 10(iii) B116	MAP	144	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 10(iii) B117	MAP	145	SAGE GREEN	7.5GY 4/4	1		1					1			1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	Lg 10(iii) B118	MAP	146	DARK SHADOW BLUE	10B 4/4	2		1	1				2					2	2		2
	Lg 10 B91	MAP	147	INDIAN RED	2.5YR 3/8	3		1	2				3			3			3		3
	Lg 10(iii)	MAP	148	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				MEDIUM TURQUOISE	5B 6/8	1		1					1					1	1		1
				LIGHT BRIGHT GREEN	2.5G 6/6	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	2		1	1				2			2			2		2
	Lg 10(ii) B109	MAP	149	TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	Lg 11 B135	MAP	150	TRANSPARENT TURQUOISE	10BG 6/8	2		1	1				2					2	2		2
				INDIAN RED	2.5YR 3/8	8		3	5				8			8			8		8
	Lg 11 (11 B4 1) B137	MAP	151	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 15 B30	MAP	152	BLACK	N0.5/0.6%R	57		2	55				57			57			57		57
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8																4
MK1 B5 (E&M)	Lg 1 B8	MAP	153	BLACK	N0.5/0.6%R	88		3	85				88			88			88		88
				TRANSPARENT TURQUOISE	10BG 6/8	1		1					1			1			1		1
				MEDIUM TURQUOISE	5B 6/8	1			1				1					1	1		1
				CELEDON TURQUOISE	5BG 5/6	15			15				15			15			15		15
				GREEN	5GY 5/6	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	12			12				12			12			12		12
				BRIGHT DUSTY YELLOW	5Y 8.5/10	9			9				9			9			9		9
				DARK MARIGOLD	7.5YR 6/10																2
				BRIGHT NAVY	7.5PB 2/8																4
				WHITE														2			2
	Lg 1 139	MAP	154	BLACK	N0.5/0.6%R	82		4	78				82			82			82		82
				CELEDON TURQUOISE	5BG 5/6	6			6				6			6			6		6
				GREEN	5GY 5/6	1			1					1		1			1		1
				INDIAN RED	2.5YR 3/8	8		8					8			8			8		8
				YELLOW	7.5Y 8.5/10	2			2				2			2			2		2
				BRIGHT NAVY	7.5PB 2/8																3
				BROWN	2.5YR 3/4																1
	Lg 6	MAP	155	BLACK	N0.5/0.6%R	18			18				18			18			18		18
				DARK SHADOW BLUE	10B 4/4	1			1				1					1	1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
	Lg 6 (6.B5.1)	MAP	156	BLACK	N0.5/0.6%R	8			8				8			8			8		8
				BLUE GREEN	5BG 6/4	1			1					1		1			1		1
				INDIAN RED	2.5YR 3/8	2		1	1				2			2			2		2
	Lg 7	MAP	157	BLACK	N0.5/0.6%R	60			60				60			60			60		60
				DARK SHADOW BLUE	10B 4/4	7			7				7					7	7		7
				TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
				BLUE GREEN	5BG 6/4	5			5				5			5			5		5
				CELEDON TURQUOISE	5BG 5/6	5			5				5			5			5		5
				GREEN	5GY 5/6	2			2				2				2		2		2
				INDIAN RED	2.5YR 3/8	6		3	3				6			6			6		6
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1

Heading	LOCATION: Greefswald SITE: Mapungubwe Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	Lg 7	MAP	158	BLACK	N0.5/0.6%R	9			9				9			9			9		9
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	3		1	2				3			3			3		3
	Lg 8	MAP	159	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 8	MAP	160	BLACK	N0.5/0.6%R	28		3	25				28			28			28		28
				DARK SHADOW BLUE	10B 4/4	2			2				2					2	2		2
				CELEDON TURQUOISE	5BG 5/6	3			3				3			3			3		3
				INDIAN RED	2.5YR 3/8	13			13				13			13			13		13
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
	Lg 9(i)	MAP	161	BLACK	N0.5/0.6%R	3			3				3			3			3		3
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 9(ii) B5.4	MAP	162	BLACK	N0.5/0.6%R	6			6				6			6			6		6
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
	Lg 9(ii) B5.1	MAP	163	BLACK	N0.5/0.6%R	14			14				14			14			14		14
				DARK SHADOW BLUE	10B 4/4	1			1				1				1		1		1
				GREEN	5GY 5/6	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	6			6				6			6			6		6
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				OSTRICH EGG SHELL																	1
	Lg 10	MAP	164	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	Lg 10	MAP	165	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				GREY FRAGMENTS														1			1
	Lg 10 (10.B5.1)	MAP	166	BLACK	N0.5/0.6%R	2			2				2			2			2		2
				VASELINE YELLOW (TP)	7.5Y 8/8	3			3				3			3			3		3
	Lg 10(ii) B111	MAP	167	BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1			1					1		1		1
	Lg 10(iiii) B122	MAP	168	BLACK	N0.5/0.6%R	2			2				2			2			2		2
	Lg 10(iiii)	MAP	169	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	6		2	4				6			6			6		6
MK2 A1 (E&M)	HOUER:441 Lg 1 BLOCK:1	MAP	170	BLACK	N0.5/0.6%R	52			52				52			52			52		52
				CELEDON TURQUOISE	5BG 5/6	9			9				9				9		9		9
				INDIAN RED	2.5YR 3/8	6			6				6			6			6		6
	HOUER:445 Lg 1 AL1 BLOCK:B2	MAP	171	BLACK	N0.5/0.6%R	15			15				15			15			15		15
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1				1		1		1
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
	HOUER:439 Lg 2 BLOCK:5	MAP	172	BLACK	N0.5/0.6%R	23			23				23			23			23		23
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				BLUE GREEN	5BG 6/4	6			6				6			6			6		6
				INDIAN RED	2.5YR 3/8	6			6				6			6			6		6
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
	HOUER:446 Lg 2 (LAL2) BLOCK:B6	MAP	173	BLACK	N0.5/0.6%R	7			7				7			7			7		7
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1

Heading	LOCATION Greefswald SITE Mapungubwe Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	HOUER 432 Lg 3 BLOCK MK2/A1B9	MAP	174	BLACK	N0.5/0.6%R	16			16				16			16			16		16
				TRANSPARENT TURQUOISE	10BG 6/8	7			7				7					7	7		7
				CELEDON TURQUOISE	5BG 5/6	4			4				4				4		4		4
				BLUE GREEN	5BG 6/4	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	7			7				7			7			7		7
	HOUER 435 Lg 4 BLOCK	MAP	175	BLACK	N0.5/0.6%R	4			4				4			4			4		4
				TRANSPARENT TURQUOISE	10BG 6/8	3			3				3					3	3		3
				GREEN	5GY 5/6	2			2				2				2		2		2
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
				DARK MARIGOLD	7.5YR 6/10	1			1					1		1			1		1
	HOUER:428 Lg 5 BLOCK B	MAP	176	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				GREEN	5GY 5/6	1			1				1				1		1		1
MK2 A2 (E&M)	HOUER:427 Lg 1 DET B7 BLOCK:B3	MAP	177	BLACK	N0.5/0.6%R	26			26				26			26			26		26
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				CELEDON TURQUOISE	5BG 5/6	1			1				1				1		1		1
				BLUE GREEN	5BG 6/4	3			3				3				1	2	3		3
				INDIAN RED	2.5YR 3/8	10			10				10			10			10		10
				BRIGHT NAVY	7.5PB 2/8	4			4				4					4	4		4
	HOUER:431 Lg 2 BLOCK:B	MAP	178	BLACK	N0.5/0.6%R	3			3				3			3			3		3
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	HOUER:426 Lg 2 DET:B7 BLOCK.MK2/A2	MAP	179	GARDEN ROLLER FRAGMENT																	1
	HOUER:421 Lg 3 BLOCK:A	MAP	180	BLACK	N0.5/0.6%R	18			18				18			18			18		18
				TRANSPARENT TURQUOISE	10BG 6/8	4			4				4					4	4		4
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				GREEN	5GY 5/6	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	19			19				19			19			19		19
				YELLOW	7.5Y 8.5/10	2															2
				DARK MARIGOLD	7.5YR 6/10	1			1				1			1			1		1
	HOUER:435 Lg 4 BLOCK:	MAP	181	BLACK	N0.5/0.6%R	1			1				1			1			1		1
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
				OSTRICH EGG SHELL																	1
	HOUER:415 Lg 6	MAP	182	TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	5			5				5			5			5		5
				OSTRICH EGG SHELL																	2
MK3 A1 (E&M)	HOUER:396 Lg 1 BLOCK:A1	MAP	183	BLACK	N0.5/0.6%R	29			29				29			29			29		29
				BLUE GREEN	5BG 6/4	14			14				14			14			14		14
				GREEN	5GY 5/6	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3		3
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	3			3				3				1	2	3		3
				DARK MAUVE HEATHER	10P 3/4	1			1				1					1	1		1
	Layer 4	MAP	183a	BLACK	N0.5/0.6%R	7		1	6				7			7				7	7
				GREEN	5GY 5/6	1															1
				INDIAN RED	2.5YR 3/8	7		1	6				7			7				7	7

Heading	LOCATION Greefswald SITE Mapungubwe Layer	Site	UCT No BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	HOUER:403 Lg 2 BLOCK:	MAP	184	BLACK	N0.5/0.6%R	47			47				47			47			47		47
				CELEDON TURQUOISE	5BG 5/6	2			2				2			2			2		2
				GREEN	5GY 5/6	4			4				4			4			4		4
				INDIAN RED	2.5YR 3/8	12			12				12			12			12		12
				LIGHT MARIGOLD	2.5Y 6/10	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	2			2				2					2	2		2
	HOUER:422 Lg 3 BLOCK:	MAP	185	BLACK	N0.5/0.6%R	94			94				94			94			94		94
				CELEDON TURQUOISE	5BG 5/6	6			6				6				6		6		6
				INDIAN RED	2.5YR 3/8	18			18				18			18			18		18
				VASELINE YELLOW (TP)	7.5Y 8/8	9			9				9			9			9		9
				BRIGHT NAVY	7.5PB 2/8	4			4				4					4	4		4
	HOUER:395 Lg 4 BLOCK:	MAP	186	BLACK	N0.5/0.6%R	10			10				10			10			10		10
				GREEN	5GY 5/6	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	7			7				7			7			7		7
				YELLOW	7.5Y 8.5/10	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	1			1				1					1	1		1
				COPPER BEAD											1						1
	HOUER:424 Lg 4(i) BLOC	MAP	187	BLACK	N0.5/0.6%R	4			4				4			4			4		4
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1			1			1		1
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	2			2				2			2			2		2
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1				1			1			1		1
				DARK MARIGOLD	7.5YR 6/10	1			1				1			1			1		1
	HOUER:405 Lg 4(ii) BLOC	MAP	188	BLACK	N0.5/0.6%R	7			7				7			7			7		7
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1				1		1		1
				BLUE GREEN	5BG 6/4	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	1			1				1				1		1		1
				DARK SHADOW BLUE	10B 4/4	1			1				1				1		1		1
	HOUER:423 Lg 5 BLOCK:	MAP	189	BLACK	N0.5/0.6%R	6			6				6			6			6		6
				BLUE GREEN	5BG 6/4	3			3				3			3			3		3
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1				1				1		1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
	HOUER:423 Lg 6 BLOCK:	MAP	190	BLACK	N0.5/0.6%R	1			1				1			1			1		1
	HOUER:419 Lg 6 BLOCK:	MAP	191	BLACK	N0.5/0.6%R	3			3				3			3			3		3
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	HOUER:420 Lg 7 BLOCK:	MAP	192	BLACK	N0.5/0.6%R	3			3				3			3			3		3
				INDIAN RED	2.5YR 3/8	4			4				4			4			4		4
	HOUER:401 Lg 7 BLOCK:	MAP	193	BLACK	N0.5/0.6%R	4			4				4			4			4		4
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	9			9				9			9			9		9
MK3 A2 (E&M)	HOUER:390 Lg 1 BLOCK:A2/B2	MAP	194	BLACK	N0.5/0.6%R	17			17				17			17			17		17
				CELEDON TURQUOISE	5BG 5/6	1			1				1				1		1		1
				BLUE GREEN	5BG 6/4	4			4				4				4		4		4
				INDIAN RED	2.5YR 3/8	5			5				5			5			5		3
	HOUER:400 Lg 2 BLOCK:	MAP	195	BLACK	N0.5/0.6%R	30			30				30			30			30		30
				BLUE GREEN	5BG 6/4	5			5				5			5			5		5
				INDIAN RED	2.5YR 3/8	6			6				6			6			6		6
				VASELINE YELLOW (TP)	7.5Y 8/8	4			4				4			4			4		4
				BRIGHT NAVY	7.5PB 2/8	2			2				2					2	2		2
				BLACK	N0.5/0.6%R	46			46				46			46			46		46

LOCATION Greefswald
SITE Mapungubwe

Heading	Layer	Site	UCT No. BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total	Total n=
	HOUER:414 Lg 3 BLOCK:A2 B8	MAP	196	BLUE GREEN	5BG 6/4	3			3				3			3			3		3	
				GREEN	5GY 5/6	2			2				2			2			2		2	
				INDIAN RED	2.5YR 3/8	8			8				8			8			8		8	
				YELLOW	7.5Y 8.5/10	3			3				3			3			3		3	
				DARK MARIGOLD	7.5YR 6/10	1			1				1			1			1		1	63
	HOUER:413 BLOCK:A2 B1	MAP	197	BLACK	N0.5/0.6%R	9			9				9			9			9		9	
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1		1	
				INDIAN RED	2.5YR 3/8	9			9				9			9			9		9	19
	HOUER:418 Lg 4(i) BLOCK:A2 B10	MAP	198	BLACK	N0.5/0.6%R	4			4				4			4			4		4	
				BADLY WEATHERED BEAD																	1	5
	HOUER:397 Lg 4(iii) BLOCK:A2 B14	MAP	199	BLACK	N0.5/0.6%R	7			7				7			7			7		7	
				CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1		1	
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1	
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1	10

LOCATION: Greefswald

SITE: Bambandyanalo

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IF	Structure Type WId	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Total
Fouche (1933)	Pot Finds B6	BAM	396	NEUTRAL WHITE	N9.5/90.0%R	16			16				16			16			16	16
				OYSTER WHITE	5GY 9/1	18			18				18			18			18	18
				BLACK	N O.5/0.6% R	17		8	9				17			17			17	17
				DEEP TURQUOISE	7.5B 6/10	32		6	26				32			31	1		32	32
				CELEDON TURQUOISE	5BG 5/6	8		8					8			8			8	8
				BLUE GREEN	5BG 6/4	6			6				6			6			6	6
				MEDIUM BRIGHT GREEN	2.5G 5/6	8		8					8			8			8	8
				INDIAN RED	2.5YR 3/8	7			7				7			7			7	7
				YELLOW	7.5Y 8.5/10	4		4					4			4			4	4
				BRIGHT NAVY	7.5PB 2/8	6			6				6			6			6	6
				MEDIUM COPEN BLUE	5PB 6/8	11			11				11			11			11	11
				DARK SHADOW BLUE	10B 7/4	6			6				6			6			6	6
				PALE PINK	10RP 8/4	8			8				8			8			8	8
				MAUVE PINK	5RP 6/8	13		9	4				13			13			13	13
				RUBY ON WHITE CORE	2.5R 3/10	9			9				9				9		9	9
				INDIAN RED ON GREEN CORE	7.5R 3/8	28		17	11				28			28			28	28
				CELEDON ON WHITE CORE		6			6				6			6			6	6
				LIGHT BLUE	10B 7/4	13			13				13			13			13	13
				INDIAN RED/BROWN MIX		3		3					3			3			3	3
				BRIGHT NAVY (ANNULAR)	7.5PB 2/8						1				1		1			1
				BRIGHT NAVY	7.5PB 2/8					1					1		1			1
	B.d.NALO TREASURE POT No 14 B6		397	CELEDON TURQUOISE	5BG 5/6	2			2				2			2			2	2
				GREEN	5GY 5/6	8		5	3				8			8			8	8
	B.d.NALO TREASURE POT No 15 B6		398	MEDIUM COPEN BLUE	5PB 6/8	1			1				1			1			1	1
				DARK SHADOW BLUE	10B 7/4	17			17				17				17		17	17
	TREASURE POT No 16 B6		399	RUBY ON WHITE CORE	2.5R 3/10	11			11				11				11		11	11
	No 18 B6		400	RUBY ON WHITE CORE	2.5R 3/10	8			8				8				8		8	8
	No 22 B6		401	RUBY ON WHITE CORE	2.5R 3/10	12			12				12				12		12	12
	No 25 B6		402	DARK SHADOW BLUE	10B 7/4	7			7				7				7		7	7
	No 26 B6		403	BLACK	N O.5/0.6% R	15		15					15			15			15	15
	No 37 B6		404	NEUTRAL WHITE	N9.5/90.0%R	13			13				13			13			13	13
				OYSTER WHITE	5GY 9/1	2			2				2			2			2	2
	No 41 B6		405	NEUTRAL WHITE	N9.5/90.0%R	38			38				38			38			38	38
	No 42 B6		406	BLACK	N O.5/0.6% R	4		1	3				4			4			4	4
				DEEP TURQUOISE	7.5B 6/10	15		14	1				15				15		15	15
				GREEN	5GY 5/6	2		2					2				2		2	2
				BRIGHT NAVY	7.5PB 2/8	6			6				6				6		6	6
				MID BLUE	5PB 4/6	17		6	11				17				17		17	17
				MEDIUM COPEN BLUE	5PB 6/8	8			8				8			8			8	8
				DARK SHADOW BLUE	10B 7/4	2			2				2				2		2	2
	No 43 B6		407	BRIGHT NAVY (ANNULAR)	7.5PB 2/8						23				23			23		23
	MIDDEN		408	OSTRICH EGG SHELL																749
	GRAVE AREA		409	INDIAN RED	2.5YR 3/8	27		8	19				27			27			27	27
				OSTRICH EGG SHELL																71
				COWRIE SHELL BEAD																1

Heading	SITE: Bambandyanalo Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IF	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
				TRANSPARENT TURQUOISE	10BG 6/8	809		455	354				809					809	809	809
				GREEN	5GY 5/6	96		70	26				96					96	96	96
				OSTRICH EGG SHELL																36
				LONG PIECE OF BONE																1
	BURIAL No 3		411	SEA SHELL BEAD																1
	POT FIND ?		412	CELEDON TURQUOISE	5BG 5/6	6		6					6			6			6	6
Jones &	Q3 BURIAL No 1	BAM	413	TRANSPARENT TURQUOISE	10BG 6/8	39		18	2				39					39	39	39
Schofield	Q4 GRAVE AREA		414	BLACK	N O.5/0.6% R	6			6				6			6			6	6
				DEEP TURQUOISE	7.5B 6/10	1		1					1					1	1	1
				CELEDON TURQUOISE	5BG 5/6	1		1					1			1			1	1
				INDIAN RED	2.5YR 3/8	15		6	9				15			15			15	15
	Q5 BURIAL No 3		415	BLACK	N O.5/0.6% R	11		1	10				11			11			11	11
				TRANSPARENT TURQUOISE	10BG 6/8	6			6				6				1	5	6	6
				DEEP TURQUOISE	7.5B 6/10	1			1				1					1	1	1
				CELEDON TURQUOISE	5BG 5/6	5			5				5			1	4		5	5
				GREEN	5GY 5/6	3			3				3			3			3	3
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1				1			1			1	1
				YELLOW	7.5Y 8.5/10	11			11				11					11	11	11
				OLIVE YELLOW	7.5Y 7/6	12			12				12				12		12	12
				BONE BEAD																1
				OSTRICH EGG SHELL																1
				WEATHERD BEADS																3
	Found in K2 Box																			
	Probably associated with late walling		416	NEUTRAL WHITE	N9.5/90.0%R	29			29				29			29			29	29
				OYSTER WHITE	5GY 9/1	2			2				2			2			2	2
				BLACK	N O.5/0.6% R	27			27				27			27			27	27
				TRANSPARENT TURQUOISE	10BG 6/8	1			1				1				1		1	1
				DEEP TURQUOISE	7.5B 6/10	156		61	95				156			95	61		156	156
				BLUE GREEN	5BG 6/4	66			66				66			66			66	66
				GREEN	5GY 5/6	73		55	18				73			73			73	73
				MEDIUM BRIGHT GREEN	2.5G 5/6	4			4				4				4		4	4
				INDIAN RED	2.5YR 3/8	491		11	480				491			491			491	491
				BRIGHT NAVY	7.5PB 2/8	1		1						1			1		1	1
				MEDIUM COPEN BLUE	5PB 6/8	76			76				76			76			76	76
				DARK SHADOW BLUE	10B 7/4	4		4					4				4		4	4
				PALE PINK	10RP 8/4	93			93				93			93			93	93
				MAUVE PINK	5RP 6/8	1061			1061				1061			1061			1061	1061
				INDIAN RED ON GREEN CORE	7.5R 3/8	708		89	619				708			708			708	708
				STRIPED BEADS		1		1					1			1			1	1
				LIGHT BLUE	10B 7/4	148			148				148			148			148	148

LOCATION Greefswald
SITE K2

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	Wld	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
K2 (Gardner)	1935 TEST PIT No. 9 27"	K2	417	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
				CELEDON TURQUOISE	5BG 5/6	1			1						1				1		1	1
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	1			1						1			1			1	1
	1935 TRENCH 1 SECTION 16 9',2',10'	K2	418	BLACK	N O.5/0.6% R	2				2					2			2			2	2
				GARDEN ROLLER FRAGMENTS																		4
	1935 TRENCH 1 S.27 5',30',3' LAYER POT	K2	419	TRANSPARENT TURQUOISE	10BG 6/8																	1
				GARDEN ROLLER BEADS				15														15
				GARDEN ROLLER FRAGMENTS				19														19
	1935 July S.31 No. 2 A3'6" R3" D4"	K2	420	OSTRICH EGG SHELL																		2
	1935 SECTION 33	K2	421	GARDEN ROLLER BEAD				1														1
	1935 TRENCH 2 SECTION 45 No 1 A7" R2" D2"	K2	422	DEEP TURQUOISE	10BG 5/6	2			1	1					2					2	2	2
	1936 PIT No 9 B.2.S.9 14'18'5'	K2	423	TRANSPARENT TURQUOISE	10BG 6/8	10			3	9					10					10	10	10
				BLUE GREEN	5BG 6/4	4			2	2					4			1	3		4	4
				GREEN	5GY 5/6	1			1						1			1			1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	2				2					2				2		2	2
				ACHATINA DISC																		6
				OSTRICH EGG SHELL																		4
	1938 B.3.S.10 3'12'1'	K2	424	GARDEN ROLLER BEAD		1																1
	1938 B.5.S.4 9'18'2	K2	425	GARDEN ROLLER BEAD		1																1
	1938 B.5.S.13 6'14'1'	K2	426	GARDEN ROLLER BEAD		1																1
	1938 B.4.S.11 3'5'3'	K2	427	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1				1		1	1
				DEEP TURQUOISE	10BG 5/6	2			1	1					2					2	2	2
	1938 B.5.S.8 11'17'2'	K2	428	CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
	1938 B.3.S.14 8'20'3'	K2	429	GARDEN ROLLER FRAGMENTS													1	1				1
	1938 B.5.S.11 3'19'1'	K2	430	GARDEN ROLLER FRAGMENTS													1	1				1
	1938 B.5.S.13 6'14'1'	K2	431	GARDEN ROLLER FRAGMENTS													1	1				1
	1938 B.4.S.7 1'21'5'	K2	432	TRANSPARENT TURQUOISE	10BG 6/8	2			2						2					2	2	2
				INDIAN RED	2.5YR 3/8	3			3						3			3			3	3
	1938 B.4.S.14 6'10'1'	K2	433	GARDEN ROLLER FRAGMENTS																		1
	1938 B.5.S.11 4'17'1'	K2	434	GARDEN ROLLER FRAGMENTS													1	1				1
	1938 B.4.S.13 5'4'3' with POT No 35	K2	435	TRANSPARENT TURQUOISE	10BG 6/8	2			2						2					2	2	2
				BLUE GREEN	5BG 6/4	2				2					2			1	1		2	2
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				YELLOW	7.5Y 8.5/10	1				1					1				1		1	1
	1938 B.4.S.7 1'21'5'	K2	436	GARDEN ROLLER FRAGMENTS													1	1				1
	1939 B.5.S.6 8'16'3'	K2	437	COPPER HELIX																		2
				GARDEN ROLLER FRAGMENTS																		5
	1935 T.PIT No 8 A2" R8" B18" No 10	K2	438	OSTRICH EGG SHELL													5					5
	1935 T.PIT No 9 A8" R6" D12"	K2	439	CELEDON TURQUOISE	5BG 5/6	1			1						1					1	1	1
				BLUE GREEN	5BG 6/4	2			1	1					2			1	1		2	2
				INDIAN RED	2.5YR 3/8	1			1						1			1			1	1
	1935 July S.21 No 21 A4'6" R4' D12"	K2	440	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
				GARDEN ROLLER FRAGMENTS																		3

SITE K2

Heading Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method			Structure Type					Size				Diaphaneity			Lusture	Total
					D	W	M	Ia	IIa	IIIf	WI	Wld	VS	S	M	L	O	TL	TP	D	
1935 July S.25 No 14 A5" R3'6" D30"	K2	441	BLACK	N O.5/0.6% R	1			1						1			1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	2			2						2					2	2	2
			DEEP TURQUOISE	10BG 5/6	1			1						1				1		1	1
			ACHATINA DISC																	2	2
			OSTRICH EGG SHELL																	1	3
1935 August T.PIT No 1 A30" R12" D18"	K2	443	DEEP TURQUOISE	10BG 5/6	3			3						3					3	3	3
			OSTRICH EGG SHELL																		1
1935 August T.PIT 3 No 3 A7" R2" D18"	K2	444	GARDEN ROLLER FRAGMENTS																		1
1935 August SECTION 33 A4" R4'6" D3"	K2	445	TRANSPARENT TURQUOISE	10BG 6/8	2			1	1					2					2	2	2
			YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
			OSTRICH EGG SHELL																		2
1935 August S.33 No 5 A4" R4"6" D3"	K2	446	CELEDON TURQUOISE	5BG 5/6	2				2					2			2			2	2
1935 August T.PIT No 2 3" 5" 18"	K2	447	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
			DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
K2 (no label)	K2	448	GARDEN ROLLER BEADS				5									5				5	5
			GARDEN ROLLER FRAGMENTS				5														5
			STONE																		1
			POTTERY BEAD																		1
			COWRIE SHELL																		1
			CLAY BEAD MOULD																		2
POT K2 (modern)	K2	449	MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1			1			1	1
			MEDIUM COPEN BLUE	5PB 6/8	2				2					2			2			2	2
			MAUVE PINK	5RP 6/8	1				1					1			1			1	1
			OSTRICH EGG SHELL																		5
			BRIGHT NAVY (ANNULAR)	7.5PB 2/8		11						11				11		11		11	11
			BRIGHT NAVY (FACETTED)	7.5PB 2/8	1					1						1		1		1	1
			STONE BEAD																		1
K2 17 (modern)	K2	450	BRIGHT NAVY (FACETTED)	7.5PB 2/8	24							24				24	24			24	24
			MEDIUM COPEN BLUE (Wb)	5PB 6/8		40					40					40	40			40	40
B.1.4 S8 4.24.4. (Illustrated in chapter 8.1.3.(ii).1 -(a)	K2	451	GARDEN ROLLER BEADS				4									4	4			4	4
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
1938 PIT No 18 B.3.S.7 A2" R3" D5"	K2	452	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
			OSTRICH EGG SHELL																		1
			ACHATINA DISC																		1
			GARDEN ROLLER BEAD				1									1	1			1	1
			GARDEN ROLLER FRAGMENTS				2									2	2			2	2
1935 SECTION 23	K2	453	GARDEN ROLLER BEADS				6									6	6			6	6
			GARDEN ROLLER FRAGMENTS				6									6	6			6	6
1935 SECTION 24	K2	454	GARDEN ROLLER BEADS				3									3	3			3	3
SECTION 40 TRENCH 2	K2	455	GARDEN ROLLER BEAD				1									1	1			1	1
SECTION 43 TRENCH 2	K2	456	GARDEN ROLLER BEADS				6									6	6			6	6
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
K2 337 (no other info.) (modern)	K2	457	BLACK	N O.5/0.6% R	5666				5666					5666			5666			5666	5666
			TRANSPARENT TURQUOISE	10BG 6/8	222				222					222			220		2	2	222
			DEEP TURQUOISE	10BG 5/6	4			3	1					4			1		3	4	4
			CELEDON TURQUOISE	5BG 5/6	44				44					44			37		7	44	44

SITE K2 Heading Layer	UCT Site	Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
K2 337 (no more info.).	K2	457	BLUE GREEN	5BG 6/4	93				93					93			93			93	93
			GREEN	5GY 5/6	10				10					10			10			10	10
			INDIAN RED	2.5YR 3/8	12				12					12			12			12	12
			YELLOW	7.5Y 8.5/10	298				298					298			298			298	298
			DARK MARIGOLD	7.5YR 6/10	277				277					277			277			277	277
			BRIGHT NAVY	7.5PB 2/8	454				454					454					454	454	454
			MEDIUM COPEN BLUE	5PB 6/8	1				1					1			1			1	1
[probably a skeleton - note modern head component].			PALE PINK	10RP 8/4	4				4					4			4			4	4
			DARK MAUVE HEATHER	10P 3/4	1				1					1				1		1	1
			INDIAN RED ON GREEN CORE	7.5R 3/8	2				2					2			2			2	2
SKELETONS			OLIVE YELLOW	7.5Y 7/6	16				16					16			16			16	16
Gardner (1936) SKELETON KS. No. 11 (no more info.).	K2	458	TRANSPARENT TURQUOISE	10BG 6/8	12			1	11					12					12	12	12
			DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
			BLUE GREEN	5BG 6/4	3				3					3				3		3	3
			GREEN	5GY 5/6	1				1					1			1			1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1					1	1	1
			YELLOW	7.5Y 8.5/10	2				2					2			2			2	2
			OSTRICH EGG SHELL																		21
GARDNER 1940 SKELETON KS. No. 17 (no more info.).	K2	459	TRANSPARENT TURQUOISE	10BG 6/8	14			2	12					14					14	14	14
			BLUE GREEN	5BG 6/4	3				3					3			3			3	3
			OSTRICH EGG SHELL																		5
GARDNER 1940 SKELETON KS. No. 13 (no more info.).	K2	460	TRANSPARENT TURQUOISE	10BG 6/8	16			2	14				7	9				2	14	16	16
GARDNER 1940 SKELETON KS. No. 14a (no more info.).	K2	461	TRANSPARENT TURQUOISE	10BG 6/8	5			5						5				1	4	5	5
			BLUE GREEN	5BG 6/4	2				2					2				2		2	2
			GREEN	5GY 5/6	1				1					1				1		1	1
			OSTRICH EGG SHELL																		16
GARDNER 1940 SKELETON KS. No. 16 (no more info.).	K2	462	TRANSPARENT TURQUOISE	10BG 6/8	12				12					12				2	10	12	12
			CELEDON TURQUOISE	5BG 5/6	2				2					2				2		2	2
			BLUE GREEN	5BG 6/4	10									10				10		10	10
			GREEN	5GY 5/6	1				1					1				1		1	1
			YELLOW	7.5Y 8.5/10	1									1				1		1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	2									2				2		2	2
			OSTRICH EGG SHELL																		18
			METAL																		1
GARDNER 1940 SKELETON KS. No. 18 (no more info).	K2	463	BLACK	N O.5/0.6% R	171				171					171			171			171	171
			TRANSPARENT TURQUOISE	10BG 6/8	11				11					11					11	11	11
			CELEDON TURQUOISE	5BG 5/6	4				4					4			3	1		4	4
			GREEN	5GY 5/6	1				1					1			1			1	1
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
			YELLOW	7.5Y 8.5/10	5				5					5			5			5	5
			OSTRICH EGG SHELL																		26
KS. SKELETON NO 9. BLOCK: I SECTION 9 3"24"2".	K2	464	TRANSPARENT TURQUOISE	10BG 6/8	9			1	8					9					9	9	9
			DEEP TURQUOISE	10BG 5/6	9				9					9					9	9	9
			GREEN	5GY 5/6	5				5				5						5	5	5
			ACHATINA DISCS																		6
			OSTRICH EGGSHELL																		2
Garden Roller beads illustrated in chapter 8.1.3.(II).1.			GARDEN ROLLER BEADS				9									9	9			9	9
No's. (d) (e) (f) & (g).			GARDEN ROLLER FRAGMENTS				1									1	1			1	1
			WEATHERED BEADS																		3

SITE: K2

Heading Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
SKELETON KS No 33 BLOCK 33 SECTION 6 3'15'5'	K2	465	TRANSPARENT TURQUOISE	10BG 6/8	235				235					235				19	216	235	235
SKELETON KS No 60 BLOCK 3 SECTION 14 0'26'2'	K2	466	TRANSPARENT TURQUOISE	10BG 6/8	30				30					30				30		30	30
			DEEP TURQUOISE	10BG 5/6	10				10					10					10	10	10
			BLUE GREEN	5BG 6/4	149				149					149				149		149	149
			GREEN	5GY 5/6	6				6					6			4	2	1	6	6
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
			YELLOW	7.5Y 8.5/10	7				7					7				7		7	7
			VASELINE YELLOW (TP)	7.5Y 8/8	2				2	•				2			2			2	2
			DARK SHADOW BLUE	10B 4/4	1			1						1				1		1	1
			ACHATINA DISCS																		100's
			WEATHERED BEADS																		20
SKELETON KS. No. 69 BLOCK 5 SECTION 9 8'11'3'	K2	467	TRANSPARENT TURQUOISE	10BG 6/8	152				152					152					152	152	152
			GREEN	5GY 5/6	6				6					6					6	6	6
			INDIAN RED	2.5YR 3/8	128				128					128			128			128	128
			YELLOW	7.5Y 8.5/10	1				1					1				1		1	1
			BLACK POTTERY BEAD																		2
SKELETON KS. No. 57 BLOCK 4 SECTION 15 8'23'1'	K2	468	TRANSPARENT TURQUOISE	10BG 6/8	41			1	40								7		34	41	41
			YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
			LIGHT MARIGOLD	2.5Y 6/10	10				10					10					10	10	10
			OSTRICH EGG SHELL																		6
SKELETON KS. No. 56. BLOCK 4 SECTION 15 5'24'1'	K2	469	TRANSPARENT TURQUOISE	10BG 6/8	6			1	5					6					6	6	6
			OSTRICH EGG SHELL																		6
SKELETON (1936). KS. No. 24. K29 (no more info.).	K2	470	BLACK	N O.5/0.6% R	2681				2681					2681			2681			2681	2681
			CELEDON TURQUOISE	5BG 5/6	22				22					22			22			22	22
			DARK MAUVE HEATHER	10P 3/4	151				151					151					151	151	151
SKELETON (1937) August. KS. No. 48. 0'21'2'	K2	471	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
			BLUE GREEN	5BG 6/4	5				5					5			3	2		5	5
			GREEN	5GY 5/6	1				1					1			1			1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1			1			1	1
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
SKELETON (1938) July No. 11. A8'6" R6" D6"	K2	472	BLACK	N O.5/0.6% R	1				1					1			1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	11				11					11				6	5	11	11
			DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
			BLUE GREEN	5BG 6/4	3			1	2					3				3		3	3
			GREEN	5GY 5/6	2				2					2				2		2	2
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
			OSTRICH EGG SHELL																		10
K2 (1940) 5:2:12:6:8 (illustration (h) 8.1.3.(ii).1)	K2	473	GARDEN ROLLER BEADS				4									4	4			4	4
			GARDEN ROLLER FRAGMENTS				7									7	7			7	7
SKELETON. KS. No. 53. K2 B.3.S.9 2'20'4'	K2	474	CELEDON TURQUOISE	5BG 5/6	250				250					250				250		250	250
			BRIGHT NAVY	7.5PB 2/8	138				138					138				138		138	138
Gardner SKELETON. KS. No. 69. K2 B.5.S.9.8'11'3'	K2	474a	POTTERY BEADS	.												2				2	2
K2 TS1 HOUER:294 BLOCK TS1.5.11 Lg 1 DET:B22	K2	475	TRANSPARENT TURQUOISE	10BG 6/8	4				4					4					4	4	4
(Meyer)			DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
1991			BLUE GREEN	5BG 6/4	5				5					5				3	2	5	5
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
			VASELINE YELLOW (TP)	7.5Y 8/8	3				3					3			3			3	3

SITE K2

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIf	WI	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
	HOUER 293 BLOCK:TS1 5 Lg 3 DET:B12	K2	476	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8					8	8	8
				DEEP TURQUOISE	10BG 5/6	7				7					7					7	7	7
				BLUE GREEN	5BG 6/4	2				2					2				2		2	2
				GREEN	5GY 5/6	1				1					1				1		1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
				GARDEN ROLLER BEAD				1									1	1			1	1
K2 TS2 (Meyer) 1991	HOUER:219 BLOCK:TS2 Lg 1 DET:B6	K2	477	TRANSPARENT TURQUOISE	10BG 6/8	7				7					7				2	5	7	7
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
				GARDEN ROLLER FRAGMENTS				1									1	1			1	1
	HOUER:213 BLOCK:TS2 Lg 1 DET:B5	K2	478	TRANSPARENT TURQUOISE	10BG 6/8	10				10					10					10	10	10
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	2				2					2					2	2	2
				GREEN	5GY 5/6	2				2					2					2	2	2
				MEDIUM BRIGHT GREEN	2.5G 5/6	2				2					2					2	2	2
	[one very worn "Indian" red bead]			INDIAN RED	2.5YR 3/8	16				16					16			16			16	16
	HOUER:227 BLOCK:TS2 Lg 1 DET:Bd	K2	479	TRANSPARENT TURQUOISE	10BG 6/8	8									8					8	8	8
				DEEP TURQUOISE	10BG 5/6	2									2					2	2	2
				BLUE GREEN	5BG 6/4	1									1				1		1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1									1				1		1	1
				INDIAN RED	2.5YR 3/8	6									6			6			6	6
	HOUER:233 BLOCK:TS2 Lg 2 DET:C6	K2	480	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2					2	2	2
				DEEP TURQUOISE	10BG 5/6	2				2					2				1	1	2	2
				GREEN	5GY 5/6	1				1					1				1		1	1
	HOUER:216 BLOCK:TS2 Lg 2 DET:B5 (same as K2 482)	K2	481	TRANSPARENT TURQUOISE	10BG 6/8	4				4					4					4	4	4
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				BLUE GREEN	5BG 6/4	4				4					4				4		4	4
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
	HOUER:236 BLOCK:TS2 Lg 2 DET:B5	K2	482	GARDEN ROLLER BEAD				1									1	1				1
				GARDEN ROLLER FRAGMENT				1									1	1				1
	HOUER:246 BLOCK:TS2 Lg 2 DET:B6	K2	483	TRANSPARENT TURQUOISE	10BG 6/8	18				18					18				7	11	18	18
				DEEP TURQUOISE	10BG 5/6	3				3					3					3	3	3
				CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	2				2					2				2		2	2
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
	HOUER:221 BLOCK:TS2 Lg 3 DET:B4	K2	484	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6					6	6	6
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				BLUE GREEN	5BG 6/4	2				2					2			2			2	2
				GREEN	5GY 5/6	1				1					1			1			1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				YELLOW	7.5Y 8.5/10	2				2					2			2			2	2
	HOUER:217 BLOCK:TS2 Lg 3	K2	485	DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
				GREEN	5GY 5/6	1				1					1					1	1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1

SITE K2

Heading Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER 242 BLOCK:TS2 Lg 3 DET:C6		486	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2				2		2	2
			DEEP TURQUOISE	10BG 5/6	5				5					5				1	4	5	5
			MEDIUM BRIGHT GREEN	2.5G 5/6	2				2					2				2		2	2
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
			YELLOW	7.5Y 8.5/10	2				2					2				1	1	2	2
HOUER 243 BLOCK:TS2 Lg 4 DET:C6	K2	487	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
HOUER:241 BLOCK:TS2 Lg 6	K2	488	INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
			GARDEN ROLLER FRAGMENTS				1									1	1			1	
HOUER 251 BLOCK:TS2 GRAF 1	K2	489	TRANSPARENT TURQUOISE	10BG 6/8	29				29					29				29		29	29
(Grave 1)			DEEP TURQUOISE	10BG 5/6	2				2					2				2		2	2
			BLUE GREEN	5BG 6/4	12				12					12				12		12	12
HOUER:250 BLOCK:TS2 GRAF 1 DET:A1	K2	490	TRANSPARENT TURQUOISE	10BG 6/8	277				277					277				277		277	277
(Grave 2)			DEEP TURQUOISE	10BG 5/6	29				29					29				29		29	29
			BLUE GREEN	5BG 6/4	18				18					18				18		18	18
HOUER:298 BLOCK:TS2 Lg G.L.A.1 DET:B24	K2	491	TRANSPARENT TURQUOISE	10BG 6/8	110				110					110				110		110	110
			DEEP TURQUOISE	10BG 5/6	12				12					12				12		12	12
			CELEDON TURQUOISE	5BG 5/6	10				10					10				10		10	10
			BLUE GREEN	5BG 6/4	10				10					10				10		10	10
			GREEN	5GY 5/6	1				1					1			1			1	1
			DARK SHADOW BLUE	10B 4/4	1				1					1				1		1	1
HOUER:229 BLOCK:TS2 GRAF 3	K2	492	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1				1		1	1
(Grave 3)			DEEP TURQUOISE	10BG 5/6	5			2						2					2	2	2
			MEDIUM BRIGHT GREEN	2.5G 5/6	19				16					16				16		16	16
			INDIAN RED	2.5YR 3/8	288				287					287			287			287	287
			DEEP TURQUOISE	10BG 5/6	3				3					3				3		3	3
			MEDIUM BRIGHT GREEN	2.5G 5/6	3				3					3				3		3	3
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
HOUER:211 BLOCK:TS2A1 Lg 1 DET:B2	K2	493	TRANSPARENT TURQUOISE	10BG 6/8	10				10					10				3	7	10	10
			DEEP TURQUOISE	10BG 5/6	5				5					5				2	3	5	5
			BLUE GREEN	5BG 6/4	7				7					7				5	2	7	7
			GREEN	5GY 5/6	1				1					1				1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	5				5					5				5		5	5
			YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
			WEATHERED BEADS																		4
HOUER:220 BLOCK:TS2A1 Lg 1 DET:B1	K2	494	GARDEN ROLLER FRAGMENTS																		1
HOUER:210 BLOCK:TS2A1 Lg 2 DET:B6	K2	495	TRANSPARENT TURQUOISE	10BG 6/8	9				9					9				4	5	9	9
			DEEP TURQUOISE	10BG 5/6	5				5					5				1	4	5	5
			BLUE GREEN	5BG 6/4	4				4					4				4		4	4
[note one unusual Garden Roller bead].			GARDEN ROLLER BEADS				3									3	3			3	3
HOUER:224 BLOCK:TS2A1 Lg 3 DET:B10	K2	496	TRANSPARENT TURQUOISE	10BG 6/8	13				13					13				11	2	13	13
			DEEP TURQUOISE	10BG 5/6	2				2					2				2		2	2
			GREEN	5GY 5/6	1				1					1				1		1	1
			GARDEN ROLLER FRAGMENTS																		1
HOUER:238 BLOCK:TS2A1 Lg 4 DET:B15	K2	497	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6				2	4	6	6
			DEEP TURQUOISE	10BG 5/6	10				10					10					10	10	10
			CELEDON TURQUOISE	5BG 5/6	2				2					2				2		2	2
			GREEN	5GY 5/6	1				1					1				1		1	1

SITE K2

Heading Layer	UCT Site	Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER 239 BLOCK TS2A2 Lg 3 DET B11	K2	498	TRANSPARENT TURQUOISE	10BG 6/8	11				11					11				4	7	11	11
			BLUE GREEN	5BG 6/4	3				3					3				3		3	3
			GREEN	5GY 5/6	1				1					1				1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
			YELLOW	7.5Y 8.5/10	1				1					1					1	1	1
			WEATHERED BEADS		1				1					1					1	1	1
HOUER 209 BLOCK TS2A2 Lg 1 DET B3	K2	499	TRANSPARENT TURQUOISE	10BG 6/8	13				13					13					13	13	13
			DEEP TURQUOISE	10BG 5/6	2				2					2				2		2	2
			CELEDON TURQUOISE	5BG 5/6	5				5					5				5		5	5
			BLUE GREEN	5BG 6/4	7				7					7				7		7	7
			INDIAN RED	2.5YR 3/8	5				5					5			5			5	5
			GARDEN ROLLER FRAGMENTS				4									4	4			4	4
HOUER 240 BLOCK TS2A2 Lg 4(a) DET B20	K2	500	TRANSPARENT TURQUOISE	10BG 6/8	22									22				6	16	22	22
			DEEP TURQUOISE	10BG 5/6	2									2					2	2	2
			BLUE GREEN	5BG 6/4	3									3				3		3	3
			YELLOW	7.5Y 8.5/10	1									1				1		1	1
			WEATHERED BEADS																		2
HOUER 249 BLOCK TS2A2 Lg 4(b) DET B21	K2	501	TRANSPARENT TURQUOISE	10BG 6/8	7				7					7				3	4	7	7
			DEEP TURQUOISE	10BG 5/6	5				5					5				3	2	5	5
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
HOUER 228 BLOCK TS2A3 Lg 2 DET B9	K2	502	BLACK	N O.5/0.6% R	2									2			2			2	2
			TRANSPARENT TURQUOISE	10BG 6/8	33									33				11	22	33	33
			CELEDON TURQUOISE	5BG 5/6	2									2					2	2	2
			BLUE GREEN	5BG 6/4	2									2			2			2	2
			GREEN	5GY 5/6	2									2				2		2	2
			WEATHERED BEADS																		2
HOUER 234 BLOCK TS2A3 Lg 3 DET B13	K2	503	OYSTER WHITE	5GY 9/1	1				1					1				1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	3				3					3				2	1	3	3
			DEEP TURQUOISE	10BG 5/6	2				2					2					2	2	2
			GREEN	5GY 5/6	1				1					1				1		1	1
HOUER 232 BLOCK TS2A3 Lg 3(a) DET B14	K2	504	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1				1		1	1
			DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
			GREEN	5GY 5/6	1				1					1				1		1	1
HOUER 231 BLOCK TS2AS Lg 4 DET B17	K2	505	DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
HOUER 247 BLOCK TS2A3 GRAF 2 (Grave 2)	K2	506	TRANSPARENT TURQUOISE	10BG 6/8	9				9					9				4	5	9	9
			DEEP TURQUOISE	10BG 5/6	4				4					4				3	1	4	4
			GREEN	5GY 5/6	25				25					25					25	25	25
			INDIAN RED	2.5YR 3/8	299				299					299			299			299	299
			GARDEN ROLLER FRAGMENTS																		1
HOUER 245 BLOCK TS2A3 Lg G2 DET B23	K2	507	TRANSPARENT TURQUOISE	10BG 6/8	14				14					14				9	5	14	14
			DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
			GREEN	5GY 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
HOUER 235 BLOCK TS2A4 Lg 1	K2	508	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3				1	2	3	3
			DEEP TURQUOISE	10BG 5/6	2				2					2				2		2	2
			BLUE GREEN	5BG 6/4	2				2					2				2		2	2
HOUER 222 BLOCK TS2A4 Lg 3	K2	509	TRANSPARENT TURQUOISE	10BG 6/8	5				5					5					5	5	5
			DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	2				2					2				2		2	2

SITE K2

Heading	Layer	UCT Site	Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIf	WI	Wld	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
	HOUER:244 BLOCK:TS2A4 Lg 4 DFT BA4	K2	510	TRANSPARENT TURQUOISE	10BG 6/8	4				4					4				2	2	4	4
				DEEP TURQUOISE	10BG 5/6	3				3					3				1	2	3	3
				BLUE GREEN	5BG 6/4	4				4					4				4		4	4
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				DARK MARIGOLD	7.5YR 6/10	1				1					1					1	1	1
	HOUER:237 BLOCK:TS2A5 Lg 1	K2	511	TRANSPARENT TURQUOISE	10BG 6/8	13			1	12				1	12				4	8	12	13
				DEEP TURQUOISE	10BG 5/6	5				5					5				3	2	5	5
				BLUE GREEN	5BG 6/4	5				5					5				5		5	5
				GREEN	5GY 5/6	2				2					2				2		2	2
				INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
	HOUER:223 BLOCK:TS2A5 Lg 2	K2	512	TRANSPARENT TURQUOISE	10BG 6/8	10				10					10				5	5	10	10
				DEEP TURQUOISE	10BG 5/6	2				2					2				2		2	2
				BLUE GREEN	5BG 6/4	5				5					5				5		5	5
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
	HOUER:215 BLOCK:TS2A6 Lg 1	K2	513	TRANSPARENT TURQUOISE	10BG 6/8	1				1				1						1	1	1
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
	HOUER:226 BLOCK:TS2A6 Lg 2	K2	514	TRANSPARENT TURQUOISE	10BG 6/8	13			2	11					13				7	6	13	13
				BLUE GREEN	5BG 6/4	5				5					5				5		5	5
				GREEN	5GY 5/6	1				1					1				1		1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	2				2					2				2		2	2
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
				GARDEN ROLLER FRAGMENTS																		
	HOUER:225 BLOCK:TS2C3 Lg 3	K2	515	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6					6	6	6
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
				YELLOW	7.5Y 8.5/10	1									1			1			1	1
	HOUER:212 BLOCK:TS2C5 Lg 1	K2	516	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	3				3					3				3		3	3
				GARDEN ROLLER FRAGMENTS																		2
	HOUER:218 BLOCK:TS2L5	K2	517	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
				GARDEN ROLLER FRAGMENTS																		
	HOUER:214 BLOCK:TS2L6 STRAT:1	K2	518	TRANSPARENT TURQUOISE	10BG 6/8	15				15					15				14	1	15	15
				BLUE GREEN	5BG 6/4	2				2					2			1		1	2	2
				GREEN	5GY 5/6	3				3					3				3		3	3
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	16				16					16			16			16	16
K2 TS3 (E & M) 1972	HOUER:10 BLOCK:TS3.2 Lg 1 Opg:B37	K2	519	BLACK	N O.5/0.6% R	4				4					4			4			4	4
				TRANSPARENT TURQUOISE	10BG 6/8	68				68					68					68	68	68
				INDIAN RED	2.5YR 3/8	9				9					9			9			9	9
				VASELINE YELLOW (TP)	7.5Y 8/8	1				1					1				1		1	1
				GARDEN ROLLER BEADS				1									1	1				1
				GARDEN ROLLER FRAGMENTS				7									7	7				7
	HOUER:16 BLOCK:TS3 Lg 10 Opg:B37	K2	520	MEDIUM TURQUOISE	5B 6/8	33				33				27	6					33	33	33
				GARDEN ROLLER BEADS				2									2	2			2	2
	HOUER:16 BLOCK:TS3.02 Lg 15 Opg:B47	K2	521	TRANSPARENT TURQUOISE	10BG 6/8	23				23					20	3				23	23	23
				GARDEN ROLLER BEAD				1									1	1			1	1
	HOUER:19 BLOCK:TS3.01 Lg 8 Opg:B26	K2	522	MEDIUM TURQUOISE	5B 6/8	1									1					1	1	1
	HOUER 19 BLOCK:TS3.01 Lg 9 Opg:B33	K2	523	MEDIUM TURQUOISE	5B 6/8	8			4	4				1	7					8	8	8
				INDIAN RED	2.5YR 3/8	1									1			1			1	1

SITE: K2

Heading Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIf	WI	Wld	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER 8 BLOCK TS3 1 Springhaas Gat Opg B1	K2	524	BLACK	N O.5/0.6% R	7				7					7			7			7	7
			TRANSPARENT TURQUOISE	10BG 6/8	27			12	15				25	2					27	27	27
			INDIAN RED	2.5YR 3/8	8			5	3				8				8			8	8
			GARDEN ROLLER BEADS				2									2	2			2	2
HOUER:30 BLOCK TS3 1 Lg 1 Opg:B2	K2	525	BLACK	N O.5/0.6% R	3				3					3			3			3	3
			DARK SHADOW BLUE	10B 4/4	1				1					1				1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	27			14	13					27					27	27	27
			SAGE GREEN	7.5GY 4/4	2			2						2					2	2	2
			LIGHT BRIGHT GREEN	2.5G 6/6	1				1					1			1			1	1
			INDIAN RED	2.5YR 3/8	6				6					6			6			6	6
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1				1					1			1			1	1
			GARDEN ROLLER BEADS				3									3	3			3	3
HOUER:2 BLOCK:TS3.1 Lg 3 Opg:B4	K2	526	BLACK	N O.5/0.6% R	1				1					1			1			1	1
			MEDIUM TURQUOISE	5B 6/8	14			3	11				12	2					14	14	14
			INDIAN RED	2.5YR 3/8	2			2						2			2			2	2
HOUER:31 BLOCK:TS3.1 Lg 1 Opg:B5	K2	527	MEDIUM TURQUOISE	5B 6/8	18			9	9					18					18	18	18
HOUER:45 BLOCK:TS3.1 Lg2(N1.1.2.1) B6	K2	528	TRANSPARENT TURQUOISE	10BG 6/8	4			3	1				4						4	4	4
			MEDIUM TURQUOISE	5B 6/8	5			1	4				5						5	5	5
			BRIGHT TURQUOISE	7.5B 6/10	2				2				2						2	2	2
			INDIAN RED	2.5YR 3/8	2				2				2				2			2	2
HOUER:4 BLOCK:TS3 1 Lg 2 (1.2.8) B7	K2	529	MEDIUM TURQUOISE	5B 6/8	7			5	2				5	2					7	7	7
HOUER:18 BLOCK:TS3 1 Lg 3 Opg:B11	K2	530	TRANSPARENT TURQUOISE	10BG 6/8	4			3	1				4						4	4	4
HOUER:22 BLOCK:TS3 1 Lg 5 (i)	K2	531	TRANSPARENT TURQUOISE	10BG 6/8	6			6					6						6	6	6
			DARK MAUVE HEATHER						1												1
HOUER:49 BLOCK:TS3 1 Lg 7 Opg:B21	K2	532	MEDIUM TURQUOISE	5B 6/8	19			12	7				18	1					19	19	19
HOUER:40 BLOCK:TS3.1 Lg 8 Opg:B25	K2	533	TRANSPARENT TURQUOISE	10BG 6/8	13			9	4				12	1					13	13	13
HOUER:44 BLOCK:TS3.1 Lg 9 Opg:B30	K2	534	TRANSPARENT TURQUOISE	10BG 6/8	10			4	6				8	2					10	10	10
			MEDIUM TURQUOISE	5B 6/8	6			4	2				4	2					6	6	6
			GREEN	5GY 5/6	1				1					1			1			1	1
HOUER:34 BLOCK:TS3.1 Lg 9 Opg:B31	K2	535	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6					6	6	6
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
HOUER:9 BLOCK:TS3.1 Lg 9 Opg:B32	K2	536	TRANSPARENT TURQUOISE	10BG 6/8	21			10	11				19	2					21	21	21
			LIGHT BRIGHT GREEN	2.5G 6/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	1				1				1				1			1	1
			GARDEN ROLLER BEAD				1									1	1			1	1
			GARDEN ROLLER FRAGMENTS				2									2	2			2	2
HOUER:5 BLOCK:TS3.02 Lg 6 Opg:B20	K2	537	GARDEN ROLLER BEADS				2									2	2			2	2
HOUER:27 BLOCK:TS3.02 Lg 7 Opg:B24	K2	538	MEDIUM TURQUOISE	5B 6/8	28			14	14					26	2				28	28	28
HOUER:12 BLOCK:TS3.02 Lg 8 Opg:B29	K2	539	GARDEN ROLLER BEAD				1									1	1			1	1
HOUER:35 BLOCK:TS3.02 Lg 9 Opg:B36	K2	540	TRANSPARENT TURQUOISE	10BG 6/8	2			1	1				1	1					2	2	2
			GARDEN ROLLER BEAD				1									1	1			1	1
HOUER:51 BLOCK:TS3.02 Lg 10 Opg:B39	K2	541	TRANSPARENT TURQUOISE	10BG 6/8	9			9					3						9	9	9
			MEDIUM TURQUOISE	5B 6/8	11			10	1					11					11	11	11
			GARDEN ROLLER FRAGMENT				1									1	1			1	1
HOUER:52 BLOCK:TS3.02 Lg 10 Opg:B40	K2	542	GARDEN ROLLER FRAGMENTS				8									8	8			8	8
HOUER:21 BLOCK:TS3.02 Lg 11 Opg:B41	K2	543	MEDIUM TURQUOISE	5B 6/8	3			3					2	1					3	3	3
			GARDEN ROLLER FRAGMENT				1									1	1			1	1
HOUER:46 BLOCK:TS3.02 Lg 11 Opg:B42	K2	544	BLACK	N O.5/0.6% R	1				1					1			1			1	1
			BRIGHT TURQUOISE	7.5B 6/10	29			16	13					29					29	29	29
			SAGE GREEN	7.5GY 4/4	1				1					1					1	1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1					1	1	1
			LEMON YELLOW	10Y 8.5/6	1				1					1					1	1	1

SITE: K2

Heading Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER:42 BLOCK:TS3.02 Lg 12 Opg:B13	K2	545	MEDIUM TURQUOISE	5B 6/8	15			9	6				8	7					15	15	15
HOUER:33 BLOCK:TS3.02 Lg 13 Opg:B44	K2	546	TRANSPARENT TURQUOISE	10BG 6/8	3			3					3						3	3	3
			MEDIUM TURQUOISE	5B 6/8	10			7	3				8	2					10	10	10
HOUER:24 BLOCK:TS3.02 Lg 14 Opg:B45	K2	547	TRANSPARENT TURQUOISE	10BG 6/8	53			23	30				44	7	2				53	53	53
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
			BRIGHT DUSTY YELLOW	5Y 8.5/10	4				4					3	1		4			4	4
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
HOUER:20 BLOCK:TS3.02 Lg 14 Opg:B46	K2	548	MEDIUM TURQUOISE	5B 6/8	26			16	10				19	7					26	26	26
			SAGE GREEN	7.5GY 4/4	2			1	1				1	1					2	2	2
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
HOUER:47 BLOCK:TS3.02 Lg 16 Opg:B48	K2	549	MEDIUM TURQUOISE	5B 6/8	15			13	2				9	6					15	15	15
HOUER:50 BLOCK:TS3.02 Lg 17 Opg:B49	K2	550	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
			MEDIUM TURQUOISE	5B 6/8	6			6					6						6	6	6
HOUER:38 BLOCK:TS3.02 Lg 19 Opg:B50	K2	551	MEDIUM TURQUOISE	5B 6/8	10			6	4					10					10	10	10
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
HOUER:15 BLOCK:TS3.02 Lg 20	K2	552	GARDEN ROLLER FRAGMENT				1									1	1			1	1
HOUER:29 BLOCK:TS3.02 Lg 2 Opg:B7	K2	553	TRANSPARENT TURQUOISE	10BG 6/8	6			5	1					6					6	6	6
			GARDEN ROLLER FRAGMENT				1									1	1			1	1
HOUER:13 BLOCK:TS3.02 Lg 2 Opg:B8 (same as below K2 555)	K2	554	BLACK	N O.5/0.6% R	4								4				4			4	4
			TRANSPARENT TURQUOISE	10BG 6/8	119			100	19					119					119	119	119
			GREEN	5GY 5/6	1			1						1			1			1	1
			INDIAN RED	2.5YR 3/8	14			11	3					14			14			14	14
			BRIGHT DUSTY YELLOW	5Y 8.5/10	4				4					4			4			4	4
			GARDEN ROLLER BEADS				1									1	1			1	1
			GARDEN ROLLER FRAGMENTS				2									2	2			2	2
HOUER:6 BLOCK:TS3.2 Lg 2 Opg:B8	K2	555	TRANSPARENT TURQUOISE	10BG 6/8	28			18	10				25	3					28	28	28
HOUER:7 BLOCK:TS3.2 Lg 2 (1.1.1) Opg:B9	K2	556	TRANSPARENT TURQUOISE	10BG 6/8	17			12	5				17						17	17	17
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
HOUER:3 BLOCK:TS3.2 Lg 3 Opg:B12	K2	557	LIGHT GREY	N8 25/63.65R	1				1					1					1	1	1
			TRANSPARENT TURQUOISE	10BG 6/8	20			11	9				20						20	20	20
			INDIAN RED	2.5YR 3/8	1			1						1			1			1	1
HOUER:1 BLOCK:TS3.2 Lg 3 Opg:B13	K2	558	TRANSPARENT TURQUOISE	10BG 6/8	9			6	3				7	2					9	9	9
			INDIAN RED	2.5YR 3/8	3			2	1					3			3			3	3
HOUER:39 BLOCK:TS3.2 Lg 3 Opg:B14	K2	559	TRANSPARENT TURQUOISE	10BG 6/8	14			10	4				13	1					14	14	14
HOUER:17 BLOCK:TS3.2 Lg 5 Opg:B16	K2	560	MEDIUM TURQUOISE	5B 6/8	1			1					1						1	1	1
			GARDEN ROLLER BEADS				3									3	3			3	3
			GARDEN ROLLER FRAGMENTS				2									2	2			2	2
HOUER:25 BLOCK:TS3.2 Lg 5 Opg:B17	K2	561	MEDIUM TURQUOISE	5B 6/8	9			8	1					9					9	9	9
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
			GARDEN ROLLER BEADS				3									3	3			3	3
			GARDEN ROLLER FRAGMENTS				2									2	2			2	2
HOUER:32 BLOCK:TS3.2 Lg 6 Opg:B18	K2	562	MEDIUM TURQUOISE	5B 6/8	10			9	1				10						10	10	10
			INDIAN RED	2.5YR 3/8	1			1						1			1			1	1
HOUER:11 BLOCK:TS3.2 Lg 6 Opg:B19	K2	563	TRANSPARENT TURQUOISE	10BG 6/8	7			6	1				6	1					7	7	7
HOUER:28 BLOCK:TS3.2 Lg 7 Opg:B22	K2	564	MEDIUM TURQUOISE	5B 6/8	26			14	12					21	5				26	26	26
			GARDEN ROLLER BEADS				2									2	2			2	2
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
HOUER:48 BLOCK:TS3.2 Lg 7 Opg:B23	K2	565	MEDIUM TURQUOISE	5B 6/8	12			7	5				9	3					12	12	12
HOUER:37 BLOCK:TS3.2 Lg 8 Opg:B27	K2	566	GARDEN ROLLER BEAD				1									1	1			1	1

SITE K2

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
	HOUER:23 BLOCK TS3 2 Lg 8 Opg B28	K2	567	TRANSPARENT TURQUOISE	10BG 6/8	10			7	3				9	1					10	10	10
				MEDIUM BRIGHT GREEN	2.5G 5/6	1										1			1		1	1
				LARGE BROKEN BEAD (glass)	10BG 6/8	1			1								1			1	1	1
				GARDEN ROLLER BEADS				3									3	3			3	3
				GARDEN ROLLER FRAGMENTS				4									4	4			4	4
	HOUER:36 BLOCK:TS3 2 Lg 9 Opg B34	K2	568	MEDIUM TURQUOISE	5B 6/8	4			3	1				4						4	4	4
	HOUER:14 BLOCK:TS3 2 Lg 9 Opg B35	K2	569	MEDIUM TURQUOISE	5B 6/8	35			28	7				30	5					35	35	35
				GREEN	5GY 5/6	1									1					1	1	1
				INDIAN RED	2.5YR 3/8	3			3						3			3			3	3
				GARDEN ROLLER BEAD				1									1	1			1	1
				GARDEN ROLLER FRAGMENTS				3									3	3			3	3
	HOUER:41 BLOCK:TS3.2 Lg 10 Opg B38	K2	570	MEDIUM TURQUOISE	5B 6/8	12			10	2					12					12	12	12
				GREEN	5GY 5/6	1			1					1						1	1	1
				DEEP LEMON YELLOW	10Y 8/6	1				1					1				1		1	1
K2 TS4	HOUER:274 BLOCK:TS4 Lg 4	K2	571	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
(E & M)				DEEP TURQUOISE	10BG 5/6	3				3					3				3		3	3
1972	HOUER:268 BLOCK:TS4 Lg 7 TOETSSLOOT	K2	572	GARDEN ROLLER BEAD				1									1	1			1	1
	HOUER:270 BLOCK:TS4A2 Lg 1	K2	573	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2					2	2	2
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
				GREEN	5GY 5/6	1				1					1				1		1	1
	HOUER:275 BLOCK:TS4A2 Lg 1	K2	574	LIGHT GREY	N 8.25/63.65R	1				1					1			1			1	1
				TRANSPARENT TURQUOISE	10BG 6/8	19				19					19				19		19	19
				DEEP TURQUOISE	10BG 5/6	9				9					9				2	7	9	9
				BLUE GREEN	5BG 6/4	4				4					4				4		4	4
				GREEN	5GY 5/6	6				6					6				6		6	6
				INDIAN RED	2.5YR 3/8	9				9					9			9			9	9
	illustration (i)			GARDEN ROLLER BEAD				1									1	1			1	1
	HOUER:276 BLOCK:TS4A2 Lg 2	K2	575	TRANSPARENT TURQUOISE	10BG 6/8	28				28					28				28		28	28
				DEEP TURQUOISE	10BG 5/6	11				11					11					11	11	11
				GREEN	5GY 5/6	2				2					2				2		2	2
				INDIAN RED	2.5YR 3/8	11				11					11			11			11	11
				GARDEN ROLLER FRAGMENTS																		
	HOUER:271 BLOCK:TS4A2 Lg 3.L DET:B10	K2	576	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
				GARDEN ROLLER BEAD				1									1	1			1	1
	HOUER:277 BLOCK:TS4A2 Lg 5	K2	577	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6				6		6	6
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				YELLOW	7.5Y 8.5/10	1				1					1				1		1	1
	HOUER:269 BLOCK:TS4A3 Lg 3	K2	578	TRANSPARENT TURQUOISE	10BG 6/8	7				7					7				7		7	7
				DEEP TURQUOISE	10BG 5/6	4				4					4					4	4	4
				BLUE GREEN	5BG 6/4	3				3					3				3		3	3
				INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
	HOUER:279 BLOCK:TS4A3 Lg 5	K2	579	TRANSPARENT TURQUOISE	10BG 6/8	4				4					4				4		4	4
				DEEP TURQUOISE	10BG 5/6	8				8					8					8	8	8
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				OSTRICH EGG SHELL																		1

SITE: K2

Heading	Layer	Site	Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIf	WI	WId	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
	HOUER 272 BLOCK TS4A3 Lg 6	K2	580	BLACK	N O.5/0.6% R	1				1					1			1			1	1
				TRANSPARENT TURQUOISE	10BG 6/8	29				29					29					29	29	29
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				YELLOW	7.5Y 8.5/10	1				1					1				1		1	1
				DARK MARIGOLD	7.5YR 6/10	1				1					1				1		1	1
				GARDEN ROLLER FRAGMENTS																		2
	HOUER 278 BLOCK TS4A3 Lg 7	K2	581	GREEN	5GY 5/6	1				1					1				1		1	1
	HOUER 273 BLOCK TS4B2 Lg 1	K2	582	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6				6		6	6
				DEEP TURQUOISE	10BG 5/6	5				5					5					5	5	5
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	7				7					7			7			7	7
				GARDEN ROLLER BEAD				1									1	1			1	1
K2 TS5 (Meyer) 1991	HOUER:436 BLOCK:TS5.1 Lg 1	K2	583	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
				DEEP TURQUOISE	10BG 5/6	4				4					4					4	4	4
				CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	4				4					4				4		4	4
	HOUER 437 BLOCK:TS5 2 Lg 1	K2	584	BLACK	N O.5/0.6% R	2				2					2			2			2	2
				TRANSPARENT TURQUOISE	10BG 6/8	25				25					25					25	25	25
				DEEP TURQUOISE	10BG 5/6	3				3					3				1	2	3	3
				BLUE GREEN	5BG 6/4	15				15					15				15		15	15
				GREEN	5GY 5/6	2				2					2				2		2	2
				INDIAN RED	2.5YR 3/8	11				11					11			11			11	11
				YELLOW	7.5Y 8.5/10	2				2					2			2			2	2
	HOUER:576 BLOCK:TS5.2 B9 Lg 3	K2	585	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
				DEEP TURQUOISE	10BG 5/6	8				8					8				2	6	8	8
				CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	4				4					4				4		4	4
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
				WEATHERED BEAD																		1
	HOUER:575 BLOCK:TS5.3 B6 Lg 2	K2	586	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8					8	8	8
				DEEP TURQUOISE	10BG 5/6	6				6					6					6	6	6
				BLUE GREEN	5BG 6/4	5				5					5				5		5	5
				GREEN	5GY 5/6	2				2					2				2		2	2
				INDIAN RED	2.5YR 3/8	5				5					5			5			5	5
	HOUER:438 BLOCK:TS5.4 Lg 1 (nr2.LI)	K2	587	GARDEN ROLLER FRAGMENTS																		2
	HOUER:577 BLOCK:TS5 B10 Lg 3 DET:N23.3.I.	K2	588	CELEDON TURQUOISE	5BG 5/6	1				1					1			1			1	1
				BLUE GREEN	5BG 6/4	2				2					2			2			2	2
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				YELLOW	7.5Y 8.5/10	2				2					2			2			2	2
				SHELL BEAD		1																1
K2 TS5 (Meyer) 1993	HOUER:1002/71/7 BLOCK:TS5 A5 Lg 1	K2	588a	BLACK	N O.5/0.6% R	2				2					2			2			2	2
				DEEP TURQUOISE	10BG 5/6	4				4					4				1	3	4	4
				TRANSPARENT TURQUOISE	10BG 6/8	11				11					11					11	11	11
				GREEN	5GY 5/6	2				2					2					2	2	2
				INDIAN RED (one very worn)	2.5YR 3/8	9				9					9			9				9
	HOUER:1002/71/8 BLOCK:TS5 A5 Lg 2	K2	588b	BLACK	N O.5/0.6% R	1				1					1			1			1	1
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
				TRANSPARENT TURQUOISE	10BG 6/8	14				14					14					14	14	14
				INDIAN RED	2.5YR 3/8	7				7					7			7			7	7

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIf	WI	Wld	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
SITE: K2	HOUER 1002/71/9 BLOCK TS5 A5 Lg 3	K2	588c	TRANSPARENT TURQUOISE	10BG 6/8	5				5					5					5	5	5
				DEEP TURQUOISE	10BG 5/6	3				3					3				3		3	3
				GREEN	5GY 5/6	1				1					1					1	1	1
K2 TS6 (Meyer) 1991	HOUER 256 BLOCK TS6A2 Lg 1	K2	589	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8				8		8	8
				BLUE GREEN	5BG 6/4	2				2					2				2		2	2
				GREEN	5GY 5/6	3				3					3				3		3	3
				INDIAN RED	2.5YR 3/8	3				3					3				3		3	3
	HOUER 258 BLOCK TS6A2 Lg 2	K2	590	CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
	HOUER 260 BLOCK TS6A2 Lg 2	K2	591	CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				GARDEN ROLLER BEAD				2									2	2			2	2
	HOUER 262 BLOCK TS6A2 Lg 3 TOETSSLOOT	K2	592	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
	HOUER 263 BLOCK TS6A2 Lg 3	K2	593	CELEDON TURQUOISE	5BG 5/6	2				2					2			2			2	2
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	6				6					6			6			6	6
	HOUER 264 BLOCK TS6A2 Lg 2 TOETSSLOOT	K2	594	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2					2	2	2
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				GARDEN ROLLER FRAGMENTS																		2
	HOUER 265 BLOCK TS6A2 Lg 4	K2	595	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2					2	2	2
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
	HOUER 261 BLOCK TS6A2 Lg 5 TOETSSLOOT	K2	596	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3				3		3	3
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1					1	1	1
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
				YELLOW	7.5Y 8.5/10	3				3					3			3			3	3
				GARDEN ROLLER FRAGMENTS																		2
	HOUER 267(a) BLOCK TS6A2 Lg 5 B10	K2	597	TRANSPARENT TURQUOISE	10BG 6/8	1									1				1		1	1
				BLUE GREEN	5BG 6/4	2									2				2		2	2
				INDIAN RED	2.5YR 3/8	7																7
	HOUER: 266 BLOCK TS6A2 Lg 6 DET:B12	K2	598	TRANSPARENT TURQUOISE	10BG 6/8	4				4					4				4		4	4
				DEEP TURQUOISE	10BG 5/6	7				7					7					7	7	7
				BLUE GREEN	5BG 6/4	2				2					2				2		2	2
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	11				11					11			11			11	11
				YELLOW	7.5Y 8.5/10	2				2					2				2		2	2
	HOUER 267 BLOCK TS6A2 Lg 7 TOETSSLOOT	K2	599	DEEP TURQUOISE	10BG 5/6	3				3					3					3	3	3
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	5				5					5			5			5	5
	HOUER 257 BLOCK TS6A2 Lg 8	K2	600	TRANSPARENT TURQUOISE	10BG 6/8	18				18					18					18	18	18
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
				DARK MAUVE HEATHER	10P 3/4	1				1					1				1		1	1
	HOUER 259 BLOCK TS6A2 Lg 10	K2	601	TRANSPARENT TURQUOISE	10BG 6/8	7				7					7				7		7	7
				DEEP TURQUOISE	10BG 5/6	3				3					3					3	3	3
				BLUE GREEN	5BG 6/4	2				2					2				2		2	2
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
	HOUER 255 BLOCK TS6A2 Lg 11	K2	602	BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				YELLOW	7.5Y 8.5/10	2				2					2			2			2	2
				GARDEN ROLLER FRAGMENTS																		

SITE K2	Heading, Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method			Structure Type					Size				Diaphaneity			Lusture	Total
						D	W	M	Ia	IIa	IIf	WI	WId	VS	S	M	L	O	TL	TP	D	
	HOUER:254 BLOCK:TS6A2 Lg 12	K2	603	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2				2		2	2
				GREEN	5GY 5/6	1				1					1					1	1	1
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
	HOUER:253 BLOCK:TS6A2 Lg 13	K2	604	DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
	HOUER:252 BLOCK:TS6A3 Lg 1	K2	605	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1				1		1	1
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
K2 RN2	HOUER:192 OPPERVLAKTEVONDS DET:B19	K2	606	GARDEN ROLLER FRAGMENTS																		1
(E & M)	HOUER:205 BLOCK:RN2 TOETSSLOOT DET:B6	K2	607	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2				1	1	2	2
1976	HOUER:203 BLOCK:RN2 Lg 1 DET:B3	K2	608	LIGHT GREY	N8.25/63.65R	1				1					1					1	1	1
				TRANSPARENT TURQUOISE	10BG 6/8	13				13					13					13	13	13
				DEEP TURQUOISE	10BG 5/6	8				8					8				8		8	8
				GREEN	5GY 5/6	1				1					1			1			1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	31				31					31			31			31	31
				YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
				GARDEN ROLLER FRAGMENTS				1									1	1			1	1
	HOUER:191 BLOCK:RN2 Lg 1 DET:B5	K2	609	TRANSPARENT TURQUOISE	10BG 6/8	2			2					1	1					2	2	2
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	7			1	6					7			7			7	7
	HOUER:185 BLOCK:RN2B4 Lg 2 DET:B10	K2	610	TRANSPARENT TURQUOISE	10BG 6/8	9			1	8					9				1	8	9	9
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	13				13					13			13			13	13
	Illustrated in chapter 8.1.3 (ii).1 - (j)			GARDEN ROLLER				1									1	1			1	1
	HOUER:194 BLOCK:RN2B7 Lg 6	K2	611	GARDEN ROLLER FRAGMENT				1									1	1			1	1
	HOUER:186 BLOCK:RN2B8 Lg 2	K2	612	TRANSPARENT TURQUOISE	10BG 6/8	2			1	1					2					2	2	2
	HOUER:193 BLOCK:RN2B8 Lg 7	K2	612a	TRANSPARENT TURQUOISE	10BG 6/8	7																7
				YELLOW	7.5Y 8.5/10	1																1
				GARDEN ROLLER		1																1
	HOUER:204 BLOCK:RN2C3 T.T. DET:B15	K2	613	BLACK	N O.5/0.6% R	1				1					1			1			1	1
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
	HOUER:188 BLOCK:RN2C3 Lg 2 DET:37	K2	614	TRANSPARENT TURQUOISE	10BG 6/8	12			2	10					12					12	12	12
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				INDIAN RED	2.5YR 3/8	2			1	1					2			2			2	2
	HOUER:190 BLOCK:RN2C3 Lg 2 DET:B11	K2	615	LIGHT GREY	N 8.25/63.65R	1				1					1					1	1	1
	[unusual bead]			DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
	HOUER:197 BLOCK:RN2C3 Lg 3 DET:B12	K2	616	TRANSPARENT TURQUOISE	10BG 6/8	14			1	13					14				2	12	14	14
				DEEP TURQUOISE	10BG 5/6	7			1	6					7				1	6	7	7
				BLUE GREEN	5BG 6/4	5				5					5				4	1	5	5
				GREEN	5GY 5/6	1				1					1				1		1	1
				GARDEN ROLLER BEAD				1									1	1			1	1
	HOUER:201 BLOCK:RN2C4 Lg 1(a) DET:B26	K2	617	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6					6	6	6
				DEEP TURQUOISE	10BG 5/6	9				9					9					9	9	9
				BLUE GREEN	5BG 6/4	3				3					3				3		3	3
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	19				19					19			19			19	19

SITE K2

Heading Layer	UCT Site	Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER 200 BLOCK RN2C4 Lg 1(b) DET B6	K2	618	TRANSPARENT TURQUOISE	10BG 6/8	12				12					12				3	9	12	12
			DEEP TURQUOISE	10BG 5/6	8				8					8				8		8	8
			BLUE GREEN	5BG 6/4	3				3					3				3		3	3
			GREEN	5GY 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	10				10					10			10			10	10
HOUER 199 BLOCK RN2C4 Lg 2 DET B8	K2	619	BLACK	N O.5/0.6% R	1				1					1			1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	16				16					16				8	8	16	16
			DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	9				9					9			9			9	9
			GARDEN ROLLER FRAGMENT				1									1	1			1	1
HOUER:198 BLOCK RN2C4 Lg 3 DET:B21	K2	620	TRANSPARENT TURQUOISE	10BG 6/8	9			1	8				5	4				2	7	9	9
			DEEP TURQUOISE	10BG 5/6	5				5					5					5	5	5
			GREEN	5GY 5/6	1				1					1				1		1	1
HOUER:196 BLOCK:RN2C4 Lg 4 DET:B13	K2	621	TRANSPARENT TURQUOISE	10BG 6/8	13				13					13				4	9	14	13
			DEEP TURQUOISE	10BG 5/6	5				5				1	4				1	4	5	5
			CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
			GARDEN ROLLER FRAGMENTS				3									3	3			3	3
HOUER:195 BLOCK:RN2C4 Lg 5 DET:B14	K2	622	TRANSPARENT TURQUOISE	10BG 6/8	4				4					4				2	2	4	4
			DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
			BLUE GREEN	5BG 6/4	1				1					1				1		1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	1				1					1			1			1	1
HOUER:206 BLOCK:RN2C5 Lg 1 DET:B1	K2	623	BLACK	N O.5/0.6% R	1				1					1			1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	23				23					23					23	23	23
			DEEP TURQUOISE	10BG 5/6	18				18					18					18	18	18
			CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
			BLUE GREEN	5BG 6/4	3				3					3				3		3	3
			GREEN	5GY 5/6	1				1					1				1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
			YELLOW	7.5Y 8.5/10	41				41					41			41			41	41
			GARDEN ROLLER BEAD				1									1	1			1	1
HOUER:183 BLOCK:RN2C5 Lg 2	K2	624	TRANSPARENT TURQUOISE	10BG 6/8	6			1	5					6					6	6	6
			DEEP TURQUOISE	10BG 5/6	4				4					4					4	4	4
			CELEDON TURQUOISE	5BG 5/6	1				1					1				1		1	1
			BLUE GREEN	5BG 6/4	1				1					1				1		1	1
			INDIAN RED	2.5YR 3/8	5			1	4					5			5			5	5
			DARK SHADOW BLUE	10B 4/4	2				2					2				2		2	2
			OLIVE YELLOW	7.5Y 7/6	1				1					1				1		1	1
HOUER:189 BLOCK:RN2C5 Lg 2 BET:B16	K2	625	BLUE GREEN	5BG 6/4	1				1				1					1		1	1
HOUER:187 BLOCK:RN2C5 Lg 3 DET:B18	K2	626	GARDEN ROLLER BEAD				1									1	1			1	1
April 1976 BLOCK:RN2C7 ROOI KRALE	K2	627	TRANSPARENT TURQUOISE	10BG 6/8	1			1						1					1	1	1
			DEEP TURQUOISE	10BG 5/6	5			1	4					5				2	3	5	5
			CELEDON TURQUOISE	5BG 5/6	1			1						1			1			1	1
			BLUE GREEN	5BG 6/4	1				1					1				1		1	1
			OSTRICH EGG SHELL																		41
			OSTRICH EGG SHELL FRAG.																		4
			GARDEN ROLLER FRAGMENTS																		2
			POTTERY BEADS																		9

SITE: K2

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
	HOUER 202 BLOCK RN2D9 I g 1	K2	628	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2				1	1	2	2
				DEEP TURQUOISE	10BG 5/6	1				1					1					1	1	1
				BLUE GREEN	5BG 6/4	2				2					2			1	2		2	2
				GREEN	5GY 5/6	2				2					2			2			2	2
	HOUER 207 BLOCK RN2D9 I g 1	K2	629	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8				4	4	8	8
				DEEP TURQUOISE	10BG 5/6	4				4					4				1	3	4	4
				BLUE GREEN	5BG 6/4	2				2					2				2		2	2
				MEDIUM BRIGHT GREEN	2.5G 5/6	1				1					1				1		1	1
	HOUER 208 BLOCK RN2D10 I g 1	K2	630	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2				2		2	2
				GREEN	5GY 5/6	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
	HOUER:182 BLOCK RN2D10 I g 2	K2	631	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6				6		6	6
				DEEP TURQUOISE	10BG 5/6	2				2					2					2	2	2
				GREEN	5GY 5/6	2				2					2				2		2	2
				INDIAN RED	2.5YR 3/8	4				4					4			4			4	4
				YELLOW	7.5Y 8.5/10	1				1					1				1		1	1
				GARDEN ROLLER BEAD				1									1	1			1	1
				JOINED BEADS		3				3					3			3			3	3
	HOUER:184 BLOCK:RN2D10 I g 2	K2	632	DEEP TURQUOISE	10BG 5/6	1				1					1			4		1	1	1
K2 TR Meyer (1993)	HOUER:1001/7/00 BLOCK:TR D4/a1/1 I g 1	K2	632a	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8					8	8	8
				DEEP TURQUOISE	10BG 5/6	3				3					3				3		3	3
				GREEN	5GY 5/6	2				2					1	1				2	2	2
				GARDEN ROLLER FRAGMENT																	1	1
	HOUER:1001/7/01 BLOCK:TR D4/A1/1 I G 2	K2	632b	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
				DEEP TURQUOISE	10BG 5/6	8				8					8					8	8	8
				BLUE GREEN	5BG 6/4	2				2					2				1	1	2	2
				GARDEN ROLLER (1 blue green)																		3
				GARDEN ROLLER FRAGMENTS																		3
	HOUER:1001/7/02 BLOCK:TR D4/a1/1 I g 3	K2	632c	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
	HOUER:1001/7/03 BLOCK:TR D4/a1/1 I g 4	K2	632d	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2					2	2	2
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
	HOUER:1001/7/04 BLOCK:TR D4/a1/1 I g 5	K2	632e	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
				DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
	HOUER:1001/7/05 BLOCK:TR D4/a1/2 I g 1	K2	632f	BLACK	N O.5/0.6% R	1				1					1			1			1	1
				TRANSPARENT TURQUOISE	10BG 6/8	13				13					13					13	13	13
				DEEP TURQUOISE	10BG 5/6	5				5					5				5		5	5
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				GREEN	5GY 5/6	1				1					1					1	1	1
				INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
	HOUER:1001/7/06 BLOCK:TR D4/a1/2 I g 2	K2	632g	TRANSPARENT TURQUOISE	10BG 6/8	11				11					11					11	11	11
				DEEP TURQUOISE	10BG 5/6	4				4					4				4		4	4
				GREEN	5GY 5/6	1				1					1				1		1	1
	HOUER:1001/7/07 BLOCK:TR D4/a1/2 I g3	K2	632h	INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
	HOUER:1001/7/08 BLOCK:TR D4/a1/2 I g 4	K2	632i	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6					6	6	6
				DEEP TURQUOISE	10BG 5/6	3				3					3				3		3	3
				BLUE GREEN	5BG 6/4	1				1					1				1		1	1
				INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
				GARDEN ROLLER FRAGMENT		1																1

SITE K2

Heading Layer	UCT Site	Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIf	WI	WId	VS	Size S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER 1001/7/09 BLOCK TR D4/a1/6 Lg 1	K2	632j	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8					8	8	8
			DEEP TURQUOISE	10BG 5/6	3				3					3				3		3	3
			GREEN	5GY 5/6	1				1					1					1	1	1
HOUER 1001/7/10 BLOCK TR D4/a1/6/ Lg 2	K2	632k	TRANSPARENT TURQUOISE	10BG 6/8	16				16					16					16	16	16
			DEEP TURQUOISE	10BG 5/6	4				4					4				4		4	4
			BLUE GREEN	5BG 6/4	6				6					6				5	1	1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	2				2					2			1		1	2	2
			GREEN (1 very worn)	5GY 5/6	2				2					2			1		1	2	2
			INDIAN RED	2.5YR 3/8	3				3					3			3			3	3
			YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
HOUER:1001/7/11 BLOCK TR D4/a1/6 Lg 3	K2	632l	INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
			BONE BEAD																		1
HOUER:1001/7/12 BLOCK:TR D4/a1/6 Lg 4	K2	632m	TRANSPARENT TURQUOISE	10BG 6/8	3				3					3					3	3	3
			INDIAN RED	2.5YR 3/8	1				1					1			1			1	1
HOUER:1001/7/13 BLOCK:TR D4/a1/7 Lg 1	K2	632n	TRANSPARENT TURQUOISE	10BG 6/8	8				8					8					8	8	8
			DEEP TURQUOISE	10BG 5/6	4				4					4				4		4	4
			INDIAN RED	2.5YR 3/8	2				2					2			2			2	2
HOUER 1001/7/14 BLOCK TR D4/a1/7 Lg 2	K2	632o	TRANSPARENT TURQUOISE	10BG 6/8	1				1					1					1	1	1
			DEEP TURQUOISE	10BG 5/6	1				1					1				1		1	1
			BLUE GREEN	5BG 6/4	1				1					1			1			1	1
			GREEN (1 very worn)	5GY 5/6	1				1					1			1			1	1
			YELLOW	7.5Y 8.5/10	1				1					1			1			1	1
HOUER:1001/7/15 BLOCK:TR D4/a1/7 Lg 3	K2	632p	TRANSPARENT TURQUOISE	10BG 6/8	2				2					2					2	2	2
			DEEP TURQUOISE	10BG 5/6	2				2					2				2		2	2
HOUER:1001/7/16 BLOCK:TR D4/a1/7 Lg 4	K2	632q	TRANSPARENT TURQUOISE	10BG 6/8	6				6					6					6	6	6
			DEEP TURQUOISE	10BG 5/6	4				4					4				4		4	4
			BLUE GREEN	5BG 6/4	1				1					1					1	1	1

LOCATION: Greefswald
SITE: K2B

Heading		Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
K2B	HOUER:352 BLOCK:B1(a) OPPERVLAKTE V	K2B	633	GARDEN ROLLER FRAGMENTS				1													1
	HOUER:355 BLOCK:B1(b) Lg 1(a)	K2B	634	BLACK	N O.5/0.6%	3				3				3			3			3	3
				TRANSPARENT TURQUOISE	10BG 6/8	9				9				9					9	9	9
				DEEP TURQUOISE	10BG 5/6	8				8				8				8		8	8
				BLUE GREEN	5BG 6/4	3				3				3			3			3	3
				GREEN	5GY 5/6	2				2				2			2			2	2
				INDIAN RED	2.5YR 3/8	19				19			1	18			19			19	19
				DARK SHELL BEAD																	1
				GARDEN ROLLER FRAGMENTS																	
				UNIDENTIFIABLE BEAD																	1
	HOUER:354 BLOCK:B2	K2B	635	TRANSPARENT TURQUOISE	10BG 6/8	1				1			1						1	1	1
	STRAT:SENTRALE HOOP OU TOOTSSLOOT			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
				GARDEN ROLLER FRAGMENTS																	4
	HOUER:356 BLOCK:B2 Lg 1(B)	K2B	636	TRANSPARENT TURQUOISE	10BG 6/8	7				7				7					7	7	7
				DEEP TURQUOISE	10BG 5/6	8				8				8					8	8	8
				BLUE GREEN	5BG 6/4	2				2				2				1	1	2	2
				INDIAN RED	2.5YR 3/8	8				8				8			8			8	8
				OSTRICH EGG SHELL BEAD																	1
				SHELL BEAD																	2
	HOUER:362 BLOCK:B2 Lg 4	K2B	637	GARDEN ROLLER FRAGMENTS																	1
	HOUER:366 BLOCK:B3 Lg 5	K2B	638	DEEP TURQUOISE	10BG 5/6	1				1				1				1		1	1
				INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
				GARDEN ROLLER FRAGMENTS																1	
	HOUER:361 BLOCK:B4 Lg 2	K2B	639	TRANSPARENT TURQUOISE	10BG 6/8	8				8			1	7					8	8	8
				BLUE GREEN	5BG 6/4	5				5				5				5		5	5
				GREEN	5GY 5/6	2				2				2				2		2	2
				INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
				UNIDENTIFIABLE BEAD																	1
	HOUER:367 BLOCK:B4 Lg 6	K2B	640	TRANSPARENT TURQUOISE	10BG 6/8	1				1				1				1		1	1
				DEEP TURQUOISE	10BG 5/6	2				2				2					2	2	2
				INDIAN RED	2.5YR 3/8	5				5				5			5			5	5
				OSTRICH EGG SHELL																	1
	HOUER:357 BLOCK:B5 Lg 2	K2B	641	TRANSPARENT TURQUOISE	10BG 6/8	7				7				7					7	7	7
				DEEP TURQUOISE	10BG 5/6	9				9			1	8					9	9	9
				CELEDON TURQUOISE	5BG 5/6	1				1				1			1			1	1
				INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
				VASELINE YELLOW (TP)	7.5Y 8/8	1				1				1				1		1	1
				GARDEN ROLLER FRAGMENTS																	9
	HOUER:359 BLOCK:B5 Lg 2(a)	K2B	642	DEEP TURQUOISE	10BG 5/6	3				3				3					3		3
				BLUE GREEN	5BG 6/4	1				1				1				1			1
				INDIAN RED	2.5YR 3/8	1				1				1			1				1
	HOUER:370 BLOCK:B5 Lg 7	K2B	643	TRANSPARENT TURQUOISE	10BG 6/8	3				3				3					3	3	3
				DEEP TURQUOISE	10BG 5/6	1				1				1				1		1	1
				GREEN	5GY 5/6	1				1				1			1			1	1

SITE K2B

Heading	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER 358 BLOCK B6 Lg 2	K2B	644	TRANSPARENT TURQUOISE	10BG 6/8	19							2	17				1	16	17	19
			CELEDON TURQUOISE	5BG 5/6	1								1				1		1	1
			BLUE GREEN	5BG 6/4	1								1				1		1	1
			INDIAN RED	2.5YR 3/8	7								7			7			7	7
			GARDEN ROLLER FRAGMENTS																	1
			UNIDENTIFIABLE BEAD																	1
HOUER:360 BLOCK B7 Lg 2(a)(i)	K2B	645	TRANSPARENT TURQUOISE	10BG 6/8	6				6				6					6	6	6
			DEEP TURQUOISE	10BG 5/6	2				2				2					2	2	2
HOUER:373 BLOCK B7 Lg 10	K2B	646	DEEP TURQUOISE	10BG 5/6	2				2				2					2	2	2
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
HOUER:365 BLOCK B8 Lg 4(b)	K2B	647	TRANSPARENT TURQUOISE	10BG 6/8	3				3				3				3		3	3
			DEEP TURQUOISE	10BG 5/6	5				5				5					5	5	5
			BLUE GREEN	5BG 6/4	4				4				4				4		4	4
			INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
HOUER:364 BLOCK B9 Lg 4	K2B	648	TRANSPARENT TURQUOISE	10BG 6/8	13								13			1		12	13	13
			INDIAN RED	2.5YR 3/8	1								1			1			1	1
			UNIDENTIFIABLE BEAD																	2
HOUER:363 BLOCK:B10 Lg 4	K2B	649	TRANSPARENT TURQUOISE	10BG 6/8	6				6				6				1	5	6	6
			DEEP TURQUOISE	10BG 5/6	1				1				1					1	1	1
			CELEDON TURQUOISE	5BG 5/6	1				1				1				1		1	1
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
			GREEN	5GY 5/6	1				1				1				1		1	1
			DARK SHADOW BLUE	10B 4/4	1				1				1				1		1	1
			GARDEN ROLLER FRAGMENTS																	2
HOUER:374 BLOCK:B10 Lg 13	K2B	650	BLUE GREEN	5BG 6/4	1				1				1			1			1	1
HOUER:379 TER:MK 2/3 BLOCK:B12 Lg 3 DET:A-A2+1	K2B	651	BLACK	N O.5/0.6% R	4				4				4			4				4
			TRANSPARENT TURQUOISE	10BG 6/8	14				14				14					14		14
			GREEN	5GY 5/6	1				1				1				1			1
			INDIAN RED	2.5YR 3/8	7				7				7			7				7
HOUER:368 BLOCK:B12 Lg 6	K2B	652	TRANSPARENT TURQUOISE	10BG 6/8	3				3				3					3	3	3
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
			GARDEN ROLLER FRAGMENTS																	
HOUER:369 BLOCK B13 Lg 6	K2B	653	TRANSPARENT TURQUOISE	10BG 6/8	1				1				1					1		1
			DEEP TURQUOISE	10BG 5/6	5				5				5					5		5
			CELEDON TURQUOISE	5BG 5/6	1				1				1				1			1
			BLUE GREEN	5BG 6/4	1				1				1				1			1
			GREEN	5GY 5/6	1				1				1				1			1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1				1				1			1
			GARDEN ROLLER FRAGMENTS																	1
			UNIDENTIFIABLE BEAD																	1
HOUER:371 BLOCK:B14 Lg 7	K2B	654	TRANSPARENT TURQUOISE	10BG 6/8	28				28				28				14	14	28	28
			DEEP TURQUOISE	10BG 5/6	27				27				27					27	27	27
			CELEDON TURQUOISE	5BG 5/6	1				1				1					1	1	1
			BLUE GREEN	5BG 6/4	1				1				1					1	1	1
			GREEN	5GY 5/6	2				2				2			1		1	2	2
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1				1				1		1	1
			INDIAN RED	2.5YR 3/8	2				2				2			2			2	2
			VASELINE YELLOW (TP)	7.5Y 8/8	1				1				1			1			1	1
			GARDEN ROLLER FRAGMENTS																	2

SITE: K2B

Heading	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER:372 BLOCK:B15 Lg 1	K2B	655	TRANSPARENT TURQUOISE	10BG 6/8	2				2				2					2	2	2
			DEEP TURQUOISE	10BG 5/6	1				1				1					1	1	1
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
HOUER:396 BLOCK:B16 Lg X	K2B	656	TRANSPARENT TURQUOISE	10BG 6/8	1				1				1					1	1	1
			DEEP TURQUOISE	10BG 5/6	3				3				3					3	3	3
			BLUE GREEN	5BG 6/4	3				3				3				1	2	3	3
HOUER:350 OPPERVLAKTE VONDS	K2B	657	TRANSPARENT TURQUOISE	10BG 6/8	4				4				4				3	1	4	4
			GARDEN ROLLER FRAGMENTS																	2
HOUER:351 OPPERVLAKTE VONDS	K2B	658	GARDEN ROLLER FRAGMENTS																	2
HOUER:349	K2B	659	GARDEN ROLLER																	1
HOUER:375 BLOCK:B1 Lg unsure	K2B	660	GARDEN ROLLER FRAGMENTS																	4
K2B HOUER:353 DET: OU TOETSSLOOT	K2B	661	TRANSPARENT TURQUOISE	10BG 6/8	4				4				4				4		4	4
TS1.4-TS1.6			CELEDON TURQUOISE	5BG 5/6	1				1				1				1		1	1
HOUER:306 BLOCK:TS1.4 Lg 1	K2B	662	BLACK	N O.5/0.6% R	1				1				1			1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	36				36				36				2	34	36	36
			DEEP TURQUOISE	10BG 5/6	41				41				41				2	39	41	41
			BLUE GREEN	5BG 6/4	34				34				34				27	7	34	34
			GREEN	5GY 5/6	4				4				4				4		4	4
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1				1				1		1	1
			INDIAN RED	2.5YR 3/8	6				6				6			6			6	6
			YELLOW	7.5Y 8.5/10	2				2				2			2			2	2
HOUER:298 BLOCK:TS1.4 Lg 2	K2B	663	TRANSPARENT TURQUOISE	10BG 6/8	10				10				10					10	10	10
			BLUE GREEN	5BG 6/4	3				3				3				3		3	3
			YELLOW	7.5Y 8.5/10	1				1				1			1			1	1
			GARDEN ROLLER FRAGMENTS																	4
			FRAGMENTS																	10
HOUER:292 BLOCK:TS1.4 Lg 3	K2B	664	GARDEN ROLLER FRAGMENTS																	2
HOUER:303 BLOCK:TS1.4 Lg 3	K2B	665	TRANSPARENT TURQUOISE	10BG 6/8	4				4				4					4	4	4
			BLUE GREEN	5BG 6/4	2				2				2				2		2	2
			INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
			YELLOW	7.5Y 8.5/10	1				1				1			1			1	1
			GARDEN ROLLER FRAGMENTS																	4
			FRAGMENTS																	14
HOUER:289 BLOCK:TS1.4 Lg 4	K2B	666	DEEP TURQUOISE	10BG 5/6	9								9					9	9	9
			CELEDON TURQUOISE	5BG 5/6	13								13				4	9	13	13
			BLUE GREEN	5BG 6/4	15								15				15		15	15
			GREEN	5GY 5/6	3								3				3		3	3
			INDIAN RED	2.5YR 3/8	2								2			2			2	2
			YELLOW	7.5Y 8.5/10	7								7			7			7	7
HOUER:300 BLOCK:TS1.4 Lg 4	K2B	667	TRANSPARENT TURQUOISE	10BG 6/8	3				3			3						3	3	3
			GARDEN ROLLER FRAGMENTS																	3
HOUER:301 BLOCK:TS1.4 Lg 4	K2B	668	TRANSPARENT TURQUOISE	10BG 6/8	2				2				2				2		2	2
			DEEP TURQUOISE	10BG 5/6	2				2				2					2	2	2
			GREEN	5GY 5/6	2				2				2				2		2	2
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1				1					1	1	1
			INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
			YELLOW	7.5Y 8.5/10	4				4				4				4		4	4
HOUER:280 BLOCK:TS1.4 Lg 5	K2B	669	TRANSPARENT TURQUOISE	10BG 6/8	1				1				1				1		1	1

SITE: K2B

Heading	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
HOUER:299 BLOCK:TS1.4 Lg 5	K2B	670	BLACK	N O.5/0.6% R	1				1				1			1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	5			4	1				5				1	4	5	5
			DEEP TURQUOISE	10BG 5/6	7				7				7				1	6	7	7
			BLUE GREEN	5BG 6/4	7				7				7				7		7	7
			GREEN	5GY 5/6	2				2				2				2		2	2
			YELLOW	7.5Y 8.5/10	1				1				1				1		1	1
HOUER:295 BLOCK:TS1.5 Lg 1	K2B	671	BLACK	N O.5/0.6% R	3				3				3			3			3	3
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	2				2				2				2		2	2
			INDIAN RED	2.5YR 3/8	3				3				3			3			3	3
			GARDEN ROLLER FRAGMENTS																	1
HOUER:297 BLOCK:TS1.5 Lg 1	K2B	672	TRANSPARENT TURQUOISE	10BG 6/8	5				5				5					5	5	5
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
			INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
HOUER:305 BLOCK:TS1.5 Lg 1	K2B	673	TRANSPARENT TURQUOISE	10BG 6/8	9				9				9				6	3	9	9
			DEEP TURQUOISE	10BG 5/6	5				5				5				2	3	5	5
			CELEDON TURQUOISE	5BG 5/6	1				1				1			1			1	1
			BLUE GREEN	5BG 6/4	8				8				8				8		8	8
			YELLOW	7.5Y 8.5/10	20				20				20				20		20	20
HOUER:283 BLOCK:TS1.5 Lg 2	K2B	674	TRANSPARENT TURQUOISE	10BG 6/8	67			6	61				67				41	46	67	67
			CELEDON TURQUOISE	5BG 5/6	2				2				2				2		2	2
			BLUE GREEN	5BG 6/4	28				28				28				28		28	28
			GREEN	5GY 5/6	3				3				3				3		3	3
			MEDIUM BRIGHT GREEN	2.5G 5/6	4				4				4				4		4	4
			INDIAN RED	2.5YR 3/8	5				5				5			5			5	5
			YELLOW	7.5Y 8.5/10	47				47				47				47		47	47
			WEATHERED BEADS																	7
HOUER:284 BLOCK:TS1.5 Lg 3 (basis) NR:5:3.5	K2B	675	GARDEN ROLLER FRAGMENTS																	1
HOUER:293 TS1.5 Lg 4 (basis) NR:5.4.1 DET:B17	K2B	676	GARDEN ROLLER FRAGMENTS																	1
HOUER:281 BLOCK:TS1.5 Lg 4	K2B	677	TRANSPARENT TURQUOISE	10BG 6/8	15				15				15				3	12	15	15
			DEEP TURQUOISE	10BG 5/6	25				25				25				1	24	25	25
			BLUE GREEN	5BG 6/4	5				5				5				5		5	5
			MEDIUM BRIGHT GREEN	2.5G 5/6	2				2				2				2		2	2
			YELLOW	7.5Y 8.5/10	4				4				4				4		4	4
			GARDEN ROLLER FRAGMENTS																	1
HOUER:282 BLOCK:TS1.5 Lg 4	K2B	678	TRANSPARENT TURQUOISE	10BG 6/8	1				1				1					1	1	1
			DEEP TURQUOISE	10BG 5/6	1				1				1				1		1	1
			YELLOW	7.5Y 8.5/10	1				1				1			1			1	1
			GARDEN ROLLER FRAGMENTS																	
			WEATHERED BEADS																	1
HOUER:287 BLOCK:TS1.5 Lg 5	K2B	679	TRANSPARENT TURQUOISE	10BG 6/8	8				8				8					8	8	8
			BLUE GREEN	5BG 6/4	7				7				7				7		7	7
			INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
			YELLOW	7.5Y 8.5/10	9				9				9			9			9	9
			WEATHERED BEADS																	2
HOUER:17 BLOCK:TS1.6 Lg 1	K2B	680	TRANSPARENT TURQUOISE	10BG 6/8	66				66				66				12	54	66	66
			DEEP TURQUOISE	10BG 5/6	6				6				6				1	5	6	6
			BLUE GREEN	5BG 6/4	5				5				5				5		5	5
			GREEN	5GY 5/6	4				4				4				4		4	4

SITE: K2B

Heading	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	M	Structure Type Ia	IIa	IIIF	WIb	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
			MEDIUM BRIGHT GREEN	2.5G 5/6	4				4				4				4		4	4
HOUER:291 BLOCK:TS1.6 Lg 1	K2B	681	GARDEN ROLLER FRAGMENTS																	1
HOUER:302 BLOCK:TS1.6 Lg 1	K2B	682																		
HOUER:304 BLOCK:TS1.6 Lg 2	K2B	683	TRANSPARENT TURQUOISE	10BG 6/8	7				7				7				4	3	7	7
			DEEP TURQUOISE	10BG 5/6	14				14				14				1	13	14	14
			CELEDON TURQUOISE	5BG 5/6	1				1				1				1		1	1
			BLUE GREEN	5BG 6/4	2				2				2				2		2	2
			GREEN	5GY 5/6	2				2				2				2		2	2
			MEDIUM BRIGHT GREEN	2.5G 5/6	2				2				2				2		2	2
			INDIAN RED	2.5YR 3/8	1				1				1			1			1	1
			YELLOW	7.5Y 8.5/10	5				5				5			5			5	5
			GARDEN ROLLER FRAGMENTS																	1
HOUER:285 BLOCK:TS1.6 Lg 4	K2B	684	BLACK	N O.5/0.6%	2				2				2			2			2	2
			TRANSPARENT TURQUOISE	10BG 6/8	11				11				11				5	6	11	11
			DEEP TURQUOISE	10BG 5/6	11			1	10				11				1	10	11	11
			BLUE GREEN	5BG 6/4	7				7				7				2	5	7	7
			GREEN	5GY 5/6	2				2				2				2		2	2
			MEDIUM BRIGHT GREEN	2.5G 5/6	1				1				1				1		1	1
			INDIAN RED	2.5YR 3/8	4				4				4			4			4	4
			YELLOW	7.5Y 8.5/10	2				2				2				2		2	2
HOUER:290 BLOCK:TS1.6 Lg 4	K2B	685	GARDEN ROLLER FRAGMENTS																	1
HOUER:286 BLOCK:TS1.6 Lg 5	K2B	686	CELEDON TURQUOISE	5BG 5/6	1				1				1				1		1	1
HOUER:288 BLOCK:TS1.6 Lg 5	K2B	687	TRANSPARENT TURQUOISE	10BG 6/8	4				4				4					4	4	4
			DEEP TURQUOISE	10BG 5/6	2				2				2				1	1	2	2
			CELEDON TURQUOISE	5BG 5/6	2				2				2				2		2	2
			BLUE GREEN	5BG 6/4	1				1				1				1		1	1
			YELLOW	7.5Y 8.5/10	4				4				4			4			4	4
			WEATHERED BEADS																	1

Heading	Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type Ia	Type IIa	Type IIIF	Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Total
		E2																		
E2	HOUER:472 TER:E2 DET:-30"/-33"	E2	688	BLACK	N O.5/0.6% R	3			3				3			3			3	3
				INDIAN RED	2.5YR 3/8	1			1				1			1			1	1
	HOUER:466 BLOCK:B1(b) DET:+9"/+6"	E2	689	BLACK	N O.5/0.6% R	87			87				87			87			87	87
				CELEDON TURQUOISE	5BG 5/6	19			19				19				19		19	19
				MEDIUM BRIGHT GREEN	2.5G 5/6	2			2				2				1	1	2	2
				INDIAN RED	2.5YR 3/8	12			12				12			12			12	12
				YELLOW	7.5Y 8.5/10	3			3				3			3			3	3
				BRIGHT NAVY	7.5PB 2/8	3			3				3				3		3	3
	HOUER:429 BLOCK:B2(9) DET:-34"/-42"	E2	690	BLACK	N O.5/0.6% R	1			1				1			1			1	1
				INDIAN RED	2.5YR 3/8	3			3				3			3			3	3
	HOUER:434 BLOCK:B2(b) DET:+6"/0"	E2	691	BLACK	N O.5/0.6% R	31			31				31			31			31	31
	TER:E2(a)			BLUE GREEN	5BG 6/4	7			7				7				7		7	7
				INDIAN RED	2.5YR 3/8	6			6				6			6			6	6
				YELLOW	7.5Y 8.5/10	1			1				1			1			1	1
				BRIGHT NAVY	7.5PB 2/8	1			1				1				1		1	1
	HOUER:443 BLOCK:B2(c) DET:-30"/-34"	E2	692	BLACK	N O.5/0.6% R	1			1				1			1			1	1
	TER:E2			TRANSPARENT TURQUOISE	10BG 6/8	2			2				2					2	2	2
				INDIAN RED	2.5YR 3/8	6			6				6			6			6	6
	HOUER:440 BLOCK:B3(b) DET:-34"/-42"	E2	693	BLACK	N O.5/0.6% R	2			2				2			2			2	2
	TER:E2 :GK			TRANSPARENT TURQUOISE	10BG 6/8	1			1				1					1	1	1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2	2
	HOUER:526 BLOCK:B3(b) DET:+6"/0"	E2	694	BLACK	N O.5/0.6% R	42			42				42			42			42	42
				BLUE GREEN	5BG 6/4	15			15				15			15			15	15
				INDIAN RED	2.5YR 3/8	3			3				3			3			3	3
				DARK MARIGOLD	7.5Y 8.5/10	3			3				3			3			3	3
				BRIGHT NAVY	7.5PB 2/8	2			2				2				2		2	2
	HOUER:567 TER:E2 :SS BLOCK:B4(b)	E2	695	OYSTER WHITE	5GY 9/1	1			1				1				1		1	1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1	1
	HOUER:442 BLOCK:B4(c) DET:+6"/0"	E2	696	BLACK	N O.5/0.6% R	30			30				30						30	30
	TER:E2(c)			TRANSPARENT TURQUOISE	10BG 6/8	2			2				2				1	1	2	2
				BLUE GREEN	5BG 6/4	8			8				8				8		8	8
				GREEN	5GY 5/6	2		1	1				2				1	1	2	2
				INDIAN RED	2.5YR 3/8	6			6				6						6	6
				YELLOW	7.5Y 8.5/10	1		1					1			1			1	1
				BRIGHT NAVY	7.5PB 2/8	3			3				3				3		3	3
	HOUER:430 BLOCK:B5(c) DER:01-6"	E2	697	BLACK	N O.5/0.6% R	25			25				25			25			25	25
	TER:E2(a)			CELEDON TURQUOISE	5BG 5/6	1			1				1			1			1	1
				BLUE GREEN	5BG 6/4	3			3				3			2	1		3	3
				INDIAN RED	2.5YR 3/8	7							7			7			7	7
				YELLOW	7.5Y 8.5/10	2		1	1				1	1		2			2	2

HOUER:433 BLOCK:B6 DET:0"-6"	E2	698	BLACK	N O.5/0.6% R	24		24	24	24			24	24
TER:E2(b)			BLUE GREEN	5BG 6/4	4		4	4	4			4	4
			GREEN	5GY 5/6	2		2	2	2			2	2
			INDIAN RED	2.5YR 3/8	33		33	33	33			33	33
			YELLOW	7.5Y 8.5/10	1		1	1	1			1	1
			BRIGHT NAVY	7.5PB 2/8	1		1	1		1		1	1
HOUER:417 BLOCK:B6(c) DET:-34"/-42"	E2	699	BLUE GREEN	5BG 6/4	1		1	1	1			1	1
TER:E2 :VI			INDIAN RED	2.5YR 3/8	1		1	1	1			1	1
HOUER:416 BLOCK:B7(d) DET:-34"/-42"	E2	700	INDIAN RED	2.5YR 3/8	2		2	2	2			2	2
HOUER:447 BLOCK:B7(d) DET:0/-6"	E2	701	BLACK	N O.5/0.6% R	25		25	25	25			25	25
TER:E2(c)			TRANSPARENT TURQUOISE	10BG 6/8	2		2	2			2	2	2
			BLUE GREEN	5BG 6/4	2		2	2		2		2	2
			INDIAN RED	2.5YR 3/8	19		19	19	19			19	19
			YELLOW	7.5Y 8.5/10	1		1	1	1			1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	1	1		1	1			1	1
			BRIGHT NAVY	7.5PB 2/8	1		1	1		1		1	1
			GREEN	5GY 5/6						1			1
HOUER:408 BLOCK:B8(d) DET:-34"/-42"	E2	702	TRANSPARENT TURQUOISE	10BG 6/8	1		1	1			1	1	1
TER:E2 :OVI			BLUE GREEN	5BG 6/4	1		1	1		1		1	1
			SOAPSTONE BEAD										1
HOUER:409 BLOCK:B11 DET:-12"/-18"	E2	703	BLACK	N O.5/0.6% R	6		6	6	6			6	6
TER:E2(6)			GREEN	5GY 5/6	1		1	1	1			1	1
			INDIAN RED	2.5YR 3/8	26		26	26	26			26	26
			YELLOW	7.5Y 8.5/10	1		1	1	1			1	1
HOUER:579 BLOCK:B15(b) DET:-20"/-30"	E2	704	BLACK	N O.5/0.6% R	2		2	2	2				2
TER:E2(b)			MEDIUM BRIGHT GREEN	2.5G 5/6	1	1		1	1				1
			INDIAN RED	2.5YR 3/8	2		2	2	2				2
HOUER:389 BLOCK:B70/10	E2	705	DEEP TURQUOISE	10BG 5/6	1		1	1			1	1	1
			INDIAN RED	2.5YR 3/8	3		3	3	3			3	3
			SOAPSTONE BEAD										1

LOCATION: Northern Transvaal
SITE: Allied Sites

Heading	Layer	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IF	Segm	WIc	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
MARYLAND	R	ALL	706	COPPER BEAD																	3
MARYLAND	R.1	ALL	707	BLACK	N O.5/0.6% R	4		2	2					4			4			4	4
				DEEP TURQUOISE	10BG 5/6	1			1					1			1			1	1
				CELEDON TURQUOISE	5BG 5/6	1			1					1			1			1	1
				BLUE GREEN	5BG 6/4	2			2					2			2			2	2
				GREEN	5GY 5/6	1			1					1			1			1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1					1			1			1	1
				INDIAN RED	2.5YR 3/8	2			2					2			2			2	2
				YELLOW	7.5Y 8.5/10	2			2					2			2			2	2
				BRIGHT NAVY	7.5PB 2/8	2			2					2			2			2	2
				MID BLUE	5PB 4/6	4			4					4			4			4	4
				DARK SHADOW BLUE	10B 4/4	2			2					2			2			2	2
				MAUVE PINK	5RP 6/8	3			3					3			3			3	3
				RUBY ON WHITE CORE	2.5R 3/10	3			3					3				3		3	3
				INDIAN RED ON GREEN CORE	7.5R 3/8	5		2	3					5			5			5	5
MARYLAND	R.2 Later Site	ALL	708	BLACK	N O.5/0.6% R	11		11						11			11			11	11
				DEEP TURQUOISE	10BG 5/6	23		2	21					23			23			23	23
				INDIAN RED	2.5YR 3/8	13		12	1					13			13			13	13
				MAUVE PINK	5RP 6/8	11			11					11			11			11	11
				RUBY ON WHITE CORE	2.5R 3/10	11			11					11				11		11	11
				INDIAN RED ON GREEN CORE	7.5R 3/8	11			11					11			11			11	11
HADDON	S	ALL	709	BLACK	N O.5/0.6% R	1			1					1			1			1	1
				TRANSPARENT TURQUOISE	10BG 6/8	2			2					2			2			2	2
				DEEP TURQUOISE	10BG 5/6	1			1					1			1			1	1
				CELEDON TURQUOISE	5BG 5/6	3			3					3			3			3	3
				INDIAN RED	2.5YR 3/8	1			1					1			1			1	1
				LIGHT MARIGOLD	2.5Y 6/10	1			1					1			1			1	1
				DARK MARIGOLD	7.5YR 6/10	1			1					1			1			1	1
				BRIGHT NAVY	7.5PB 2/8	2			2					2			2			2	2
				OSTRICH EGG SHELL																	22
SHIRBEEK		ALL	709a	NEUTRAL WHITE	N9.5/90.0%R	4			4					4			4			4	4
				OYSTER WHITE	5GY 9/1						1				1		1			1	1
				LIGHT GREY	N 8.25/63.65R	1			1					1					1	1	1
				BLACK	N0.5/0.6% R	2	1	2				1		3			3			3	3
				MEDIUM BRIGHT GREEN	2.5G 5/6	11		6	7					11			11			11	11
				INDIAN RED	2.5YR 3/8	2		1	1					2			2			2	2
				YELLOW	7.5Y 8.5/10	2		1	1					2			2			2	2
				VASELINE YELLOW (TP)	7.5Y 8/8	5		5						5				5		5	5
				BRIGHT NAVY	7.5PB 2/8	2		2						2				2		2	2
				MID BLUE	5PB 4/6	3		3						3					3	3	3
				DARK SHADOW BLUE	10B 4/4	1		1						1				1		1	1
				PALE PINK	10RP 8/4	1			1					1			1			1	1

Heading	SITE: Allied Sites Layer	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IF	Structure Type Segm	Structure Type WIc	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Total
SHIRBEEK		ALL	709a	MAUVE PINK	5RP 6/8	1			1					1			1			1	1
				RUBY ON WHITE CORE	2.5R 3/10	2			2					2				2		2	2
				INDIAN RED ON GREEN CORE	7.5R 3/8	4			4					3	1		4			4	4
				MID BLUE	5PB 4/6					2						2					2
				STRIPED BEADS		1			1					1			1			1	1
				SEGMENTED BEADS							3										3
				OSTRICH EGG SHELL																	6
SINGALELE	T1	ALL	710	NEUTRAL WHITE	N9.5/90.0%R	5			5					5			5			5	5
				OYSTER WHITE	5GY 9/1	6		6						6			6			6	6
				BLACK	N O.5/0.6% R	12			12					6	6		12			12	12
				DEEP TURQUOISE	10BG 5/6	6			6					6			6			6	6
				MEDIUM BRIGHT GREEN	2.5G 5/6	12			12					12					12	12	12
				INDIAN RED	2.5YR 3/8	1			1					1			1			1	1
				YELLOW	7.5Y 8.5/10	6		6						6			6			6	6
				BRIGHT NAVY	7.5PB 2/8	12		2	10					12				12		12	12
				MID BLUE	5PB 4/6	6			6					6			6			6	6
				MEDIUM COPEN BLUE	5PB 6/8	6			6					6			6			6	6
				INDIAN RED ON GREEN CORE	7.5R 3/8	11			11					11			11			11	11
				STRIPED BEADS		6			6					6			6			6	6
SINGALELE	T2	ALL	711	DEEP TURQUOISE	10BG 5/6	9			9					9			9			9	9
				GREEN	5GY 5/6	5			5					5			5			5	5
				MEDIUM BRIGHT GREEN	2.5G 5/6	2			2					2			2			2	2
				INDIAN RED	2.5YR 3/8	8		1	7					8			8			8	8
				YELLOW	7.5Y 8.5/10	11			11					11			11			11	11
				VASELINE YELLOW (TP)	7.5Y 8/8	1		1						1			1			1	1
				BRIGHT NAVY	7.5PB 2/8	3			3					3			3			3	3
				OSTRICH EGG SHELL																	19
U. ISLET		ALL	712	OYSTER WHITE	5GY 9/1	9		1	8					7	1	1	9			9	9
				BLACK	N O.5/0.6% R	2			2					2			2			2	2
				TRANSPARENT TURQUOISE	10BG 6/8	1			1					1					1	1	1
				DEEP TURQUOISE	10BG 5/6	2		2						2					2	2	2
				YELLOW	7.5Y 8.5/10	6		6						6			6			6	6
				MEDIUM COPEN BLUE	5PB 6/8	5		2	3					5			5			5	5
				DARK SHADOW BLUE	10B 4/4	2		1	1					1	1			2		2	2
				INDIAN RED ON GREEN CORE	7.5R 3/8	4		1	3					4			4			4	4
				WEATHERED BEADS																	6
V. SHIRBEEK		ALL	713	NEUTRAL WHITE	N9.5/90.0%R	4			4					4			4			4	4
				OYSTER WHITE	5GY 9/1		1		1						1		1			1	1
				LIGHT GREY	N8.25/63.65R	1			1					1					1	1	1
				BLACK	N O.5/0.6% R	2	1	2	1					3			3			3	3
				MEDIUM BRIGHT GREEN	2.5G 5/6	11		6	7					11			11			11	11
				INDIAN RED	2.5YR 3/8	2		1	1					2			2			2	2
				YELLOW	7.5Y 8.5/10	2		1	1					2			2			2	2
				VASELINE YELLOW (TP)	7.5Y 8/8	5		5						5				5		5	5
				BRIGHT NAVY	7.5PB 2/8	2		2						2				2		2	2
				MID BLUE	5PB 4/6	3		3						3					3	3	3
				DARK SHADOW BLUE	10B 4/4	1		1						1				1		1	1

Heading	SITE: Allied Sites Layer	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IF	Segm	WIc	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	Total
V. SHIRBEEK (continued)		ALL	713	PALE PINK	10RP 8/4	1			1					1			1			1	1
				MAUVE PINK	5RP 6/8	1			1					1			1			1	1
				RUBY ON WHITE CORE	2.5R 3/10	2			2					2				2		2	2
				INDIAN RED ON GREEN CORE	7.5R 3/8	4			4					3	1		4			4	4
				STRIPED BEADS		1		1						1			1			1	1
				OSTRICH EGG SHELL																	6
W. RATHO		ALL	714	OYSTER WHITE	5GY 9/1	3			3					3			3			3	3
				BLACK	N O.5/0.6% R	1			1					1			1			1	1
				DEEP TURQUOISE	10BG 5/6	2			2					2			2			2	2
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1					1			1			1	1
				MID BLUE	5PB 4/6	2			2					2			2			2	2
				PALE PINK	10RP 8/4	2			2					2			2			2	2
				MAUVE PINK	5RP 6/8	4			4					4			4			4	4
PARMA	X.I	ALL	715	NEUTRAL WHITE	N9.5/90.0%R	6			6					6			6			6	6
				OYSTER WHITE	5GY 9/1	7		2	5					7			7			7	7
				LIGHT GREY	N 8.25/63.65R	2			2					2					2	2	2
				BLACK	N O.5/0.6% R	6		2	4					6			6			6	6
				TRANSPARENT TURQUOISE	10BG 6/8	1			1					1			1			1	1
				DEEP TURQUOISE	10BG 5/6	11			11					11			11			11	11
				CELEDON TURQUOISE	5BG 5/6	1			1					1			1			1	1
				BLUE GREEN	5BG 6/4	5		5						5					5	5	5
				GREEN	5GY 5/6	2			2					2			2			2	2
				MEDIUM BRIGHT GREEN	2.5G 5/6	5		1	4					4	1		4		1	5	5
				YELLOW	7.5Y 8.5/10	1		1						1				1		1	1
				LIGHT MARIGOLD	2.5Y 6/10	2		2						1	1		2			2	2
				DARK MARIGOLD	7.5YR 6/10	3		1	2					3			3			3	3
				BRIGHT NAVY	7.5PB 2/8	12			12					10	2			10	2	12	12
				MID BLUE	5PB 4/6	4			4					4			4			4	4
				MEDIUM COPEN BLUE	5PB 6/8	12		1	11					12			12			12	12
				DARK SHADOW BLUE	10B 4/4	16		11	5					16			13		3	16	16
				DARK MAUVE HEATHER	10P 3/4	1		1						1					1	1	1
				RUBY ON WHITE CORE	2.5R 3/10	5			5					5				5		5	5
				RUBY					2									2			2
				INDIAN RED ON GREEN CORE	7.5R 3/8	10		6	4					9	1		10			10	10
				STRIPED BEADS		4			4					4			4			4	4
				CLEAR GREY						1						1		1			1
				BLUE						4						4		4			4
				METAL BEADS																	7
				OSTRICH EGG SHELL																	8
PARMA	PIT X.2 (Midden)	ALL	716	NEUTRAL WHITE	N9.5/90.0%R	13		4	9					13			13			13	13
				OYSTER WHITE	5GY 9/1	16		3	13					16			16			16	16
				DEEP TURQUOISE	10BG 5/6	12		2	10					12							12
				GREEN	5GY 5/6	13		9	4					13			13			13	13
				MEDIUM BRIGHT GREEN	2.5G 5/6	6		3	3					6			3	3		6	6
				INDIAN RED	2.5YR 3/8	4			4					4			4			4	4
				BRIGHT NAVY	7.5PB 2/8	24		7	17					24			9	10	5	24	24

Heading	SITE: Allied Sites Layer	Site	UCT Page BB	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IF	Structure Type Segm	Structure Type Wlc	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Total
PARMA	PIT X.2. (Midden)	ALL	716	MID BLUE	5PB 4/6	13		5	8					13			13			13	13
				MEDIUM COPEN BLUE	5PB 6/8	3			3					3			3			3	3
				MAUVE PINK	5RP 6/8	20		1	19					20			20			20	20
				DARK MAUVE HEATHER	10P 3/4	1		1						1					1	1	1
				RUBY ON WHITE CORE	2.5R 3/10	4			4					4			3	1		4	4
				INDIAN RED ON GREEN CORE	7.5R 3/8	35		20	15					35			35			35	35
				STRIPED BEADS		4			4					4			4			4	4
				LIGHT BLUE	10B 7/4	7		2	5					7			7			7	7
PARMA		ALL	717	NEUTRAL WHITE	N9.5/90.0%R	27		9	18					27			27			27	27
				OYSTER WHITE	5GY 9/1	42		12	30					42			42			42	42
				LIGHT GREY	N 8.25/63.65R	1			1					1					1	1	1
				DEEP TURQUOISE	10BG 5/6	4			4					4			4			4	4
				GREEN	5GY 5/6	1		1						1			1			1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	2			2					2			2			2	2
				BRIGHT NAVY	7.5PB 2/8	37		17	20					37			37			37	37
				PALE PINK	10RP 8/4	1			1					1			1			1	1
				INDIAN RED ON GREEN CORE	7.5R 3/8	15		8	7					15			15			15	15
				STRIPED BEADS		1		1						1			1			1	1
				OSTRICH EGG SHELL																	18

APPENDIX IIb
Catalogue of beads from Northern Transvaal sites

NORTHERN TRANSVAAL SITE Skutwater, Pont Drift, Schroda

		SKU	PON	SCH	TOTAL
NEUTRAL WHITE	N9.5/90.0%				
GREEN GREY	10G 6/2		35	12	47
DOVE GREY	7.5B 6/2			2	2
BLACK	N0.5/0.6%R	1532	8	7	1547
TRANSPARENT TURQUOISE	10BG 6/8	13	223	116	352
DEEP TURQUOISE	10BG 5/6	1	6	11	18
BRIGHT TURQUOISE	7.5B 6/10	141	191	22	354
MEDIUM TURQUOISE	5B 6/8	45	11	34	90
CELEDON TURQUOISE	5BG 5/6	17	1	15	33
LIGHT CELEDON	5BG 6/6	29	5	3	37
DEEP CELEDON	5BG 4/4			3	3
BLUE GREEN	5BG 6/4	64	14	17	95
DARK JADE GREEN	10G 4/6	1		4	5
SAGE GREEN	7.5GY 4/4	23	16	4	43
GREEN	5GY 5/6		38	23	61
MEDIUM BRIGHT GREEN	2.5G 5/6	14	1	4	19
LIGHT BRIGHT GREEN	2.5G 6/6	22	8	8	38
NASTURTIUM GREEN	10BG 6/6			1	1
INDIAN RED	2.5YR 3/8	378	27		405
BROWN INDIAN RED	5YR 3/8	8	1		9
YELLOW	7.5Y 8.5/10	6		2	8
VASELINE YELLOW (TP)	7.5Y 8/8	5	6	65	76
OLIVE YELLOW*	7.5Y 7/6			26	26
LEMON YELLOW	10Y 8.5/6		1	2	3
DEEP LEMON YELLOW	10Y 8/6			5	5
BRIGHT DUSTY YELLOW	5Y 8.5/10	22	5	35	62
LIGHT MARIGOLD	2.5Y 6/10			31	31
BRIGHT NAVY	7.5PB 2/8	9	3		12
BRIGHT NAVY (ANNULAR)	7.5PB 2/8				0
MID BLUE	5PB 4/6			7	7
SHADOW BLUE	2.5PB 5/4			2	2
DARK SHADOW BLUE	10B 4/4		7	128	135
OSTRICH EGG SHELL		1	3	28	32
GARDEN ROLLER BEAD			6	2	8
BONE BEAD				3	3
PATINATED BEAD			12	14	26
UNKNOWN COLOUR				17	17
WEATHERED BEAD				42	42
Total number of beads (n):		2331	628	695	3654

SITE: Skutwater

	Layer	Site	UCT Acc. No.B	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	IIa	Type Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
SKUTWATER D	TSW 1/1 BLOCK:D7 Layer 1	SKU	279	BLACK	N O.5/0.6% R	9		9			9			9			1	8	9
				MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1
				BLUE GREEN	5BG 6/4	5		5			5			5				5	5
				INDIAN RED	2.5YR 3/8	1		1			1			1			1		1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:D7 Layer 2	SKU	280	BLACK	N O.5/0.6% R	5		5			5			5				5	5
				MEDIUM TURQUOISE	5B 6/8	2		2			1	1			1			2	2
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:D7 Layer 3	SKU	281	BLACK	N O.5/0.6% R	8		8			8			8				8	8
				INDIAN RED	2.5YR 3/8	5		5			5			5				5	5
	TSW 1/1 BLOCK:D7 Layer 7	SKU	282	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
	TSW 1/1 BLOCK:D8 Layer 1	SKU	283	BLACK	N O.5/0.6% R	16		16			16			16			4	12	16
				TRANSPARENT TURQUOISE	10BG 6/8	2		2			2			1		1		2	2
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
				YELLOW	7.5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:D8 Layer 2	SKU	284	BLACK	N O.5/0.6% R	7		7			5	2		7				7	7
				BLUE GREEN	5BG 6/4	2		2			1	1		1		1	1	1	2
				DARK JADE GREEN	10G 4/6	1		1			1					1		1	1
	TSW 1/1 BLOCK:D8 Layer 3	SKU	285	BLACK	N O.5/0.6% R	1		1			1			1				1	1
	TSW 1/1 BLOCK:D8 Layer 4	SKU	286	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				TRANSPARENT TURQUOISE	10BG 6/8	1		1			1			1				1	1
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1				1			1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	2		2			2			2					2
				YELLOW	7.5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:D8 Layer 6	SKU	287	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:D8 Layer 7	SKU	288	LIGHT BRIGHT GREEN	2.5G 6/6	1		1				1		1				1	1
	TSW 1/1 BLOCK:D9 Layer 1	SKU	289	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				BLUE GREEN	5BG 6/4	1		1			1			1				1	1
				CELEDON TURQUOISE	5BG 5/6	1		1				1		1				1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:D9 Layer 3	SKU	290	BLUE GREEN	5BG 6/4	1		1			1			1			1		1
	TSW 1/1 BLOCK:D14 Layer 1	SKU	291	BLACK	N O.5/0.6% R	2		2			2			2			1	1	2
	TSW 1/1 BLOCK:D15 Layer 1	SKU	292	BLACK	N O.5/0.6% R	2		2			2			2				2	2

					Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure S	Structure C	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
SKUTWATER E	TSW 1/1 BLOCK:E7 Layer 1	SKU	293	BLACK	N O.5/0.6% R	29		29			29			29			5	24	29
				TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1				1			1	1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	3		3			3			3				3	3
				BRIGHT DUSTY YELLOW	5Y 8.5/10	3		3			3			3				3	3
	TSW 1/1 BLOCK:E7 Layer 2	SKU	294	BLACK	N O.5/0.6% R	5		5			5			5				5	5
				BLUE GREEN	5BG 6/4	1		1			1			1			1		1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1			1		1
	TSW 1/1 BLOCK:E7 Layer 3	SKU	295	BLACK	N O.5/0.6% R	7		7			7			7				7	7
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1			1		1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:E7 Layer 4	SKU	296	BLACK	N O.5/0.6% R	2		2			2			2				2	2
	TSW 1/1 BLOCK:E8 Layer 1	SKU	297	BLACK	N O.5/0.6% R	17		17			17			17			6	11	17
				BRIGHT NAVY	7.5PB 2/8	1		1		1					1		1		1
				BLUE GREEN	5BG 6/4	3		3		1	2			2	1			3	3
				INDIAN RED	2.5YR 3/8	3		3			3			3				3	3
				YELLOW	7.5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:E8 Layer 2	SKU	298	CELEDON TURQUOISE	5BG 5/6	1		1		1				1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:E8 Layer 3	SKU	299	BLACK	N O.5/0.6% R	8		8			8			8				8	8
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	2		2			2			2				2	2
	TSW 1/1 BLOCK:E8 Layer 5	SKU	300	BLACK	N O.5/0.6% R	3		3			3			3				3	3
				BLUE GREEN	5BG 6/4	2		2			2			2			1	1	2
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:E8 Layer 6	SKU	301	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:E8 Layer 7	SKU	302	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:E9 Layer 1	SKU	303	BLACK	N O.5/0.6% R	18		18			18			18			5	13	18

				Munsell Number	Manufacturing Method			Type		Size				Diaphaneity			Lusture		Total
					D	W	IIa	Ia	VS	S	M	L	O	TL	TP	S	D	
TSW 1/1 BLOCK:E9 Layer 1	SKU	303	CELEDON TURQUOISE	5BG 5/6	5		5		4	1			3		2	2	3	5
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1				1			1			1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1					1		1	1
TSW 1/1 BLOCK:E9 Layer 2	SKU	304	BLACK	N O.5/0.6% R	20		20			20			20			4	16	20
			LIGHT CELEDON (GREEN)	5BG 6/6	1		1		1				1			1		1
			INDIAN RED	2.5YR 3/8	5		5			5			5					5
TSW 1/1 BLOCK:E9 Layer 3	SKU	305	BLACK	N O.5/0.6% R	27		27			27			27			4	23	27
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
			BROWN INDIAN RED	5YR 3/8	7		7			7			7			1	6	7
TSW 1/1 BLOCK:E9 Layer 4	SKU	306	BLACK	N O.5/0.6% R	9		9			9			9			1	8	9
			SAGE GREEN	7.5GY 4/4	1		1				1			1			1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	2		2				2			2		2		2
			INDIAN RED	2.5YR 3/8	11		11			11			11			6	5	11
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
TSW 1/1 BLOCK:E9 Layer 5	SKU	307	BLACK	N O.5/0.6% R	1		1			1			1				1	1
TSW 1/1 BLOCK:E9 Layer 6	SKU	308	BLACK	N O.5/0.6% R	4		4			4			4				4	4
			SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E9 Layer 7	SKU	309	BLACK	N O.5/0.6% R	4		4			4			4				4	4
TSW 1/1 BLOCK:E10 Layer 1	SKU	310	BLACK	N O.5/0.6% R	19		19			19			19			3	16	19
			BLUE GREEN	5BG 6/4	1		1			1					1	1		1
			INDIAN RED	2.5YR 3/8	3		3			3			3				3	3
			YELLOW	7.5Y 8.5/10	1		1			1			1				1	1
TSW 1/1 BLOCK:E10 Layer 2	SKU	311	BLACK	N O.5/0.6% R	6		6			6			6				6	6
			BRIGHT NAVY	7.5PB 2/8	1		1		1						1		1	1
			LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1			1				1	1
			SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
TSW 1/1 BLOCK:E10 Layer 4	SKU	312	BLACK	N O.5/0.6% R	10		10			10			10			2	8	10
			BLUE GREEN	5BG 6/4	1		1			1				1			1	1
			SAGE GREEN	7.5GY 4/4	1		1				1		1				1	1
			INDIAN RED	2.5YR 3/8	5		5			5			5				5	5
TSW 1/1 BLOCK:E10 Layer 7	SKU	313	BLACK	N O.5/0.6% R	1		1			1			1				1	1
TSW 1/1 BLOCK:E10 Layer 9	SKU	314	MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1		1				1	1
TSW 1/1 BLOCK:E11 Layer 1	SKU	315	BLACK	N O.5/0.6% R	27		27			27			27			3	24	27
			TRANSPARENT TURQUOISE	10BG 6/8	1		1		1						1	1		1
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1

				Munsell Number	Manufacturing Method			Type	Size				Diaphaneity			Lusture		Total
					D	W	IIa	Ia	VS	S	M	L	O	TL	TP	S	D	
TSW 1/1 BLOCK:E11 Layer 1	SKU	315	BLUE GREEN	5BG 6/4	1		1		1				1				1	1
			LIGHT CELEDON (GREEN)	5BG 6/6	2		2		2				2			1	1	2
			BLUE GREEN	5BG 6/4	1		1			1			1				1	1
			CELEDON TURQUOISE	5BG 5/6	1		1			1			1				1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	4		4			3	1		4			3	1	4
			VASELINE YELLOW (TP)	7.5Y 8/8	2		2			2			1		1	2		2
TSW 1/1 BLOCK:E11 Layer 2	SKU	316	BLUE GREEN	5BG 6/4	1		1			1			1			1		1
			LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1					1		1	1
TSW 1/1 BLOCK:E11 Layer 3	SKU	317	BLACK	N O.5/0.6% R	1		1			1			1				1	1
			BLUE GREEN	5BG 6/4	1		1			1			1				1	1
TSW 1/1 BLOCK:E11 Layer 4	SKU	318	BLACK	N O.5/0.6% R	1		1			1			1				1	1
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
		*	CELEDON TURQUOISE	5BG 5/6	1		1			1			1				1	1
TSW 1/1 BLOCK:E11 Layer 5	SKU	319	BLACK	N O.5/0.6% R	10		10			10			10			5	5	10
			BLUE GREEN	5BG 6/4	1		1			1			1			1		1
		*	CELEDON TURQUOISE	5BG 5/6	1		1				1				1		1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1				1			1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1			1			1			1		1
TSW 1/1 BLOCK:E11 Layer 8	SKU	320	LIGHT CELEDON (GREEN)	5BG 6/6	1		1				1		1				1	1
TSW 1/1 BLOCK:E12 Layer 1	SKU	321	BLUE GREEN	5BG 6/4	1		1			1				1			1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E12 Layer 2	SKU	322	BLACK	N O.5/0.6% R	4		4			2	2							4
			BLUE GREEN	5BG 6/4	2		2			2			2			1	1	2
TSW 1/1 BLOCK:E12 Layer 3	SKU	323	BLACK	N O.5/0.6% R	6		6			6			6			1	5	6
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
			BLUE GREEN	5BG 6/4	1		1			1			1			1		1
			SAGE GREEN	7.5GY 4/4	1		1				1				1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1				1		1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1		1				1			1		1
TSW 1/1 BLOCK:E12 Layer 4	SKU	324	BLACK	N O.5/0.6% R	3		3			3			3			2	1	3
			MEDIUM TURQUOISE	5B 6/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E12 Layer 6	SKU	325	BLACK	N O.5/0.6% R	1		1				1		1				1	1
TSW 1/1 BLOCK:E13 Layer 2	SKU	326	BLACK	N O.5/0.6% R	7		7			7			7			2	5	7
			LIGHT CELEDON (GREEN)	5BG 6/6	3		3			1	2		3				3	3

Provenance		No.	Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type IIa	Type Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TSW 1/1 BLOCK:E13 Layer 3	SKU	327	BLACK	N O.5/0.6% R	4		4			4			4				4	4
			TRANSPARENT TURQUOISE	10BG 6/8	2		2			2			2				2	2
			LIGHT CELEDON (GREEN)	5BG 6/6	3		3		2	1					3	1	2	3
			SAGE GREEN	7.5GY 4/4	1		1				1		1				1	1
TSW 1/1 BLOCK:E13 Layer 4	SKU	328	MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1			1			1	1
			INDIAN RED	2.5YR 3/8	3		3			3			3				3	3
TSW 1/1 BLOCK:E13 Layer 6	SKU	329	BLACK	N O.5/0.6% R	458		458			458			458			214	244	458
Burial (beads found near neck			CELEDON TURQUOISE	5BG 5/6	1		1				1				1		1	1
and waist of skeleton).			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1		1				1	1
TSW 1/1 BLOCK:E13 Layer 8	SKU	330	BLACK	N O.5/0.6% R	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E13 Layer 9	SKU	331	BLACK	N O.5/0.6% R	24		24			24			24				24	24
Burial (beads found around			MEDIUM TURQUOISE	5B 6/8	18		18			18					18		18	18
neck area).			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1		1				1	1
TSW 1/1 BLOCK:E13/142 Layer 9 LB2D		332	BLACK	N O.5/0.6% R	467		467			467			467					467
			TRANSPARENT TURQUOISE	10BG 6/8	121			121		121					121			121
			LIGHT BRIGHT GREEN	2.5G 6/6	4		4			4					4		4	4
			INDIAN RED	2.5YR 3/8	248		248			248			248			120	128	248
			OSTRICH EGG SHELL															1
TSW 1/1 BLOCK:E13/142 Layer PCB2		333	BLACK	N O.5/0.6% R	4		4			4			4				4	4
			TRANSPARENT TURQUOISE	10BG 6/8	1		1			1				1			1	1
			BRIGHT TURQUOISE	7.5B 6/10	10		10			10					10		10	10
			SAGE GREEN	7.5GY 4/4	1		1			1					1		1	1
TSW 1/1 BLOCK:E14 Layer 1		334	BLACK	N O.5/0.6% R	16		16			16			16			4	12	16
		*	BLUE GREEN	5BG 6/4	6		6			6			4	2		2	4	6
			SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
		*	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
TSW 1/1 BLOCK:E14 Layer 2		335	BLACK	N O.5/0.6% R	15		15			13	2		15			3	12	15
			BLUE GREEN	5BG 6/4	6		6		4	2				6			6	6
			INDIAN RED	2.5YR 3/8	2		2			2			2			1	1	2
TSW 1/1 BLOCK:E14 Layer 3		336	BLACK	N O.5/0.6% R	7		7			7			7			4	3	7
			BLUE GREEN	5BG 6/4	1		1			1			1				1	1
			CELEDON TURQUOISE	5BG 5/6	1		1				1		1				1	1
			INDIAN RED	2.5YR 3/8	2		2			2			2				2	2

				Munsell Number	Manufacturing Method		Structure		Size				Diaphaneity			Lusture		
					D	W	S	C	VS	S	M	L	O	TL	TP	S	D	Total
TSW 1/1 BLOCK:E14 Layer 4	SKU	337	BLUE GREEN	5BG 6/4	1		1			1			1				1	1
TSW 1/1 BLOCK:E14 Layer 6	SKU	338	BLACK	N O.5/0.6% R	4		4			3	1		4			1	3	4
			MEDIUM TURQUOISE	5B 6/8	1		1			1			1				1	1
			BLUE GREEN	5BG 6/4	2		2		2				2			1	1	2
			INDIAN RED	2.5YR 3/8	3		3			3			3			2	1	3
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
TSW 1/1 BLOCK:E15 Layer 1	SKU	339	BLACK	N O.5/0.6% R	8		8			8			8				8	8
			LIGHT CELEDON (GREEN)	5BG 6/6	4		4			4			4			3	1	4
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E15 Layer 2	SKU	340	BLACK	N O.5/0.6% R	4		4			4			4				4	4
			LIGHT CELEDON (GREEN)	5BG 6/6	2		2		2				2			2		2
			BROWN INDIAN RED	5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E15 Layer 4	SKU	341	BLACK	N O.5/0.6% R	1		1			1			1				1	1
TSW 1/1 BLOCK:E15 Layer 5	SKU	342	INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E16 Layer 1	SKU	343	BLACK	N O.5/0.6% R	11		11			11			11				11	11
			LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1			1				1	1
			BLUE GREEN	5BG 6/4	1		1			1			1			1		1
			CELEDON TURQUOISE	5BG 5/6	2		2			2			2			1	1	2
			SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	1		1			1			1				1	1
TSW 1/1 BLOCK:E16 Layer 2	SKU	344	BLACK	N O.5/0.6% R	4		4			4			4				4	4
			LIGHT CELEDON (GREEN)	5BG 6/6	4		4			4			2		2		4	4
			INDIAN RED	2.5YR 3/8	3		3			3			3			1	2	3
TSW 1/1 BLOCK:E16 Layer 3	SKU	345	BLACK	N O.5/0.6% R	6		6			6			6				6	6
			INDIAN RED	2.5YR 3/8	3		3			3			3				3	3
TSW 1/1 BLOCK:E16 Layer 5	SKU	346	BLACK	N O.5/0.6% R	3		3		1	2			3			2	1	3
			BRIGHT NAVY	7.5PB 2/8	2		2		2						2	2		2
			BLUE GREEN	5BG 6/4	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1			1		1
TSW 1/1 BLOCK:E16 Layer 9	SKU	347	NEUTRAL WHITE	N9.5/90.0%R	1		1				1		1				1	1
			CELEDON TURQUOISE	5BG 5/6	1		1				1		1			1		1

					Munsell Number	Manufacturing Method D	Manufacturing Method W	Type IIa	Type Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
SKUTWATER F	TSW 1/1 BLOCK:F6 Layer 2	SKU	348	SAGE GREEN	7.5GY 4/4	1		1			1					1		1	1
	TSW 1/1 BLOCK:F6 Layer 4	SKU	349	ALL BROKEN															
	TSW 1/1 BLOCK:F7 Layer 1	SKU	350	BLACK	N O.5/0.6% R	6		6			6			6				6	6
	TSW 1/1 BLOCK:F7 Layer 2	SKU	351	BLACK	N O.5/0.6% R	4		4			4			4				4	4
				INDIAN RED	2.5YR 3/8	3		3			3			3				3	3
	TSW 1/1 BLOCK:F7 Layer 3	SKU	352	BLACK	N O.5/0.6% R	9		9			9			9				9	9
				BRIGHT NAVY	7.5PB 2/8	1		1			1					1		1	1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	4		4			4			4				4	4
	TSW 1/1 BLOCK:F7 Layer 4	SKU	353	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	6		6			6			6				6	6
	TSW 1/1 BLOCK:F7 Layer 7	SKU	354	INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:F8 Layer 1	SKU	355	BLACK	N O.5/0.6% R	13		13			10	3		13				13	13
				BLUE GREEN	5BG 6/4	1		1			1			1			1		1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1					1		1	1
	TSW 1/1 BLOCK:F8 Layer 2	SKU	356	BLACK	N O.5/0.6% R	4		4			4			4				4	4
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
	TSW 1/1 BLOCK:F8 Layer 3	SKU	357	BLACK	N O.5/0.6% R	1		1			1			1				1	1
	TSW 1/1 BLOCK:F8 Layer 4	SKU	358	BLACK	N O.5/0.6% R	2		2			1	1		2			1	1	2
	TSW 1/1 BLOCK:F9 Layer 1	SKU	359	BLACK	N O.5/0.6% R	1		1			1			1				1	1
	TSW 1/1 BLOCK:F9 Layer 2	SKU	360	BLACK	N O.5/0.6% R	2		2			2			2				2	2
	TSW 1/1 BLOCK:F9 Layer 3	SKU	361	BLACK	N O.5/0.6% R	1		1			1			1				1	1
	TSW 1/1 BLOCK:F10 Layer 2	SKU	362	BLACK	N O.5/0.6% R	7		7			7			7				7	7
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:F11 Layer 1	SKU	363	BLACK	N O.5/0.6% R	7		7			4	3		7			2	5	7
				TRANSPARENT TURQUOISE	10BG 6/8	1		1			1			1			1		1
				BLUE GREEN	5BG 6/4	2		2			1	1		2				2	2
				SAGE GREEN	7.5GY 4/4	1		1				1		1			1		1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1		1			1		1
				INDIAN RED	2.5YR 3/8	1		1			1			1			1		1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1		1				1			1		1
				YELLOW	7.5Y 8.5/10	1		1				1		1				1	1
	TSW 1/1 BLOCK:F11 Layer 6	SKU	364	YELLOW	7.5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:F12 Layer 1	SKU	365	BLACK	N O.5/0.6% R	12		12			11	1		12			3	9	12
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
				BLUE GREEN	5BG 6/4	1		1			1			1			1		1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	3		3			3			3			1	2	3

				Munsell Number	Manufacturing Method D	W	IIa	Type Ia	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture S	D	Total
TSW 1/1 BLOCK:F12 Layer 2	SKU	366	BLACK	N O.5/0.6% R	3		3			3			3				3	3
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1		1			1			1				1	1
TSW 1/1 BLOCK:F13 Layer 1	SKU	367	BLACK	N O.5/0.6% R	4		4			4			4				4	4
			MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1
			BLUE GREEN	5BG 6/4	1		1			1			1				1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	2		2			2			2				2	2
TSW 1/1 BLOCK:F13 Layer 2	SKU	368	BLACK	N O.5/0.6% R	1		1			1			1				1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TSW 1/1 BLOCK:F13 Layer 3	SKU	369	BLACK	N O.5/0.6% R	2		2			2			2				2	2
TSW 1/1 BLOCK:F13 Layer 7	SKU	370	INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1			1		1
TSW 1/1 BLOCK:F13 Layer 8	SKU	371	BLACK	N O.5/0.6% R	6		6			6			6				6	6
			MEDIUM TURQUOISE	5B 6/8	1		1				1		1				1	1
			SAGE GREEN	7.5GY 4/4	1		1				1		1				1	1
TSW 1/1 BLOCK:F13 Layer 9	SKU	372	ALL BROKEN															
TSW 1/1 BLOCK:F14 Layer 1	SKU	373	BLACK	N O.5/0.6% R	6		6			6			6			2	4	6
			TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
			DEEP TURQUOISE	10BG 5/6	1		1				1				1		1	1
			BLUE GREEN	5BG 6/4	2		2			2			2			2		2
TSW 1/1 BLOCK:F14 Layer 2	SKU	374	BLACK	N O.5/0.6% R	4		4			4			4				4	4
TSW 1/1 BLOCK:F14 Layer 7	SKU	375	BLUE GREEN	5BG 6/4	3		3		3				2		1	1	2	3
			VASELINE YELLOW (TP)	7.5Y 8/8	2		2		2				1		1		2	2
TSW 1/1 BLOCK:F15 Layer 1	SKU	376	BLACK	N O.5/0.6% R	2		2			2			2			2		2
			BRIGHT NAVY	7.5PB 2/8	1		1			1				1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
			MEDIUM TURQUOISE	5B 6/8	2		2			2			1		1		2	2
			SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1			1			1			1		1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
TSW 1/1 BLOCK:F15 Layer 2	SKU	377	BLACK	N O.5/0.6% R	2		2			2			2				2	2
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
TSW 1/1 BLOCK:F16 Layer 1	SKU	378	BLACK	N O.5/0.6% R	5		5			4	1		5			2	3	5
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
			BLUE GREEN	5BG 6/4	1		1			1			1			1		1
			SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1				1				1		1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1

					Munsell Number	Manufacturing Method D	Manufacturing Method W	Type IIa	Type Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
	TSW 1/1 BLOCK:F16 Layer 8	SKU	379	BRIGHT TURQUOISE	N O.5/0.6% R	3		3			3			3				3	3
	TSW 1/1 BLOCK:F16 Layer 9		380	BLACK	N O.5/0.6% R	2		2			2			2				2	2
SKUTWATER G	TSW 1/1 BLOCK:G7 Layer 1	SKU	381	BLACK	N O.5/0.6% R	20		20			19	1		20				20	20
				BRIGHT NAVY	7.5PB 2/8	1		1		1						1		1	1
				INDIAN RED	2.5YR 3/8	2		2			2			2				2	2
	TSW 1/1 BLOCK:G7 Layer 2	SKU	382	BLACK	N O.5/0.6% R	2		2			2			2				2	2
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1			1				1	1
				SAGE GREEN	7.5GY 4/4	2		2		2						2		2	2
				MEDIUM BRIGHT GREEN	2.5G 5/6	3		3				3		3				3	3
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:G7 Layer 3	SKU	383	BLACK	N O.5/0.6% R	4		4			4			4				4	4
				MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1
				BLUE GREEN	5BG 6/4	2		2			1	1		2				2	2
				CELEDON TURQUOISE	5BG 5/6	1		1			1			1				1	1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1		1			1			1			1		1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:G7 Layer 4	SKU	384	BLACK	N O.5/0.6% R	16		16			16			16				16	16
				INDIAN RED	2.5YR 3/8	5		5			5			5			1	4	5
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:G8 Layer 2	SKU	385	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:G8 Layer 5	SKU	386	BLACK	N O.5/0.6% R	1		1			1			1			1		1
	TSW 1/1 BLOCK:G8 Layer 6	SKU	387	BLACK	N O.5/0.6% R	2		2			2			2				2	2
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:G8 Layer 7	SKU	388	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				BLUE GREEN	5BG 6/4	1		1			1			1			1		1
				INDIAN RED	2.5YR 3/8	13		13			13			13				13	13
	TSW 1/1 BLOCK:G8 Layer 9	SKU	389	BLACK	N O.5/0.6% R	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:G9 Layer 1	SKU	390	BLACK	N O.5/0.6% R	2		2			2			2				2	2
				SAGE GREEN	7.5GY 4/4	1		1				1		1				1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1				1				1		1	1
	TSW 1/1 BLOCK:G9 Layer 2	SKU	391	BLACK	N O.5/0.6% R	3		3			3			3				3	3
				MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1

					Munsell Number	Manufacturing Method D	Manufacturing Method W	IIa	Type Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
	TSW 1/1 BLOCK:G9 Layer 4	SKU	392	BLACK	N O.5/0.6% R	5		5			5			5				5	5
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:G9 Layer 8	SKU	393	MEDIUM TURQUOISE	5B 6/8	19		19			19					19	8	11	19
SKUTWATER H	TSW 1/1 BLOCK:H7 Layer 1	SKU	394	BLACK	N O.5/0.6% R	7		7			7			7			2	5	7
				BLUE GREEN	5BG 6/4	1		1			1			1				1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	2		2			2			2				2	2
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSW 1/1 BLOCK:H7 Layer 2	SKU	395	BLACK	N O.5/0.6% R	3		3			3			3				3	3
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1		1					1			1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	2		2			2			2				2	2
	TSW 1/1 BLOCK:H7 Layer 3	SKU	396	BLACK	N O.5/0.6% R	3		3			3			3				3	3
				TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:H7 Layer 4		397	BLUE GREEN	5BG 6/4	1		1			1			1			1		1
	TSW 1/1 BLOCK:H8 Layer 2		398	BLACK	N O.5/0.6% R	3		3			3			3				3	3
				BRIGHT TURQUOISE	7.5B 6/10	1		1				1				1		1	1
				SAGE GREEN	7.5GY 4/4	1		1				1		1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:H8 Layer 4		399	BLACK	N O.5/0.6% R	2		2			2			2				2	2
				BLUE GREEN	5BG 6/4	1		1		1					1			1	1
				CELEDON TURQUOISE	5BG 5/6	1		1				1				1		1	1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:H9 Layer 2		400	BLACK	N O.5/0.6% R	2		2			2			2				2	2
				MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1
				BLUE GREEN	5BG 6/4	2		2			1	1		1		1		2	2
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TSW 1/1 BLOCK:H9 Layer 3		401	BLACK	N O.5/0.6% R	6		6			6			6				6	6
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
				BLUE GREEN	5BG 6/4	1		1			1			1				1	1
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1

SITE: Pont Drift

	Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure IIa	Structure Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TPD A1	TPD 1/2 OPG 2 BLOCK:A1 Test trench	PON	1	TRANSPARENT TURQUOISE	10BG 6/8	3		3			3					3		3	3
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
	TPD 1/2 OPG 2 Beads from burial	PON	2	BLACK	N O.5/0.6% R	4		4			4			4				4	4
				TRANSPARENT TURQUOISE	10BG 6/8	88		88			88					88	88		88
				LIGHT CELEDON (GREEN)	5BG 6/6	89		89			89				41	48		89	89
				GREEN	5GY 5/6	13		13			13					13		13	13
				INDIAN RED	2.5YR 3/8	11		11			11			11				11	11
				OSTRICH EGG SHELL															1
	TPD 1/2 OPG 2 BLOCK:A1 Van Terrein	PON	3	MEDIUM TURQUOISE	5B 6/8	1		1				1				1		1	1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 2B.4.3	PON	4	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 3	PON	5	LIGHT CELEDON (GREEN)	5BG 6/6	1		1		1						1		1	1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 4	PON	6	TRANSPARENT TURQUOISE	10BG 6/8	2		2			2					2		2	2
	TPD 1/2 OPG 2 BLOCK:A1 Layer 6	PON	7	BRIGHT TURQUOISE	7.5B 6/10	8		8			8					8		8	8
				INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 7	PON	8	BRIGHT TURQUOISE	7.5B 6/10	3		3			2	1				3		3	3
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1				1			1	1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 8	PON	9	MEDIUM TURQUOISE	5B 6/8	1		1			1				1			1	1
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	2		2			1	1		2			1	1	2
	TPD 1/2 OPG 2 BLOCK:A1 Layer 9	PON	10	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 11	PON	11	LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1			1				1	1
	TPD 1/2 OPG 2 BLOCK:A1 Layer 15	PON	12	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
	TPD 1/1 Terrace beads	PON	13	BRIGHT NAVY	5PB 4/6	1		1			1					1		1	1
				GARDEN ROLLER BEAD				1					1		1			1	1
	TPD 1/1 OPG 1 Test trench	PON	14	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
				SAGE GREEN	7.5GY 4/4	2		2			2			2				2	2
	TPD 1/1 OPG 1	PON	15	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1			1				1	1
TPD 1/1	TPD 1/1 OPG 1 Layer 2	PON	16	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
	TPD 1/2 OPG 2 BLOCK:B1 Test trench	PON	17	BRIGHT TURQUOISE	7.5B 6/10	3		3			3					3		3	3
	TPD 1/2 OPG 2 BLOCK:B1 Layer 1	PON	18	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
				SAGE GREEN	7.5GY 4/4	1		1			1			1				1	1
	TPD 1/2 OPG 2 BLOCK:B1 Layer 3	PON	19	CELEDON TURQUOISE	5BG 5/6	1		1			1			1				1	1
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1			1					1		1	1
				BONE															1

Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure IIa	Structure Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TPD 1/2 OPG 2 BLOCK:B1 Layer 4	PON	20	BLACK	N O.5/0.6% R	1		1			1			1				1	1
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
			BROWN INDIAN RED	5YR 3/8	1		1			1			1				1	1
TPD 1/2 OPG 2 BLOCK:B1 Layer 6	PON	21	MEDIUM TURQUOISE	5B 6/8	2		2			2					2		2	2
			TRANSPARENT TURQUOISE	10BG 6/8	8		8			8					8		8	8
			BLUE GREEN	5BG 6/4	1		1			1				1		1		1
			LIGHT CELEDON (GREEN)	5BG 6/6	6		6			6					6		6	6
TPD 1/2 OPG 2 BLOCK:B1 Layer 7	PON	22	TRANSPARENT TURQUOISE	10BG 6/8	3		3			3					3		3	3
			DEEP TURQUOISE	10BG 5/6	1		1			1					1		1	1
			BRIGHT TURQUOISE	7.5B 6/10	7		7			7					7		7	7
			MEDIUM BRIGHT GREEN	2.5G 5/6	1		1			1					1		1	1
			GARDEN ROLLER BEAD															1
TPD 1/2 OPG 2 BLOCK:B1 Layer 8	PON	23	BRIGHT TURQUOISE	7.5B 6/10	3		3			3					3		3	3
TPD 1/2 OPG 2 BLOCK:B1 Layer 9	PON	24	BRIGHT TURQUOISE	7.5B 6/10	2		2			2					2		2	2
			BLUE GREEN	5BG 6/4	3		3			1	2				3		3	3
			SAGE GREEN	7.5GY 4/4	1		1			1					1		1	1
TPD 1/2 OPG 2 BLOCK:B1 Layer 15	PON	25	BRIGHT TURQUOISE	7.5B 6/10	1		1				1				1		1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	1		1			1					1		1	1
TPD 1/1 OPG 1 BLOCK:B1 Layer 1	PON	26	MEDIUM TURQUOISE	5B 6/8	1		1			1					1		1	1
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
			INDIAN RED	2.5YR 3/8	1		1				1		1				1	1
TPD 1/1 OPG 1 BLOCK:B1 Layer 2	PON	27	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
			INDIAN RED	2.5YR 3/8	2		2				2		2				2	2
TPD 1/1 OPG 1 BLOCK:B1 Layer 4	PON	28	BRIGHT TURQUOISE	7.5B 6/10	1		1			1				1			1	1
TPD 1/1 OPG 1 BLOCK:C1 Test trench	PON	29	INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TPD 1/1 OPG 1 BLOCK:C1 Layer 1	PON	30	INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TPD 1/2 OPG 2 BLOCK:2A Layer 1	PON	31	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
TPD 1/2 OPG 2 BLOCK:2A Layer 4	PON	32	CELEDON TURQUOISE	5BG 5/6	1		1			1					1		1	1
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TPD 1/2 OPG 2 BLOCK:2A Layer 4	PON	33	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
TPD 1/2 OPG 2 BLOCK:2A Layer 4	PON	34	RUBY ON WHITE CORE	2.5R 3/10														1
TPD 1/2 OPG 2 BLOCK:2A Layer 5	PON	35	TRANSPARENT TURQUOISE	10BG 6/8	4		4			4					4		4	4
			BRIGHT TURQUOISE	7.5B 6/10	2		2		1	1					2		2	2
			SAGE GREEN	7.5GY 4/4	1		1			1					1		1	1

	Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure IIa	Structure Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
	TPD 1/2 OPG 2 BLOCK:2A Layer 6	PON	36	GARDEN ROLLER BEAD									1		1				1
	TPD 1/2 OPG 2 BLOCK:2A Layer 6	PON	37	MEDIUM TURQUOISE	5B 6/8	2		2			2				2			2	2
				LIGHT CELEDON (GREEN)	5BG 6/6	3		3			3				3			3	3
			*	BLUE GREEN	5BG 6/4	2		2			2				2			2	2
	TPD 1/2 OPG 2 BLOCK:2A Layer 6	PON	38	BRIGHT TURQUOISE	7.5B 6/10	1		1				1				1		1	1
	TPD 1/2 OPG 2 BLOCK:2A Layer 7	PON	39	BLACK	N O.5/0.6% R	1		1				1		1				1	1
	TPD 1/2 OPG 2 BLOCK:2A Layer 8	PON	40	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
	TPD 1/2 OPG 2 BLOCK:2A Layer 10	PON	41	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1				1			1		1		1
	TPD 1/2 OPG 2 BLOCK:2A Layer 28.4.3	PON	42	LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1					1		1	1
TPD 2AA	TPD 1/2 OPG 2 BLOCK:2AA Layer 1	PON	43	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1					1		1	1
				BRIGHT TURQUOISE	7.5B 6/10	2		2			2				2			2	2
	TPD 1/2 OPG 2 BLOCK:2AA Layer 2	PON	44	BRIGHT TURQUOISE	7.5B 6/10	1		1			1				1			1	1
	TPD 1/2 OPG 2 BLOCK:2AA Layer 3	PON	45	BRIGHT TURQUOISE	7.5B 6/10	2		2			2				2			2	2
	TPD 1/2 OPG 2 BLOCK:2AA Layer 4	PON	46	BRIGHT TURQUOISE	7.5B 6/10	1		1			1				1			1	1
	TPD 1/2 OPG 2 BLOCK:2AA Layer 6	PON	*47	TRANSPARENT TURQUOISE	10BG 6/8	4		4		1	3					4	1	3	4
				DEEP TURQUOISE	10BG 5/6	1		1			1					1		1	1
				BRIGHT TURQUOISE	7.5B 6/10	4		4			4					4		4	4
				BLUE GREEN	5BG 6/4	1		1		1						1		1	1
	TPD 1/2 OPG 2 BLOCK:2AA Layer 7	PON	48	BRIGHT TURQUOISE	7.5B 6/10	1		1		1						1		1	1
	TPD 1/2 OPG 2 BLOCK:2AA Layer 2B.4	PON	49	TRANSPARENT TURQUOISE	10BG 6/8	2		2			2					2		2	2
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
				GREEN	5GY 5/6	1		1			1			1				1	1
	TPD 1/2 OPG 2 Layer 2B.5.1	PON	50	TRANSPARENT TURQUOISE	10BG 6/8	19		19			19					19		19	19
				BRIGHT TURQUOISE	7.5B 6/10	35		35			35					35		35	35
				LIGHT BRIGHT GREEN	2.5G 6/6	4		4			4					4		4	4
				INDIAN RED	2.5YR 3/8	2		2			2			2				2	2
				VASELINE YELLOW (TP)	7.5Y 8/8	1		1			1					1		1	1
TPD 2B	TPD 1/2 OPG 2 BLOCK:2B Layer 1	PON	51	BLACK	N O.5/0.6% R	2		2			2			2				2	2
				TRANSPARENT TURQUOISE	10BG 6/8	2		2			2					2		2	2
				BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
				BLUE GREEN	5BG 6/4	1		1			1				1			1	1
				INDIAN RED	2.5YR 3/8	4		4			3	1		4				4	4
	TPD 1/2 OPG 2 BLOCK:2B Layer 4	PON	52	BRIGHT TURQUOISE	7.5B 6/10	3		3			3					3	2	1	3
	TPD 1/2 OPG 2 BLOCK:2B Layer 4	PON	53	BRIGHT TURQUOISE	7.5B 6/10	1		1		1						1		1	1
	TPD 1/2 OPG 2 BLOCK:2B Layer 4	PON	54	GREEN	5GY 5/6	1		1			1			1				1	1
	TPD 1/2 OPG 2 BLOCK:2B Layer 5	PON	55	GARDEN ROLLER BEAD															1
	TPD 1/2 OPG 2 BLOCK:2B Layer 5	PON	56	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1

Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure IIa	Structure Ia	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
			INDIAN RED	2.5YR 3/8	1		1			1			1				1	1
TPD 1/2 OPG 2 BLOCK:2B Layer 6	PON	57	BRIGHT TURQUOISE	7.5B 6/10	3		3			2	1				3		3	3
TPD 1/2 OPG 2 BLOCK:2B Layer 7	PON	58	TRANSPARENT TURQUOISE	10BG 6/8	3		3			3					3	1	2	3
			BRIGHT TURQUOISE	7.5B 6/10	9		9			9					9	6	3	9
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1				1			1			1	1
TPD 1/2 OPG 2 BLOCK:2B Layer 8	PON	59	TRANSPARENT TURQUOISE	10BG 6/8	4		4			4					4		4	4
			BRIGHT TURQUOISE	7.5B 6/10	2		2			2					2		2	2
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1					1		1	1
TPD 1/2 OPG 2 BLOCK:2B Layer 9	PON	60	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	1		1			1					1		1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	2		2			2			2				2	2
TPD 1/2 OPG 2 BLOCK:2B Layer 11	PON	61	TRANSPARENT TURQUOISE	10BG 6/8	2		1	1		1			1				1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	2		1	1		2				2			2	2
			GARDEN ROLLER BEAD															1
TPD 1/2 OPG 2 Layer 2B.5.1	PON	62	BRIGHT NAVY	5PB 4/6	2		2			2					2		2	2
			GREEN GREY	10G 6/2	37		37			37			37				37	37
			BRIGHT TURQUOISE	7.5B 6/10	22		22			22			22				22	22
			GREEN	5GY 5/6	4		4			4			4				4	4
			INDIAN RED	2.5YR 3/8	2		2			2			2				2	2
			LEMON YELLOW	10Y 8.5/6	1		1			1				1			1	1
TPD 3A TPD 1/2 OPG 2 BLOCK:3A Opervlakte	PON	63	GARDEN ROLLER															1
TPD 1/2 OPG 2 BLOCK:3A Layer 3	PON	64	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
TPD 1/2 OPG 2 BLOCK:3A Layer 4	PON	65	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
TPD 1/2 OPG 2 BLOCK:3A Layer 4	PON	66	TRANSPARENT TURQUOISE	10BG 6/8	1		1			1				1			1	1
TPD 1/2 OPG 2 BLOCK:3A Layer 5	PON	67	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
			GREEN	5GY 5/6	1		1			1				1			1	1
TPD 1/2 OPG 2 BLOCK:3A Layer 6	PON	68	BRIGHT TURQUOISE	7.5B 6/10	3		3			3					3	2	1	3
TPD 1/2 OPG 2 BLOCK:3A Layer 6	PON	69	TRANSPARENT TURQUOISE	10BG 6/8	1		1				1				1		1	1
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1	1		1
TPD 1/2 OPG 2 BLOCK:3A Layer 7	PON	70	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
			VASELINE YELLOW (TP)	7.5Y 8/8	1		1			1			1				1	1
TPD 1/2 OPG 2 BLOCK:3A Layer 8	PON	71	OSTRICH EGG SHELL BEAD															1
TPD 1/2 OPG 2 BLOCK:3A Layer 9	PON	72	BRIGHT TURQUOISE	7.5B 6/10	3		3			3					3	1	2	3
TPD 1/2 OPG 2 BLOCK:3A Layer 11	PON	73	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
TPD 1/2 OPG 2 BLOCK:3A Layer 12	PON	74	DARK SHADOW BLUE	10B 4/4	2		2			1	1				2		2	2
TPD 1/2 OPG 2 BLOCK:3A Layer 15	PON	75	BLUE GREEN	5BG 6/4	1		1		1						1		1	1

SITE: Schroda

	Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type Ia	Type IIa	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TSR 1/1	TSR 1/1 OPG 1 BLOCK:A1 Test Trench	SCH	1	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
OPG 1				OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
(survey)	TSR 1/1 OPG 1 BLOCK:A1 Layer 1	SCH	2	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
				VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
				OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
	TSR 1/1 OPG 1 BLOCK:A1 Layer 2	SCH	3	BLUE GREEN	5BG 6/4	1			1		1				1			1	1
	TSR 1/1 OPG 1 BLOCK:A1 Layer 3	SCH	4	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
	TSR 1/1 OPG 1 BLOCK:A1.A.1.1 LAYER 4	SCH	5	VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 2																			
(survey)	TSR 1/1 OPG 2 BLOCK:1A Layer 1	SCH	6	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
	TSR 1/1 OPG 2 BLOCK:1A Layer 5	SCH	7	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
	TSR 1/1 OPG 2 BLOCK:1AA Layer 3(i)	SCH	8	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
	TSR 1/1 OPG 2 BLOCK:1AA Layer 5	SCH	9	VASELINE YELLOW	7.5Y 8/8	3			3		3			3				3	3
	TSR 1/1 OPG 2 BLOCK:2AA Layer 3(i)	SCH	10	DARK SHADOW BLUE	10B 4/4	1			1		1				1			1	1
				OLIVE YELLOW	7.5Y 7/6	1			1		1				1			1	1
	TSR 1/1 OPG 2 BLOCK:3A Layer 3(i)	SCH	11	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
	TSR 1/1 OPG 2 BLOCK:3A Layer 4	SCH	12	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
	TSR 1/1 OPG 2 BLOCK:3A Layer 5	SCH	13	CELEDON TURQUOISE	5BG 5/6	1			1		1				1			1	1
	TSR 1/1 OPG 2 BLOCK:4A Layer 2	SCH	14	BLUE GREEN	5BG 6/4	1			1		1				1			1	1
	TSR 1/1 OPG 2 BLOCK:4A Layer 4	SCH	15	TRANSPARENT TURQUOISE	10BG 6/8	2			2		2					2		2	2
	TSR 1/1 OPG 2 BLOCK:4A Layer 5	SCH	16	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	1			1			1			1			1	1
	TSR 1/1 OPG 2 BLOCK:1B Layer 3(i)	SCH	17	OLIVE YELLOW	7.5Y 7/6	1			1		1				1			1	1
	TSR 1/1 OPG 2 BLOCK:1BB Layer 3(ii)	SCH	18	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
	TSR 1/1 OPG 2 BLOCK:1BB Layer B4	SCH	19	FRAGMENTS															
	TSR 1/1 OPG 2 BLOCK:2B Layer 1	SCH	20	BRIGHT TURQUOISE	7.5B 6/10	1			1			1				1		1	1
	TSR 1/1 OPG 2 BLOCK:2B Layer 2	SCH	21	BRIGHT TURQUOISE	7.5B 6/10	1			1			1				1		1	1
	TSR 1/1 OPG 2 BLOCK:2B Layer 3	SCH	22	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
				PATINATED BEADS															7
	TSR 1/1 OPG 2 BLOCK:2B Layer 5	SCH	23	GREEN	5GY 5/6	1			1		1			1				1	1
	TSR 1/1 OPG 2 BLOCK:2B Layer 2B.5.2	SCH	24	TRANSPARENT TURQUOISE	10BG 6/8	2			2		2				2			2	2
				UNIDENTIFIED															2
	TSR 1/1 OPG 2 BLOCK:2BB Layer 5	SCH	25	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
	TSR 1/1 OPG 2 BLOCK:3B Layer 3	SCH	26	FRAGMENTS															
	TSR 1/1 OPG 2 BLOCK:B1 Test trench	SCH	27	FRAGMENTS															
	TSR 1/1 OPG 2 BLOCK:B1 Layer 1	SCH	28	BRIGHT TURQUOISE	7.5B 6/10	1		1			1					1		1	1
	TSR 1/1 OPG 2 BLOCK:B1 Layer 4	SCH	29	DARK SHADOW BLUE	10B 4/4	1			1		1				1			1	1
TSR 1/1 OPG 3																			
(survey)	TSR 1/1 OPG 3 BLOCK:A1 Layer 1	SCH	30	DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
	TSR 1/1 OPG 3 BLOCK:A1 Layer 3	SCH	31	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
	TSR 1/1 OPG 3 BLOCK:A1 Layer 6	SCH	32	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
	TSR 1/1 OPG 3 BLOCK:B1 Layer 1	SCH	33	DARK JADE GREEN	10G 4/6	1			1		1			1				1	1
	TSR 1/1 OPG 3 BLOCK:B1 Layer 6	SCH	34	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
	TSR 1/1 OPG 3 BLOCK:C1 Layer 1	SCH	35	DARK SHADOW BLUE	10B 4/4	2		2			1	1			2			2	2
	TSR 1/1 OPG 3 BLOCK:C1 Layer 3	SCH	36	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSR 1/1 OPG 3 BLOCK:C1 Layer 4	SCH	37	OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
	TSR 1/1 OPG 3 BLOCK:C1 Layer 6	SCH	38	DARK SHADOW BLUE	10B 4/4	1			1		1				1			1	1

	Layer	Site	Acc. No.	Bead Colour	Munsell Number	Manufacturing Method		Type		Size			Diaphaneity			Lusture	
(survey)	TSR 1/1 OPG 4 BLOCK:A1 Test trench	SCH	39	DEEP TURQUOISE	10BG 5/6	2		2		2				2		2	2
				VASELINE YELLOW	7.5Y 8/8	5		5		5			5			5	5
	TSR 1/1 OPG 4 BLOCK:A1 Layer 1	SCH	40	DARK SHADOW BLUE	10B 4/4	7	7			7				7			7
				DEEP TURQUOISE	10BG 5/6	1		1		1				1		1	1
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1		1				1			1
				CELEDON TURQUOISE	5BG 5/6	1		1		1			1			1	1
				VASELINE YELLOW	7.5Y 8/8	2		2		2			2				2
				GREEN	5GY 5/6	1		1		1				1		1	1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1		1	1						1	1	1
	TSR 1/1 OPG 4 BLOCK:A1 Layer 2	SCH	41	DARK SHADOW BLUE	10B 4/4	1	1				1				1	1	1
	TSR 1/1 OPG 4 BLOCK:A1 Layer 3	SCH	42	DARK SHADOW BLUE	10B 4/4	1	1			1				1		1	1
	TSR 1/1 OPG 4 BLOCK:B1 Layer 1	SCH	43	DARK SHADOW BLUE	10B 4/4	4	4			4				4		4	4
				DEEP TURQUOISE	10BG 5/6	1		1		1				1		1	1
				VASELINE YELLOW	7.5Y 8/8	1		1		1			1			1	1
	TSR 1/1 OPG 4 BLOCK:B1 Layer 2	SCH	44	DARK SHADOW BLUE	10B 4/4	5	5			5				5		5	5
				TRANSPARENT TURQUOISE	10BG 6/8	1		1		1				1		1	1
				DEEP TURQUOISE	10BG 5/6	1		1		1			1			1	1
				LIGHT CELEDON (GREEN)	5BG 6/6	1		1		1			1			1	1
				VASELINE YELLOW	7.5Y 8/8	4		4		4			4			4	4
	TSR 1/1 OPG 4 BLOCK:B1 Layer 3	SCH	45	DARK SHADOW BLUE	10B 4/4	3		3		3				3		3	3
				DEEP CELEDON (GREEN)	5BG 4/4	2		2		2				2		2	2
				VASELINE YELLOW	7.5Y 8/8	2		2		2				2		2	2
	TSR 1/1 OPG 4 BLOCK:C1 Layer 1	SCH	46	UNKNOWN COLOUR		1		1		1			1			1	1
				VASELINE YELLOW	7.5Y 8/8	1		1		1			1			1	1
	TSR 1/1 OPG 4 BLOCK:C1 Layer 2	SCH	47	TRANSPARENT TURQUOISE	10BG 6/8	2		2		2			2			2	2
				DEEP LEMON YELLOW	10Y 8/6	2		2		2			2			2	2
	TSR 1/1 OPG 4 BLOCK:C1 Layer 3	SCH	48	DARK SHADOW BLUE	10B 4/4	1		1		1				1		1	1
				OLIVE YELLOW	7.5Y 7/6	1		1			1		1			1	1
TSR 1/1 OPG 6 (survey)	TSR 1/1 OPG 6 SURFACE OF DWELLING	SCH	49	LIGHT CELEDON (GREEN)	5BG 6/6	1		1		1				1		1	1
	TSR 1/1 OPG 6 BLOCK:A1 Layer 6	SCH	50	TRANSPARENT TURQUOISE	10BG 6/8	1		1		1			1			1	1
				VASELINE YELLOW	7.5Y 8/8	1		1		1			1			1	1
				BONE BEAD													1
	TSR 1/1 OPG 6 BLOCK:A2 Layer 1	SCH	51	OSTRICH EGG SHELL BEAD													1
	TSR 1/1 OPG 6 BLOCK:A2 Layer 2	SCH	52	GREEN	5GY 5/6												1
				LIGHT BRIGHT GREEN	2.5G 6/6	1		1		1			1			1	1
				SAGE GREEN	7.5GY 4/4	1		1		1			1			1	1
	TSR 1/1 OPG 6 BLOCK:A2 Layer 4	SCH	53	OLIVE YELLOW	7.5Y 7/6	1		1		1				1		1	1
				VASELINE YELLOW	7.5Y 8/8	1		1		1		1				1	1
	TSR 1/1 OPG 6 BLOCK:A3 Layer 2	SCH	54	LIGHT BRIGHT GREEN	2.5G 6/6	1		1	1						1	1	1
	TSR 1/1 OPG 6 BLOCK:A4 Layer 3	SCH	55	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1		1			1			1	1
				OSTRICH EGGSHELL													3
				TRANSPARENT TURQUOISE	10BG 6/8	2		2		2					2	2	2
	TSR 1/1 OPG 6 BLOCK:A4 Layer 4	SCH	56	BRIGHT DUSTY YELLOW	5Y 8.5/10	4		4	2	2					4	4	4
	TSR 1/1 OPG 6 BLOCK:A5 Layer 1	SCH	57	TRANSPARENT TURQUOISE	10BG 6/8	1		1		1			1			1	1
	TSR 1/1 OPG 6 BLOCK:A5 Layer 3	SCH	58	DARK SHADOW BLUE	10B 4/4	1		1		1				1		1	1
				BRIGHT TURQUOISE	7.5B 6/10	1		1		1					1	1	1
				VASELINE YELLOW	7.5Y 8/8	1		1		1			1			1	1
				OSTRICH EGG SHELL BEAD													3
				GARDEN ROLLER		1		1		1			1			1	

Layer	Site	UCT acc. No.		Bead Colour	Manufacturing Method		Type		Size				Diaphaneity			Lusture		Total
					D	W	Ia	IIa	VS	S	M	L	O	TL	TP	S	D	
TSR 1/1 OPG 6 BLOCK:A6 Layer 3	SCH	59	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
			OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
			OSTRICH EGG SHELL BEAD															1
TSR 1/1 OPG 6 BLOCK:A7 Loose ground	SCH	60	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:AA1 Layer 2	SCH	61	GREEN	5GY 5/6	2			2		2			2				2	2
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:AA1 Layer 3	SCH	62	CELEDON TURQUOISE	5BG 5/6	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:AA1 Layer 3(i)	SCH	63	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:AA2 Layer 1	SCH	64	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:AA2 Layer 6	SCH	65	BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:B1 Test trench	SCH	66	FRAGMENTS															
TSR 1/1 OPG 6 BLOCK:B3 Layer 6	SCH	67	VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:B4 Layer 3	SCH	68	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1				1			1	1
			OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:B4 Layer 5	SCH	69	BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:B4 Layer 6	SCH	70	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
TSR 1/1 OPG 6 BLOCK:B5 Layer 1	SCH	71	OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:B5 Layer 5	SCH	72	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	2			2		1	1				2		2	2
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			MID BLUE	5PB 4/6	2			2		2			2				2	2
TSR 1/1 OPG 6 BLOCK:B6 Layer 3	SCH	73	VASELINE YELLOW	7.5Y 8/8	1			1			1		1				1	1
TSR 1/1 OPG 6 BLOCK:BB1 Layer 3(i)	SCH	74	OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:BE1 Layer 3	SCH	75	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			DEEP TURQUOISE	10BG 5/6	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:C2 Layer 1	SCH	76	DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
TSR 1/1 OPG 6 BLOCK:C3 Layer 3	SCH	77	GREEN	5GY 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:C4 Layer 4	SCH	78	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
TSR 1/1 OPG 6 BLOCK:C5 Layer 3	SCH	79	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:C6 Layer 1	SCH	80	TRANSPARENT TURQUOISE	10BG 6/8	1			1	1						1		1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
TSR 1/1 OPG 6 BLOCK:C6 Layer 2	SCH	81	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
			GREEN	5GY 5/6	1			1		1				1			1	1
			OLIVE YELLOW	7.5Y 7/6	1						1		1				1	1
TSR 1/1 OPG 6 BLOCK:D1 Layer 1	SCH	82	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
			TRANSPARENT TURQUOISE	10BG 6/8	2			2		1			1				1	1
			GREEN	5GY 5/6	1			1		1			1				1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	2		2			2			2				2	2
			OSTRICH EGG SHELL BEAD															5
TSR 1/1 OPG 6 BLOCK:D2 Layer 3	SCH	83	TRANSPARENT TURQUOISE	10BG 6/8	2			2		2			2				2	2
TSR 1/1 OPG 6 BLOCK:1A Layer 3	SCH	84	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:1A Layer 3.1	SCH	85	DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
TSR 1/1 OPG 6 BLOCK:1A Layer 5	SCH	86	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:1AA Control block	SCH	87	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
TSR 1/1 OPG 6 BLOCK:1AA Layer 1	SCH	88	TRANSPARENT TURQUOISE	10BG 6/8	1			1			1				1		1	1
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:1AA Layer 3	SCH	89	BLUE GREEN	5BG 6/4	1			1		1				1			1	1

Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type Ia	Type IIa	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TSR 1/1 OPG 6 BLOCK:1AA Layer 6	SCH	90	OLIVE YELLOW FRAGMENTS	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:1B Layer 1	SCH	91	TRANSPARENT TURQUOISE	10BG 6/8	5			5			5				5		5	5
			BRIGHT TURQUOISE	7.5B 6/10	2			2		2					2		2	2
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
			MID BLUE	5PB 4/6	5			5		5			5				5	5
TSR 1/1 OPG 6 BLOCK:1B Layer 2	SCH	92	DARK SHADOW BLUE	10B 4/4	3		3			3				3			3	3
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:1B Layer 3	SCH	93	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			BLUE GREEN	5BG 6/4	1			1		1				1			1	1
			GREEN	5GY 5/6	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:1C Layer 2	SCH	94	DARK SHADOW BLUE	10B 4/4	4		4			4					4		4	4
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
			BRIGHT TURQUOISE	7.5B 6/10	1		1			1			1				1	1
			GARDEN ROLLER															
TSR 1/1 OPG 6 BLOCK:1E Layer 1	SCH	95	TRANSPARENT TURQUOISE	10BG 6/8	1			1	1						1		1	1
			CELEDON TURQUOISE	5BG 5/6	1			1	1						1		1	1
			DARK JADE GREEN	10G 4/6	1			1		1				1			1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	1			1		1			1				1	1
			BONE BEAD															1
TSR 1/1 OPG 6 BLOCK:1E Layer 3	SCH	96	TRANSPARENT TURQUOISE	10BG 6/8	3			3		3			3				3	3
			CELEDON TURQUOISE	5BG 5/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:1F Layer 1A	SCH	97	OLIVE YELLOW	7.5Y 7/6	2			2		2				2			2	2
TSR 1/1 OPG 6 BLOCK:1C Layer 1	SCH	98	DARK SHADOW BLUE	10B 4/4	4		4			4				4			4	4
			BLUE GREEN	5BG 6/4	1			1		1				1				1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1		1								1
			OLIVE YELLOW	7.5Y 7/6	1			1		1								1
TSR 1/1 OPG 6 BLOCK:1C Layer 3	SCH	99	OSTRICH EGG SHELL BEAD															2
TSR 1/1 OPG 6 BLOCK:1C Layer 5	SCH	100	DARK SHADOW BLUE	10B 4/4	1		1				1			1			1	1
TSR 1/1 OPG 6 BLOCK:1D Surface	SCH	101	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
TSR 1/1 OPG 6 BLOCK:1D Layer 1A	SCH	102	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
			OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
			OSTRICH EGG SHELL BEAD															5
TSR 1/1 OPG 6 BLOCK:1D Layer 2		103	OSTRICH EGG SHELL BEAD															2
TSR 1/1 OPG 6 BLOCK:1D Layer 3		104	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	2													2
			CELEDON TURQUOISE	5BG 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:1D Layer 4	SCH	105	DARK SHADOW BLUE	10B 4/4	2		2			1	1		2				2	2
TSR 1/1 OPG 6 BLOCK:2A Layer 1	SCH	106	TRANSPARENT TURQUOISE	10BG 6/8	10			10		10				10			10	10
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1				1			1	1
			GREEN	5GY 5/6	3			3		3			3				3	3
			VASELINE YELLOW	7.5Y 8/8	2			2		2			2				2	2
TSR 1/1 OPG 6 BLOCK:2A Layer 2	SCH	107	BLACK	N 0.5/0.6% R	1			1		1			1				1	1
			DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
TSR 1/1 OPG 6 BLOCK:2A Layer 3	SCH	108	WEATHERED BEAD															3
TSR 1/1 OPG 6 BLOCK:2AA Layer 1	SCH	109	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
TSR 1/1 OPG 6 BLOCK:2AA Layer 3	SCH	110	TRANSPARENT TURQUOISE	10BG 6/8	3			3		3			3				3	3
TSR 1/1 OPG 6 BLOCK:2AA Rabbit Hole	SCH	111	VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:2AA Layer 5.2	SCH	112	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
			OSTRICH EGG SHELL															1

Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type Ia	Type IIa	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TSR 1/1 OPG 6 BLOCK:2B Layer 1	SCH	113	DARK SHADOW BLUE	10B 4/4	2		2			2			2				2	2
			TRANSPARENT TURQUOISE	10BG 6/8	6			6		6			6				6	6
			VASELINE YELLOW (TP)	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:2B Layer 2	SCH	114	TRANSPARENT TURQUOISE	10BG 6/8	5			5			5		5				5	5
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			LIGHT BRIGHT GREEN	2.5G 6/6	2			2		2				2			2	2
			BRIGHT DUSTY YELLOW	5Y 8.5/10	3		3			1	2		2	1			3	3
TSR 1/1 OPG 6 BLOCK:2B Layer 4	SCH	115	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			SHADOW BLUE	2.5PB 5/4	1		1			1				1			1	1
TSR 1/1 OPG 6 BLOCK:2C Layer 1	SCH	116	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
TSR 1/1 OPG 6 BLOCK:2C Layer 2	SCH	117	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1				1			1	1
TSR 1/1 OPG 6 BLOCK:2C Layer 4	SCH	118	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:2D Layer 1	SCH	119	DARK SHADOW BLUE	10B 4/4	1			1		1					1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1		1				1			1	1
			SHADOW BLUE	2.5PB 5/4	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:2D Layer 2	SCH	120	DARK SHADOW BLUE	10B 4/4	1			1		1					1		1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:2E Layer 1	SCH	121	BRIGHT TURQUOISE FRAG.	7.5B 6/10														2
TSR 1/1 OPG 6 BLOCK:2F Layer 1	SCH		DARK SHADOW BLUE	10B 4/4	2			2		2				2			2	2
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
			BLACK	N O.5/0.6% R	2			2		2			2				2	2
			DARK SHADOW BLUE	10B 4/4	2			2		2				2			2	2
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1		1		1	1
TSR 1/1 OPG 6 BLOCK:2F Layer 1.A	SCH	123	DARK SHADOW BLUE	10B 4/4	1			1		1				1			1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
			GARDEN ROLLER									1		1			1	1
			GREEN	5GY 5/6	1			1		1				1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1			1				1		1	1
TSR 1/1 OPG 6 BLOCK:3A Layer 2	SCH	124	DARK SHADOW BLUE	10B 4/4	1			1		1			1				1	1
			CELEDON TURQUOISE	5BG 5/6	1			1		1				1				1
			GREEN	5GY 5/6	1			1		1				1				1
TSR 1/1 OPG 6 BLOCK:3AA Rabbit Hole	SCH	125	CELEDON TURQUOISE	5BG 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:3AA Layer 1	SCH	126	CELEDON TURQUOISE	5BG 5/6	1			1		1			1				1	1
			GREEN	5GY 5/6	1			1		1			1				1	1
			OSTRICH EGG SHELL BEAD															1
TSR 1/1 OPG 6 BLOCK:3AA Layer 2	SCH	127	CELEDON TURQUOISE	5BG 5/6	1			1		1					1		1	1
			GREEN	5GY 5/6	1			1		1				1			1	1
			OSTRICH EGG SHELL BEAD															1
TSR 1/1 OPG 6 BLOCK:3BB Layer 1	SCH	128	CELEDON TURQUOISE	5BG 5/6	1			1		1			1				1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:3BB Layer 2	SCH	129	CELEDON TURQUOISE	5BG 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:3BB Layer 3	SCH	130	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
TSR 1/1 OPG 6 BLOCK:3C Layer 2	SCH	131	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			SAGE GREEN	7.5GY 4/4	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:3D Layer 2	SCH	132	BLUE GREEN	5BG 6/4	1			1		1			1				1	1
			UNIDENTIFIED															1
TSR 1/1 OPG 6 BLOCK:3D Layer 3	SCH	133	BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			VASELINE YELLOW	7.5Y 8/8	2			2		2			2				2	2
			UNIDENTIFIED															2

Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type Ia	Type IIa	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TSR 1/1 OPG 6 BLOCK:3D Layer 4	SCH	134	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			GREEN	5GY 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:3E Layer 1	SCH	135	DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
			BLUE GREEN	5BG 6/4	1			1		1				1			1	1
			DARK JADE GREEN	10G 4/6	1			1		1				1			1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:3E Layer 1A	SCH	136	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1				1		1				1	1
TSR 1/1 OPG 6 BLOCK:3F Loose Ground	SCH	137	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
TSR 1/1 OPG 6 BLOCK:3F Layer 1	SCH	138	GREEN	5GY 5/6	1			1		1			1				1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
			UNIDENTIFIED															2
TSR 1/1 OPG 6 BLOCK:3F Layer 1A	SCH	139	BRIGHT TURQUOISE	7.5B 6/10	1			1			1				1		1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:4A Layer 1	SCH	140	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1				1		1				1	1
TSR 1/1 OPG 6 BLOCK:4A Layer 3	SCH	141	VASELINE YELLOW	7.5Y 8/8										1				1
TSR 1/1 OPG 6 BLOCK:4A Layer 4	SCH	142	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
TSR 1/1 OPG 6 BLOCK:4AA Layer 1	SCH	143	VASELINE YELLOW (TP)	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4AA Layer 2	SCH	144	BLUE GREEN	5BG 6/4	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:4AA Layer 3	SCH	145	WEATHERED BEAD															1
TSR 1/1 OPG 6 BLOCK:4AA Layer 4	SCH	146	BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			WEATHERED BEAD															2
TSR 1/1 OPG 6 BLOCK:4AA Layer 6	SCH	147	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	2			2		2					2		2	2
TSR 1/1 OPG 6 BLOCK:4B Layer 1	SCH	148	DARK JADE GREEN	10G 4/6	1			1		1					1		1	1
TSR 1/1 OPG 6 BLOCK:4B Layer2	SCH	149	GREEN	5GY 5/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4B Layer 3	SCH	150	FRAGMENTS															
TSR 1/1 OPG 6 BLOCK:4B Layer 4	SCH	151	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1				1			1	1
			OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4BB Layer 1	SCH	152	DEEP CELEDON (GREEN)	5BG 4/4	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:4BB Layer 3	SCH	153	GREEN	5GY 5/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4C Layer 1A	SCH	154	VASELINE YELLOW	7.5Y 8/8										1				1
			DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
TSR 1/1 OPG 6 BLOCK:4C Layer 2	SCH	155	BLUE GREEN	5BG 6/4	1			1		1				1			1	1
			YELLOW	7.5Y 8.5/10	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4D Layer 1	SCH	156	TRANSPARENT TURQUOISE	10BG 6/8	2			2		2			2				2	2
			WEATHERED BEAD															1
TSR 1/1 OPG 6 BLOCK:4D Layer 2	SCH	157	DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
			DEEP TURQUOISE	10BG 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:4D Layer 4	SCH	158	GREEN	5GY 5/6	1			1		1			1				1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1			1		1			1				1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1				1			1	1
			BONE BEAD															1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1			1		1			1				1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:4E Layer 1	SCH	159	DARK SHADOW BLUE	10B 4/4	2		2			2				2			2	2
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
			VASELINE YELLOW	7.5Y 8/8	2			2		2			2				2	2
TSR 1/1 OPG 6 BLOCK:4E Layer 4	SCH	160	MEDIUM TURQUOISE	5B 6/8	1			1		1			1				1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
			PATINATED BEADS															3

Layer	Site	UCT Acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Type Ia	Type IIa	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
TSR 1/1 OPG 6 BLOCK:4F Layer 1	SCH	161	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1			1				1	1
			LEMON YELLOW	10Y 8.5/6	2			2		2			2				2	2
			UNIDENTIFIED															1
TSR 1/1 OPG 6 BLOCK:4F Layer 1A	SCH	162	DARK SHADOW BLUE	10B 4/4	1		1			1			1				1	1
TSR 1/1 OPG 6 BLOCK:4F Layer 2	SCH	163	VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4F.41	SCH	164	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			MEDIUM TURQUOISE	5B 6/8	29			29		29					29		29	29
			WEATHERED BEAD															30
TSR 1/1 OPG 6 BLOCK:4F Layer 5	SCH	165	GREEN GREY	10G 6/2	11			11		11			11				11	11
			BLUE GREEN	5BG 6/4	2			2		2				2			2	2
			BRIGHT DUSTY YELLOW	5Y 8.5/10	2		2			2			2				2	2
TSR 1/1 OPG 6 BLOCK:4G Layer 1	SCH	166	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			GREEN	5GY 5/6	1			1		1				1			1	1
			MEDIUM BRIGHT GREEN	2.5G 5/6	1			1		1				1			1	1
TSR 1/1 OPG 6 BLOCK:4G Layer 1A	SCH	167	BLACK	N O.5/0.6% R	2			2		2			2				2	2
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:4G Layer 3	SCH	168	BLUE GREEN	5BG 6/4	1			1		1					1		1	1
			WHITE BEAD (stone)															1
TSR 1/1 OPG 6 BLOCK:5A Layer 2	SCH	169	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			MEDIUM TURQUOISE	5B 6/8	1			1		1					1		1	1
			NASTURTIUM GREEN	10GY 6/6	1			1		1					1		1	1
			DEEP LEMON YELLOW	10Y 8/6	3			3			3		3				3	3
			UNIDENTIFIED															1
TSR 1/1 OPG 6 BLOCK:5B Layer 2	SCH	170	VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:5B Layer 3	SCH	171	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			VASELINE YELLOW	7.5Y 8/8	3			3			3			3			3	3
			OSTRICH EGG SHELL															2
TSR 1/1 OPG 6 BLOCK:5C Layer 2	SCH	172	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
TSR 1/1 OPG 6 BLOCK:5C Layer 4	SCH	173	UNIDENTIFIED															1
TSR 1/1 OPG 6 BLOCK:5C Layer 5	SCH	174	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			VASELINE YELLOW	7.5Y 8/8	3			3		3			3				3	3
			UNIDENTIFIED															3
TSR 1/1 OPG 6 BLOCK:5D Layer 2	SCH	175	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
			TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
			BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1				1		1			1		1
TSR 1/1 OPG 6 BLOCK:5D Layer 3	SCH	176	OSTRICH EGG SHELL BEAD															1
			WEATHERED BEAD															3
TSR 1/1 OPG 6 BLOCK:5D Layer 4	SCH	177	UNIDENTIFIED															1
TSR 1/1 OPG 6 BLOCK:5D Layer 5	SCH	178	WEATHERED BEAD															3
TSR 1/1 OPG 6 BLOCK:5E Layer 1	SCH	179	DARK SHADOW BLUE	10B 4/4	2		2			1	1				2		2	2
TSR 1/1 OPG 6 BLOCK:5E Layer 3	SCH	180	BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:5E Layer 4	SCH	181	TRANSPARENT TURQUOISE	10BG 6/8	3			3		3			3				3	3
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
TSR 1/1 OPG 6 BLOCK:5E Layer 5	SCH	182	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
			TRANSPARENT TURQUOISE	10BG 6/8	3			3	1	2				3			3	3
			VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1

	Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	W	Type Ia	IIa	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture S	D	Total
	TSR 1/1 OPG 6 BLOCK:5F Layer 2	SCH	183	BLACK	N O.5/0.6% R	1			1		1			1				1	1
				UNIDENTIFIED															1
	TSR 1/1 OPG 6 BLOCK:5F Layer 4	SCH	184	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
				TRANSPARENT TURQUOISE	10BG 6/8	2			2	2						2		2	2
	TSR 1/1 OPG 6 BLOCK:5F Layer 5	SCH	185	DARK SHADOW BLUE	10B 4/4	2		2			2					2		2	2
	TSR 1/1 OPG 6 BLOCK:5G Layer 1	SCH	186	DARK SHADOW BLUE	10B 4/4	2		2			2			1	1			2	2
				TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1		1			1				1	1
				UNIDENTIFIED															2
	TSR 1/1 OPG 6 BLOCK:5G Layer 2	SCH	187	MEDIUM TURQUOISE	5B 6/8	2			2		2			2				2	2
	TSR 1/1 OPG 6 BLOCK:5G Layer 4	SCH	188	DEEP TURQUOISE	10BG 5/6	1			1		1					1		1	1
				GREEN	5GY 5/6	1			1		1			1				1	1
				VASELINE YELLOW (TP)	7.5Y 8/8	1			1		1			1				1	1
	TSR 1/1 OPG 6 BLOCK:5G Layer 5	SCH	189	UNKNOWN COLOUR		1			1	1				1				1	1
				DARK SHADOW BLUE	10B 4/4	1		1				1			1			1	1
BLOCK 6	TSR 1/1 OPG 6 BLOCK:6A Layer 1	SCH	190	DOVE GREY	7.5B 6/2	2			2		2			2				2	2
				DEEP TURQUOISE	10BG 5/6	1					1					1		1	1
	TSR 1/1 OPG 6 BLOCK:6A Layer 2	SCH	191	BRIGHT TURQUOISE	7.5B 6/10	1			1		1					1		1	1
			•	BLUE GREEN	5BG 6/4	1			1		1			1				1	1
				LIGHT BRIGHT GREEN	2.5G 6/6	1			1		1			1				1	1
				YELLOW	7.5Y 8.5/10	1			1		1			1				1	1
				OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
	TSR 1/1 OPG 6 BLOCK:6A Layer 13	SCH	192	UNKNOWN COLOUR		1			1		1			1				1	1
				DARK SHADOW BLUE	10B 4/4	1		1				1				1		1	1
				MEDIUM TURQUOISE	5B 6/8	1			1		1					1		1	1
				SAGE GREEN	7.5GY 4/4	1			1		1			1				1	1
	TSR 1/1 OPG 6 BLOCK:6B Layer 2	SCH	193	CELEDON TURQUOISE	5BG 5/6	1			1		1					1		1	1
	TSR 1/1 OPG 6 BLOCK:6B Layer 3	SCH	194	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
				DEEP TURQUOISE	10BG 5/6	1			1		1				1			1	1
	TSR 1/1 OPG 6 BLOCK:6B Layer 4	SCH	195	BRIGHT DUSTY YELLOW	5Y 8.5/10	1		1			1			1				1	1
	TSR 1/1 OPG 6 BLOCK:6B Layer 5	SCH	196	DARK SHADOW BLUE	10B 4/4	1			1			1				1		1	1
				TRANSPARENT TURQUOISE	10BG 6/8	1			1			1				1		1	1
	TSR 1/1 OPG 6 BLOCK:6C Layer 1	SCH	197	GREEN GREY	10G 6/2	1			1		1			1				1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	2		2			2			2				2	2
				OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1
				BLUE GREEN	5BG 6/4	1			1		1				1			1	1
	TSR 1/1 OPG 6 BLOCK:6C Layer 1	SCH	198	BLUE GREEN	5BG 6/4	6			1		1				6			6	1
				CELEDON TURQUOISE	5BG 5/6	1			1		1					1		1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	4		4			4				4			4	1
	TSR 1/1 OPG 6 BLOCK:6C Layer 4	SCH	199	BLUE GREEN	5BG 6/4	2			2		2				2			2	2
	TSR 1/1 OPG 6 BLOCK:6C Layer 5	SCH	200	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1			1				1	1
				VASELINE YELLOW	7.5Y 8/8	1			1		1				1			1	1
	TSR 1/1 OPG 6 BLOCK:6F Layer 2	SCH	201	OLIVE YELLOW	7.5Y 7/6	1			1		1				1			1	1
	TSR 1/1 OPG 6 BLOCK:7A Layer 1	SCH	202	TRANSPARENT TURQUOISE	10BG 6/8														1
	TSR 1/1 OPG 6 BLOCK:7A Layer 2	SCH	203	DARK SHADOW BLUE	10B 4/4	1		1			1				1			1	1
				TRANSPARENT TURQUOISE	10BG 6/8	1			1		1					1		1	1
				CELEDON TURQUOISE	5BG 5/6	2			2		2					2		2	2
				LIGHT BRIGHT GREEN	2.5G 6/6	1			1		1				1			1	1
	TSR 1/1 OPG 6 BLOCK:7A Layer 3	SCH	204	TRANSPARENT TURQUOISE	10BG 6/8	2			2		2					2		2	2
				SAGE GREEN	7.5GY 4/4	1			1		1			1				1	1
				VASELINE YELLOW	7.5Y 8/8	1			1		1			1				1	1
	TSR 1/1 OPG 6 BLOCK:7B Layer 1	SCH	205	DARK SHADOW BLUE	10B 4/4	1		1			1					1		1	1
				TRANSPARENT TURQUOISE	10BG 6/8	2			2		2			2				2	2
	TSR 1/1 OPG 6 BLOCK:7B Layer 2	SCH	206	DARK SHADOW BLUE	10B 4/4	3		3				3				3		3	3
				TRANSPARENT TURQUOISE	10BG 6/8	1		1				1				1		1	1
				BRIGHT DUSTY YELLOW	5Y 8.5/10	3		3			1	2		3				3	3
	TSR 1/1 OPG 6 BLOCK:7B Layer 4	SCH	207	TRANSPARENT TURQUOISE	10BG 6/8	1			1		1				1			1	1
				OLIVE YELLOW	7.5Y 7/6	1			1		1			1				1	1

APPENDIX IIc
Catalogue of beads from Eastern Transvaal sites

EASTERN TRANSVAAL BEADS

		PHA	LET	NKW	PAF	PHA	SH	MAH	OLI	KWA	SAT	MAS	TOTAL
NEUTRAL WHITE	N9.5/90.0%R	20		5			12	14		411			462
OYSTER WHITE	5GY 9/1	206	4	5	2		27	17		400	1		662
LIGHT GREY	N 8.25/63.65R						1						1
BLUE NEUTRAL GREY	5BG 6/1	6					1						7
DOVE GREY	7.5B 6/2	15											15
GREEN GREY	10G 6/2	2					1	3		1			7
GREY & OLIVE YELLOW							9						9
BLACK	N0.5/0.6%R	4	1	1		42	770	140		3			961
TRANSPARENT TURQUOISE	10BG 6/8		1				72	58		4			135
DEEP TURQUOISE	10BG 5/6	17	6	2			1230	354		16	1		1626
CELEDON TURQUOISE	5BG 5/6			2			19	4					25
BLUE GREEN	5BG 6/4	11				7	4				1		23
DEEP CELEDON	5BG 4/4						2						2
GREEN	5GY 5/6	6					2		1				9
MEDIUM BRIGHT GREEN	2.5G 5/6	4		1	1		10	7		20			43
DARK GREEN	2.5G 3/6	235								2			237
INDIAN RED	2.5YR 3/8	11				7	852	11					881
INDIAN RED ON GREEN CORE	7.5R 3/8	15		2	2	5	3394	2113			1		5532
DEEP SCARLET	2.5R 3/10	1								179			180
BRIGHT ORANGE										12			12
YELLOW	7.5Y 8.5/10		1							1			2
VASELINE YELLOW (TP)	7.5Y 8/8					57	763	3					823
KHAKI YELLOW	5Y 7/8						2						2
OLIVE YELLOW	7.5Y 7/6	2					98	1					101
LIGHT MARIGOLD	2.5Y 6/10						3	2		4			9
DARK MARIGOLD	7.5YR 6/10	12								9			21
BRIGHT NAVY	7.5PB 2/8	33		7				80		227	4		351
BRIGHT NAVY (FACETTED)	7.5PB 2/8					12	9	3				1019	1043
BRIGHT NAVY (ANNULAR)	7.5PB 2/8						1						1
MID BLUE	5PB 4/6	4	3	2			2895	135		1	1		3041
MEDIUM COPEN BLUE	5PB 6/8		9				16	6		2			33
DARK SHADOW BLUE	10B 4/4		2				6	10	1				19
SHADOW BLUE	2.5PB 5/4	28											28
LIGHT BLUE	10B 7/4		1		3		247	326					577
PALE PINK	10RP 8/4	2		1			1	10		8	1		23
MAUVE PINK	5RP 6/8	2		1			325	508		18			854
OSTRICH EGG SHELL		105											105
GREY & CREAM STRIPES							12						12
BLACK & CREAM STRIPES							5						5
BLUE STRIPE		1											1
PINK STRIPE		1											1
PINK & GREEN STRIPE		1											1
PINK & BLUE STRIPE		1											1
DEEP RED BROWN	10R 2/4							2					2
RUBY ON WHITE CORE	2.5R 3/10	2		2			4	4		6	2		20
COPPER BEAD		4											4
STRIPED BEADS				1	1	7	49	45			1		104
UMGAZI	7.5R 3/8	4											4
GREEN GLASS		1											1
DROPLETS OF GLASS							2						2
GYPSUM		1											1
SEED/POD		1											1
FRESH WATER SHELL		1											1
ARMY BUTTON		1											1
MOLLUSC		1											1
TRIANGULAR X SECTION							36	296					332
METAL BEAD			2				20	1					23
BONE BEAD							1						1
TRIANGULAR BEAD							208						208
MELTED FUSED BEAD							85						85
UNUSUAL COLOUR BEAD							4						4
WEATHERED BEAD				1		16	312						329
Total number of beads (n):		761	30	33	9	153	11510	4153	2	1324	13	1019	19007

LOCATION:
SITE: Phalaborwa

Heading	Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WId	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
SPK I	Level A	ETVL	D727	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	6			6				6			6			5	1	6
				BRIGHT NAVY	7.5PB 2/8	1	1		2					1	1		2		2		2
				RUBY ON WHITE CORE	2.5R 3/10	2			2				1	1		2			2		2
				COPPER BEAD																	4
SPK II	C3 1'6"-2'0" ABOVE HUT FLOOR	ETVL	D728	BRIGHT NAVY	7.5PB 2/8	2				2				1	1		2		2		2
	D3 1'9"-1'6"	ETVL	D729	DOVE GREY	7.5B 6/2	1			1				1			1			1		1
				SEED/POD																	1
	E3 8"-1'6"	ETVL	D730	DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	1				1					1						1
	F3 1'-1'6"	ETVL	D731	NEUTRAL WHITE	N9.5/90.0%R	2			2				2			2			2		2
				DOVE GREY	7.5B 6/2	1					1				1	1			1		1
				BRIGHT NAVY	7.5PB 2/8		3			3					3						3
	F3	ETVL	D732	BRIGHT NAVY	7.5PB 2/8	1				1					1		1		1		1
	J2 6"-1'0"	ETVL	D733	BRIGHT NAVY	7.5PB 2/8	1	1			1	1				2						2
	J3 1'6"-2'0"	ETVL	D734	BRIGHT NAVY	7.5PB 2/8	2				2					2		2		2		2
				BRITISH ARMY BUTTON																	1
				PIECE OF FRESHWATER SHELL																	1
SPK III	A 2'6"-	ETVL	D735	OSTRICH EGG SHELL BEAD																	1
	BC 2"-1'0"	ETVL	D736	GREEN	5GY 5/6	1			1				1					1	1		1
				OSTRICH EGG SHELL BEAD																	4
	1'6"	ETVL	D737	OSTRICH EGG SHELL BEAD																	1
	C-CD 10"-1'2"	ETVL	D738	OSTRICH EGG SHELL BEAD																	2
	CD ON FLOOR 1'6"	ETVL	D739	OSTRICH EGG SHELL BEAD																	1
	CCD 0-3"6"	ETVL	D740	OSTRICH EGG SHELL BEAD (BROKEN)																	1
	D 5"-1'0"	ETVL	D741	OSTRICH EGG SHELL BEAD																	1
	0-1'6"	ETVL	D742	OSTRICH EGG SHELL BEAD																	5
	D-H 7"	ETVL	D743	DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				BLUE STRIPE		1			1			1				1			1		1
				DARK MARIGOLD	7.5YR 6/10				11												11
	F 2'0"	ETVL	D744	OSTRICH EGG SHELL BEAD																	3
	G 1'7"-2'0"	ETVL	D745	DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				BLUE GREEN	5BG 6/4	1			1				1					1	1		1
				OSTRICH EGG SHELL BEAD																	1
	G.H 1'4"	ETVL	D746	BLACK	N O.5/0.6% R		1		1				1			1			1		1
				OSTRICH EGG SHELL BEAD																	2
	H 1'2"	ETVL	D747	OSTRICH EGG SHELL BEAD																	1
	H 1'4"	ETVL	D748	OSTRICH EGG SHELL BEAD																	11
	H 1'9"	ETVL	D749	DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				OSTRICH EGG SHELL BEAD																	9

LOCATION:
SITE: Phalaborwa

Heading	Layer	Site	UCT acc No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WI	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	I 1'0"-1'3"	ETVL	D751	OSTRICH EGG SHELL BEAD																	5
	I 1'6"	ETVL	D752	INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				OSTRICH EGG SHELL BEAD																	3
	I 1'10"	ETVL	D753	OSTRICH EGG SHELL BEAD																	1
	J 1'-0'	ETVL	D754	OSTRICH EGG SHELL BEAD																	3
	1'6"	ETVL	D755	OSTRICH EGG SHELL BEAD																	1
	K 1'5"-1'6"	ETVL	D756	DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				OSTRICH EGG SHELL BEAD																	4
	KG 1'6"-1'9"	ETVL	D757	OSTRICH EGG SHELL BEAD																	1
	10"-1'1"	ETVL	D758	OSTRICH EGG SHELL BEAD																	8
	1'6"-1'9"	ETVL	D759	OSTRICH EGG SHELL BEAD																	2
	HL 11"	ETVL	D760	OSTRICH EGG SHELL BEAD																	1
	I 11"	ETVL	D761	OSTRICH EGG SHELL BEAD																	1
	2'6"	ETVL	D762	OSTRICH EGG SHELL BEAD																	1
	S 1'9" ON FLOOR 1'02" IN	ETVL	D763	OSTRICH EGG SHELL BEAD																	1
	HOLE UNDER UPSLOPE ROCK	ETVL	D764	OPERCULUM LAND MOLLUSC																	1
MK3	TERRACE 3	ETVL	D765	MID BLUE	5PB 4/6	1			1				1					1	1		1
MK7	TERRACE 8 SURFACE 0-4"	ETVL	D766	DOVE GREY	7.5B 6/2	1			1				1			1			1		1
	TERRACE 7 TRENCH GROUND HOUSE	ETVL	D767	OYSTER WHITE	5GY 9/1	4			4				4			4			4		4
				BLUE NEUTRAL GREY	5BG 6/1	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	1			1				1			1			1		1
				MID BLUE	5PB 4/6	2			2				2			1		1	2		2
	TERRACE 2-1"	ETVL	D768	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				DOVE GREY	7.5B 6/2	1			1				1			1			1		1
MK8	TERRACE 8 0"-6"	ETVL	D769	BLUE NEUTRAL GREY	5BG 6/1	1			1				1			1			1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	2			2				2			2			2		2
				BRIGHT NAVY	7.5PB 2/8	3			3					3				3	3		3
NAGOME MN3	HOUSE 1 UNIT 2 0-12"	ETVL	D770	NEUTRAL WHITE	N9.5/90.0%R	1			1				1			1			1		1
				OSTRICH EGG SHELL BEAD																	3
				BROKEN PIECE OF GREEN GLASS																	1
				GYPSYM BEAD																	1
	HOUSE 1-ASH	ETVL	D771	OSTRICH EGG SHELL BEAD																	7
	HOUSE 2 12" BELOW SURFACE 6'-23-70	ETVL	D772	BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				OSTRICH EGG SHELL BEAD																	2
	HOUSE 2 1"-12"	ETVL	D773	OLIVE YELLOW	7.5Y 7/6	1			1				1			1			1		1
				GREEN GREY	10G 6/2	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	2			2				2			2			2		2
	HOUSE 3 0"-12" BELOW SURFACE	ETVL	D774	OSTRICH EGG SHELL BEAD																	2
	HOUSE 3 15"-18"	ETVL	D775	OSTRICH EGG SHELL BEAD																	3
	HOUSE 3 36"	ETVL	D776	OSTRICH EGG SHELL BEAD																	6
	T30 HOUSE 1 0.5-0.8 NW 1/4	ETVL	D777	OYSTER WHITE	5GY 9/1	14			14				14			14			14		14
				DARK GREEN	2.5G 3/6	10			10				10					10	10		10
				SHADOW BLUE	2.5PB 5/4	2			2				2			2			2		2

LOCATION:
SITE: Phalaborwa

Heading	Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WId	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
NAGOME MN4	T30 SW'14 OF HOUSE FROM WALL FALL TO ASH	ETVL	D778	OYSTER WHITE	5GY 9/1	23			23				23			23			23		23
				BLUE GREEN	5BG 6/4	1			1			1				1			1		1
				DARK GREEN	2.5G 3/6	151			151				151					151	151		151
	T30 HOUSE FALL AND FILL	ETVL	D779	OYSTER WHITE	5GY 9/1	2			2				2			2			2		2
				DEEP TURQUOISE	10BG 5/6	2			2				2			2			2		2
				DARK GREEN	2.5G 3/6	2			2				2			2			2		2
				SHADOW BLUE	2.5PB 5/4	1			1				1			1			1		1
	T30 NE 1/4 HOUSE WALL FALL. BACK WALL	ETVL	D780	OYSTER WHITE	5GY 9/1	81			81				81			81			81		81
				BLUE GREEN	5BG 6/4	1			1			1				1			1		1
				DARK GREEN	2.5G 3/6	37			37				37					37	37		37
				SHADOW BLUE	2.5PB 5/4	6			6				6				6		6		6
	T30 BENEATH HOUSE FLOOR	ETVL	D781	NEUTRAL WHITE	N9.5/90.0%R	1			1				1			1			1		1
	SE 1/4 OF HOUSE. HOUSE 1	ETVL	D782	OYSTER WHITE	5GY 9/1	14			14				14			14			14		14
				DARK GREEN	2.5G 3/6	4			4				4					4	4		4
	SE 1/4 OF HOUSE. HOUSE 1	ETVL	D783	NEUTRAL WHITE	N9.5/90.0%R	4			4				4			4			4		4
				OYSTER WHITE	5GY 9/1	10			10				10			10			10		10
				DARK GREEN	2.5G 3/6	14			14				14					14	14		14
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
	T30 NW 1/4 HOUSE 1	ETVL	D784	OYSTER WHITE	5GY 9/1	5			5				5			5			5		5
				DARK GREEN	2.5G 3/6	7			7				7				2	5	7		7
	BURIAL I 7-10-70	ETVL	D785	OSTRICH EGG SHELL BEAD																	1
NAGOME MN5	T4 HOUSE 1 20W OW 0-6"	ETVL	D786	OYSTER WHITE	5GY 9/1	2			2				2			2			2		2
				BRIGHT NAVY	7.5PB 2/8	2			1	1			1		1		2		2		2
				OSTRICH EGG SHELL BEAD																	4
	HOUSE 2	ETVL	D787	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				SHADOW BLUE	2.5PB 5/4	1			1				1			1			1		1
	X SECTION HOUSE 2	ETVL	D788	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1				1					1	1		1
	UNIT 2 2-6"	ETVL	D789	NEUTRAL WHITE	N9.5/90.0%R	1			1												1
				OYSTER WHITE	5GY 9/1	1			1												1
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1												1
				BRIGHT NAVY	7.5PB 2/8	2			2												2
				DARK GREEN	2.5G 3/6	1			1				1					1	1		1
				GREEN/INDIAN RED STRIPE		1			1				1			1			1		1
	HOUSE 3 7-8-70	ETVL	D790	NEUTRAL WHITE	N9.5/90.0%R	1			1				1			1			1		1
				OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				DOVE GREY	7.5B 6/2	2			2				2			2			2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	3			3				3					3	3		3
	WALL FALL ... FLOOR (details on label indistinguishable)	ETVL	D791	NEUTRAL WHITE	N9.5/90.0%R	1			1				1			1			1		1
				OYSTER WHITE	5GY 9/1	2			2				2			2			2		2
				MAUVE PINK	5RP 6/8	1			1			1				1			1		1
				MID BLUE	5PB 4/6	1			1				1					1	1		1

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type WId	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
				DARK GREEN	2.5G 3/6	1			1				1					1	1		1
NAGOME MN6	T32 0.5-1.00 OUTSIDE HOUSE	ETVL	D792	NEUTRAL WHITE	N9.5/90.0%R	2			2				2			2			2		2
				OYSTER WHITE	5GY 9/1	6			6				6			6			6		6
				BLACK	N O.5/0.6% R	1			1				1			1			1		1
				BLUE NEUTRAL GREY	5BG 6/1	3			3			1	2			3			3		3
				DOVE GREY	7.5B 6/2	3			3				3			3			3		3
				GREEN GREY	10G 6/2	1			1				1			1			1		1
				DEEP TURQUOISE	10BG 5/6	2			2				2				1	1	2		2
				GREEN	5GY 5/6	2			2				2			2			2		2
				DARK GREEN	2.5G 3/6	2			2				2					2	2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	2			2				2			2			2		2
				SHADOW BLUE	2.5PB 5/4	1			1				1					1	1		1
				BRIGHT NAVY	7.5PB 2/8	3			3				3					3	3		3
				PALE PINK	10RP 8/4	1			1				1			1			1		1
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1				1					1	1		1
	T32 OUTSIDE HOUSE 1 1.0-1.5	ETVL	D793	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
	T32 HOUSE 1 WALL FALL NE SIDE	ETVL	D794	OYSTER WHITE	5GY 9/1	5			5				5			5			5		5
				BLUE NEUTRAL GREY	5BG 6/1	1			1				1			1			1		1
				DEEP TURQUOISE	10BG 5/6	1			1					1				1	1		1
				BLUE GREEN	5BG 6/4	1			1				1					1	1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	2			2				2			2			2		2
				SHADOW BLUE	2.5PB 5/4	3			3				3			3			3		3
				BRIGHT NAVY	7.5PB 2/8	1			1				1			1			1		1
				PALE PINK	10RP 8/4	1			1				1			1			1		1
	T32 FILL ABOVE WALL FALL 0.2-0.3 HOUSE 1	ETVL	D795	OYSTER WHITE	5GY 9/1	2			2				2			2			2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
				SHADOW BLUE	2.5PB 5/4	1			1				1					1	1		1
				PINK & BLUE STRIPE		1			1				1			1			1		1
				PINK STRIPE		1			1				1			1			1		1
	T32 HOUSE 1 PLATFORM TO FLOOR	ETVL	D796	BRIGHT NAVY	7.5PB 2/8	1			1				1			1			1		1
	T32 HOUSE 1 TO FLOOR 2	ETVL	D797	OYSTER WHITE	5GY 9/1	9			9				9			9			9		9
				BLACK	N O.5/0.6% R	1			1				1			1			1		1
				DOVE GREY	7.5B 6/2	3			3				3					3	3		3
				DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				BLUE GREEN	5BG 6/4	5			5				5			1		4	5		5
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
				SHADOW BLUE	2.5PB 5/4	9			9				9			9			9		9
				MEDIUM BRIGHT GREEN	2.5G 5/6	2			2				2					2	2		2
				DARK GREEN	2.5G 3/6	1			1				1					1	1		1
	T32 HOUSE 1 FLOOR 1 TO DOOR 2	ETVL	D798	OYSTER WHITE	5GY 9/1	4			4				4			4			4		4
				DEEP TURQUOISE	10BG 5/6	1			1				1					1	1		1
				SHADOW BLUE	2.5PB 5/4	3			3				2	1				3	3		3
				BRIGHT NAVY	7.5PB 2/8	1			1				1					1	1		1
				DARK GREEN	2.5G 3/6	1			1				1					1	1		1
				PINK & GREEN STRIPE		1			1				1			1			1		1
				OSTRICH EGG SHELL FRAGMENT																	1

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIF	Structure Type Wld	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	T32 HOUSE 1	ETVL	D799	OYSTER WHITE	5GY 9/1	7			7				7			7			7		7
				DOVE GREY	7.5B 6/2	3			3				3			3			3		3
				DEEP TURQUOISE	10BG 5/6	3			3				3				3		3		3
				GREEN	5GY 5/6	2			2				2				2		2		2
				SHADOW BLUE	2.5PB 5/4	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	3			3				3				3		3		3
				DARK GREEN	2.5G 3/6	3			3				3				3		3		3
	T32 HOUSE BENEATH FLOOR 2	ETVL	D800	BLACK	N O.5/0.6% R	1			1						1	1			1		1
				DARK MARIGOLD	7.5YR 6/10	1			1								1		1		1
				OSTRICH EGG SHELL BEAD																	1
SPR8	M4 GC	ETVL	D801	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
	M4 HG	ETVL	D802	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				OLIVE YELLOW	7.5Y 7/6	1			1				1			1			1		1
	M4 HDG2	ETVL	D803	UMGAZI	7.5R 3/8	1			1				1					1	1		1
	M4 S6	ETVL	D804	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
	N4 SURFACE	ETVL	D805	NEUTRAL WHITE	N9.5/90.0%R				1												1
				MAUVE PINK	5RP 6/8	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	1			1												1
	N4 BG	ETVL	D806	OYSTER WHITE	5GY 9/1	2			2				2			2			2		2
	N4 HG	ETVL	D807	INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
	N4 MG	ETVL	D808	NEUTRAL WHITE	N9.5/90.0%R	2			2				2			2			2		2
				DEEP SCARLET	2.5R 3/10	1			1				1				1		1		1
	N4 PP	ETVL	D809	INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
	N4 RC	ETVL	D810	DEEP TURQUOISE	10BG 5/6	1			1				1			1			1		1
	N4 RG	ETVL	D811	UMGAZI	7.5R 3/8	1			1				1					1	1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
	N4 SG	ETVL	D812	GREEN	5GY 5/6	1			1				1			1			1		1
	O4 LG1	ETVL	D813	OYSTER WHITE	5GY 9/1	1			1				1					1		1	1
	P4 OVER BURDEN	ETVL	D814	UMGAZI	7.5R 3/8	1			1				1					1	1		1
	QR S 5'6	ETVL	D815	OYSTER WHITE	5GY 9/1		1		1					1		1			1		1
	QR S 5'6 PUDDLE A	ETVL	D816	NEUTRAL WHITE	N9.5/90.0%R	2			2			1	1			2			2		2
				OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				UMGAZI	7.5R 3/8	1			1				1					1	1		1
	R5 SURFACE PUDDLE A	ETVL	D817	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
	SG N4	ETVL	D818	NEUTRAL WHITE	N9.5/90.0%R	1	1		2				1	1		2			2		2

LOCATION Eastern Transvaal
SITE Letaba River/Area

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIf	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
LETABA RIVER/ AREA	HOUER 380 TER LETABA ASGAT 2	ETVL	D819	DEEP TURQUOISE	10BG 5/6	1			1			1				1		1		1
	HOUER 384 TER LETABA 2 1	ETVL	D820	OYSTER WHITE	5GY 9/1	2			2			2			2			2		2
				BLACK	N O.5/0.6% R	1			1			1			1			1		1
	HOUER 383 TER LETABA 6 6 Laag1	ETVL	D821	TRANSPARENT TURQUOISE	10BG 6/8	1														1
	HOUER 385 TER LETABA 2 2 Lg1	ETVL	D822	OLIVE YELLOW FRAGMENT	7.5Y 7/6									1						1
	HOUER:410 TER LETABA 2.1	ETVL	D823	DARK SHADOW BLUE	10B 4/4	2		2				2				2		2		2
	HOUER:388 TER:NKW LE. 2.1 Lg2	ETVL	D824	LIGHT BLUE	10B 7/4	1			1			1			1			1		1
	HOUER:391 TER:NKW LE. 2.1 Lg1	ETVL	D825	METAL BEAD																1
	HOUER:392 TER:NKW LETABA 2.1 Lg	ETVL	D826	OYSTER WHITE	5GY 9/1	2		2				2			2			2		2
				DEEP TURQUOISE	10BG 5/6	5		2	3			5.				2	3	5		5
				YELLOW	7.5Y 8.5/10	1			1			1			1			1		1
				MID BLUE	5PB 4/6	3		3				3				3		3		3
				MEDIUM COPEN BLUE	5PB 6/8	9		9				9			9			9		9
	HOUER:399 TER:NKW LE. 2.1 Lg2	ETVL	D827	METAL BEAD																1
	LOCATION: Eastern Transvaal																			
	SITE: Nasionale Kruger Wildtuin																			
NKW SK4	HOUER:452 TER:SKU BLOK:D7 Lg3	ETVL	D828	MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1			1			1		1
	HOUER:455 TER:SK4 BLOK:D7 Lg2	ETVL	D829	BLACK	N O.5/0.6% R	1		1				1			1			1		1
				DEEP TURQUOISE	10BG 5/6	1		1				1			1			1		1
				CELEDON TURQUOISE	5BG 5/6	1			1			1				1		1		1
				BRIGHT NAVY	7.5PB 2/8	2		2				2			2			2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	2			2			2			2			2		2
	HOUER:457 TER:SK4 DET:BY ROTSTEK L.S.T NABY PRET. KOP	ETVL	D830	NEUTRAL WHITE	N9.5/90.0%R	3			3			3			3			3		3
				OYSTER WHITE	5GY 9/1	3		2	1			3			3			3		3
				CELEDON TURQUOISE	5BG 5/6	1			1			1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	5		5				5			5			5		5
				MID BLUE	5PB 4/6	2			2			2				2		2		2
				PALE PINK	10RP 8/4	1			1			1			1			1		1
				MAUVE PINK	5RP 6/8	1			1			1			1			1		1
				RUBY ON WHITE CORE	2.5R 3/10	2			2			1	1			2		2		2
				STRIPED BEADS		1			1			1			1			1		1
				WEATHERED BEAD																1
	HOUER:565 SK17.2 BLK:C7 Lg3	ETVL	D831	NEUTRAL WHITE	N9.5/90.0%R	2			2			2			2			2		2
	HOUER:534 TER:SK4 BLOK:B.E.3. Lg3	ETVL	D832	OYSTER WHITE	5GY 9/1	1			1			1			1			1		1
	HOUER:525 TER:NKW SK4	ETVL	D833	OYSTER WHITE	5GY 9/1	1			1			1			1			1		1
	HOUER:493 TER:NKW SK4 BLK:G4 Lg	ETVL	D834	DEEP TURQUOISE	10BG 5/6	1			1			1			1			1		1
PA	HOUER:377 TER:PA 6.1 BLOK:A2 Lg1	ETVL	D835	INDIAN RED ON GREEN CORE	7.5R 3/8	2			2			2			2			2		2
	HOUER:379 TER:PA 6.1 BLOK:A2 Lg1	ETVL	D836	OYSTER WHITE	5GY 9/1	2			2			2			2			2		2
				STRIPED BEADS		1			1			1			1			1		1
	HOUER:393 TER:PA 6.1 BLOK:A2 Lg1	ETVL	D837	MEDIUM BRIGHT GREEN	2.5G 5/6	1			1			1			1			1		1
	HOUER:394 TER:PA 6.1 BLOK:A2 Lg1	ETVL	D838	LIGHT BLUE	10B 7/4	3			3			2	1		3			3		3

LOCATION: Eastern Transvaal
SITE: Phalaborwa

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIf	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
PH	HOUER:485 TER PH/MAHLANGENI	ETVL	D839	BRIGHT NAVY (FACETTED)	7.5PB 2/8	12				12				12		12				12
	HOUER:406 TER PH 6.1 STRAT:Laag1	ETVL	D840	BLUE GREEN	5BG 6/4	7			7			7			7			7		7
	HOUER:407 TER:PH 6.1 STRAT:Laag1	ETVL	D841	INDIAN RED	2.5YR 3/8	6			6			6			6			6		6
	HOUER:459 TER:PH 6.1 STRAT:Laag1	ETVL	D842	BLACK	N O.5/0.6% R	26			26			26			26			26		26
				INDIAN RED	2.5YR 3/8	1			1			1			1			1		1
				WEATHERED BEADS																16
	HOUER:478 TER:PH/MAHLANGENI	ETVL	D843	BLACK	N O.5/0.6% R	5		2	3			5			5			5		5
				VASELINE YELLOW (TP)	7.5Y 8/8	57		53	4			57			55	2		57		57
				INDIAN RED ON GREEN CORE	7.5R 3/8	5			5			5			5			5		5
				STRIPED BEADS		7			7			7			7			7		7
	HOUER:381 TER:PH 6 STRAT:Laag1	ETVL	D844	BLACK	N O.5/0.6% R	11			11			11			11			11		11
	LOCATION: Eastern Transvaal																			
	SITE: Shikumbu																			
SH3	HOUER:571 TER:SH3	ETVL	D845	DEEP TURQUOISE	10BG 5/6	37			37			37			37			37		37
	STRAT:OPPERVLAKTE			MID BLUE	5PB 4/6	80		80				80			80			80		80
	HOUER:458 TER:SH3	ETVL	D846	TRANSPARENT TURQUOISE	10BG 6/8	65			65			65			65			65		65
	STRAT:OPPERVLAKTE			DEEP TURQUOISE	10BG 5/6	48			48			48			48			48		48
				MID BLUE	5PB 4/6	264		264				264			264			264		264
	HOUER:500 TER:NKW SH3 Lg1	ETVL	D847	PALE PINK	10RP 8/4	1			1			1			1			1		1
	HOUER:529 TER:SH3 STRAT:Laag1	ETVL	D848	INDIAN RED ON GREEN CORE	7.5R 3/8	2			2			2			2			2		2
	HOUER:464 TER:SH3 STRAT:Laag1	ETVL	D849	NEUTRAL WHITE	N9.5/90.0%R	1			1			1			1			1		1
				OYSTER WHITE	5GY 9/1	3			3			3			3			3		3
	HOUER:492 TER:SH3 NKW Lg1	ETVL	D850	BLACK	N O.5/0.6% R	3		2	1			3			3			3		3
				DARK SHADOW BLUE	10B 4/4	1		1				1			1			1		1
	HOUER:562 TER:NKW SH3 Lg1	ETVL	D851	BRIGHT NAVY (ANNULAR)	7.5PB 2/8		1			1				1		1		1		1
				BRIGHT NAVY (FACETTED)	7.5PB 2/8	1				1				1		1		1		1
	HOUER:515 TER:SH3 STRAT:Laag1	ETVL	D852	OYSTER WHITE	5GY 9/1	5			5			5			5			5		5
				MID BLUE	5PB 4/6	3		3				3			3			3		3
	HOUER:573 TER:NKW SH3 Lg1	ETVL	D853	BLACK	N O.5/0.6% R	9		9				9			9			9		9
				LIGHT MARIGOLD	2.5Y 6/10	1		1				1			1			1		1
	HOUER:448 TER:NKW SH3 Lg1	ETVL	D854	DEEP TURQUOISE	10BG 5/6	11			11			11			11			11		11
				INDIAN RED	2.5YR 3/8	1			1			1			1			1		1
	HOUER:540 TER:SH3	ETVL	D855	METAL BEADS																19
	HOUER:564 TER:NKW SH3 Lg1	ETVL	D856	BLACK	N O.5/0.6% R	3			3			3			3			3		3
				DEEP TURQUOISE	10BG 5/6	11			11			11			11			11		11
				CELEDON TURQUOISE	5BG 5/6	1			1			1			1			1		1
				MID BLUE	5PB 4/6	13		13				13			13			13		13
	HOUER:560 TER:NKW SH3 Lg1	ETVL	D857	OYSTER WHITE	5GY 9/1	1			1			1			1			1		1
				TRANSPARENT TURQUOISE	10BG 6/8	2		2				2					2	2		2
				MID BLUE	5PB 4/6	58		53	5			58			58			58		58
				MEDIUM COPEN BLUE	5PB 6/8	3			3			3			3			3		3
				INDIAN RED ON GREEN CORE	7.5R 3/8	2			2			2			2			2		2

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	IIIf	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	SITE Shikumbu			STRIPED BEADS		1			1			1			1			1		1
	HOUER:568 TER:NKW SH3	ETVL	D858	DEEP TURQUOISE	10BG 5/6	64			64			64			64			64		64
				GREEN	5GY 5/6	1			1			1			1			1		1
SH4	HOUER:451 TER SH4 OPPERVLAKTE	ETVL	D859	METAL BEAD																1
	HOUER:470 OPGRAWING 2 T S I	ETVL	D860	BRIGHT NAVY (FACETTED)	7.5PB 2/8	1				1				1		1		1		1
	HOUER:531 TER SH4	ETVL	D861	OYSTER WHITE	5GY 9/1	2			2			2			2			2		2
	HOUER:535 TER:SH4	ETVL	D862	LIGHT MARIGOLD	2.5Y 6/10	1		1				1			1			1		1
	BLOK:TOETSSLOOT I			GREEN GREY	10G 6/2	1		1				1			1			1		1
	HOUER:517 TER SH4	ETVL	D863	BRIGHT NAVY (FACETTED)	7.5PB 2/8	5				5				5		5		5		5
	HOUER:510 TER SH4	ETVL	D864	CELEDON TURQUOISE	5BG 5/6	5			5			5			5			5		5
				BLUE GREEN	5BG 6/4	1			1			1			1			1		1
	HOUER:469 TER:SH4	ETVL	D865	TRANSPARENT TURQUOISE	10BG 6/8	3			3			3			3			3		3
				DEEP TURQUOISE	10BG 5/6	47			47			47			47			47		47
				BLUE GREEN	5BG 6/4	1			1			1			1			1		1
				MEDIUM BRIGHT GREEN	2.5G 5/6	9			9			9			9			9		9
				LIGHT BLUE	10B 7/4	1			1			1			1			1		1
				UNUSUALLY COLOURED BEAD																2
	HOUER:535 TER:SH4	ETVL	D866	LIGHT GREY	N 8.25/63.65	1			1			1					1	1		1
				BLACK	N O.5/0.6%	16		4	12			16			16			16		16
				CELEDON TURQUOISE	5BG 5/6	2			2			2			2			2		2
				MID BLUE	5PB 4/6	183		45	140			183			167	18		183		183
				MEDIUM COPEN BLUE	5PB 6/8	1			1			1			1			1		1
				DARK SHADOW BLUE	10B 4/4	4		3	1			4				4		4		4
				DEEP CELEDON	5BG 4/4	2			2								2	2		2
				LIGHT BLUE	10B 7/4	2			2								2	2		2
				UNUSUALLY COLOURED BEAD																2
	HOUER:541 TER:SH4	ETVL	D867	WEATHERED BEAD																283
				BONE BEAD																1
	HOUER:511 TER:SH4	ETVL	D868	VASELINE YELLOW (TP)	7.5Y 8/8	253		253				253			253			253		253
	HOUER:518 TER:SH4	ETVL	D869	NEUTRAL WHITE	N9.5/90.0%R	1		1				1			1			1		1
				MAUVE PINK	5RP 6/8	323			323			323			323			323		323
				INDIAN RED ON GREEN CORE	7.5R 3/8	1		1				1			1			1		1
				OLIVE YELLOW	7.5Y 7/6	1		1				1			1			1		1
	HOUER:456 TER:SH4	ETVL	D870	VASELINE YELLOW (TP)	7.5Y 8/8	470		470				470			470			470		470
	HOUER:454 TER:SH4	ETVL	D871	MEDIUM BRIGHT GREEN	2.5G 5/6	1		1				1			1			1		1
				MID BLUE	5PB 4/6	562		562				562			562			562		562
				BLACK	N O.5/0.6%	254		254				254			254			254		254
	HOUER:453 TER:SH4 IN KLEI POT	ETVL	D872	INDIAN RED ON GREEN CORE	7.5R 3/8	955						955			955			955		955
	HOUER 514 TER:SH4	ETVL	D873	BLACK & IRREGULAR CREAM STRIPES		5			5			5			5			5		5
	HOUER:462 TER:SH4	ETVL	D874	GREY & OLIVE YELLOW		9			9			9			9			9		9
	HOUER 543 TER:NKW SH4	ETVL	D875	DEEP TURQUOISE	10BG 5/6	2			2			2			2			2		2
	OPPERVLAKTE			MID BLUE	5PB 4/6	4		4				4			4			4		4
	HOUER:569 TER:NKW SH4	ETVL	D876	DEEP TURQUOISE	10BG 5/6	2			2			2			2			2		2
	HOUER:491 TER:NKW SH4	ETVL	D877	INDIAN RED	2.5YR 3/8	4		1	3			4			4			4		4
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1			1			1			1		1
	HOUER 542 TER:NKW SH4	ETVL	D878	VASELINE YELLOW (TP)	7.5Y 8/8	2			2			2			2			2		2
				WEATHERED BEAD																7
	HOUER 566 TER:NKW SH4	ETVL	D879	CREAM/GREY STRIPES		12			12			12			12			12		12

Heading	Layer	Site	Page No.	Bead Colour	Number	Method D	Method W	Structure Type Ia	Structure Type IIa	Structure Type WId IIIf	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
	HOUER:572 TER:NKW SH4	ETVL	D880	BLACK	N O.5/0.6% R	23		1	22			23			23			23		23
	HOUER:494 TER:NKW SH4	ETVL	D881	NEUTRAL WHITE	N9.5/90.0% R	10		10				10			10			10		10
				OYSTER WHITE	5GY 9/1	7		7				7			7			7		7
				INDIAN RED	2.5YR 3/8	1			1			1			1			1		1
				MEDIUM COPEN BLUE	5PB 6/8	1			1			1			1			1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	1		1				1			1			1		1
				STRIPED BEADS		4			4			4			4			4		4
				LIGHT BLUE	10B 7/4	1			1			1			1			1		1
	HOUER:563 TER:NKW SH4	ETVL	D882	OYSTER WHITE	5GY 9/1	2		2				2			2			2		2
				BLACK	N O.5/0.6% R	2		2				2			2			2		2
				GREEN	5GY 5/6	1		1				1			1			1		1
				VASELINE YELLOW (TP)	7.5Y 8/8	30		30				30			30			30		30
				LIGHT MARIGOLD	2.5Y 6/10	1			1			1				1		1		1
				DARK SHADOW BLUE	10B 4/4	1			1			1				1		1		1
				STRIPED BEADS		8			8			8			8			8		8
	HOUER:489 TER:SH4 NKW	ETVL	D883	OYSTER WHITE	5GY 9/1	5		3	2			5			5			5		5
				VASELINE YELLOW (TP)	7.5Y 8/8	3		3				3			3			3		3
				STRIPED BEADS		34			34			34			34			34		34
	HOUER:561 TER:NKW SH4	ETVL	D884	OYSTER WHITE	5GY 9/1	1		1				1			1			1		1
				BLACK	N O.5/0.6% R	43		13	30			43			43			43		43
				MID BLUE	5PB 4/6	2		2				2				2		2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	1		1				1			1			1		1
	HOUER:449 NKW SH4	ETVL	D885	TRIANGULAR SHAPED (UNKNOWN MATERIAL)								208			208					208
	HOUER:496 TER:NKW SH4	ETVL	D886	BLACK	N O.5/0.6% R	1			1			1			1			1		1
				DEEP TURQUOISE	10BG 5/6	6			6			6			6			6		6
				CELEDON TURQUOISE	5BG 5/6	8			8			8			8			8		8
				INDIAN RED	2.5YR 3/8	1			1			1			1			1		1
				LIGHT BLUE	10B 7/4	241		147	94			241			241			241		241
	HOUER:501 TER:NKW SH4	ETVL	D887	DEEP TURQUOISE	10BG 5/6	251			251			251			251			251		251
				CELEDON TURQUOISE	5BG 5/6	2		2			2				2			2		2
				MEDIUM COPEN BLUE	5PB 6/8	5		5				5			5			5		5
	HOUER:507 TER:NKW SH4	ETVL	D888	INDIAN RED	2.5YR 3/8	25			25			25			25			25		25
				VASELINE YELLOW (TP)	7.5Y 8/8	2		2				2			2			2		2
				RUBY ON WHITE CORE	2.5R 3/10	3			3			3			3			3		3
				INDIAN RED ON GREEN CORE	7.5R 3/8	548			548			548			548			548		548
	HOUER:502 TER:NKW SH4	ETVL	D889	BLACK	N O.5/0.6% R	4		4				4			4			4		4
				MID BLUE	5PB 4/6	1449		724	725			1449			1449			1449		1449
				TRIANGULAR X																36

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	W	Structure Type Ia	IIa	WId	IIIf	Size VS	S	M	L	Diaphaneity O	TL	TP	Lusture D	S	Total
	HOUER:520 TER:NKW SH4	ETVL	D890	INDIAN RED	2.5YR 3/8	548			548				548			548			548		548
				VASELINE YELLOW (TP)	7.5Y 8/8	1		1					1			1			1		1
				MAUVE PINK	5RP 6/8	1			1				1			1			1		1
				RUBY ON WHITE CORE	2.5R 3/10	1			1				1				1		1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	187			187				187			187			187		187
				STRIPED BEADS		1			1				1			1			1		1
	HOUER:522 TER:NKW SH KLEIPOT GEVIND	ETVL	D891	OYSTER WHITE	5GY 9/1	1			1				1			1			1		1
				INDIAN RED	2.5YR 3/8	166			166				166			166			166		166
				BRIGHT NAVY (FACETTED)	7.5PB 2/8	1		1					1			1			1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	830			830				830			830			830		830
				STRIPED BEADS		1			1				1			1			1		1
SH5	HOUER:461 TER:SH5	ETVL	D892	TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1	1		1
	HOUER:537 TER:SH5	ETVL	D893	CELEDON TURQUOISE	5BG 5/6	1			1				1					1	1		1
	HOUER:519 TER:SH5	ETVL	D894	DEEP TURQUOISE	10BG 5/6	1			1				1			1			1		1
	HOUER:530 TER:SH5	ETVL	D895	INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
	HOUER:477 TER:SH5	ETVL	D896	BLACK	N O.5/0.6% R										1						1
	HOUER:463 TER:SH5	ETVL	D897	TRANSPARENT TURQUOISE	10BG 6/8	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				MEDIUM COPEN BLUE	5PB 6/8	1			1				1			1			1		1
				BLUE NEUTRAL GREY	5BG 6/1	1			1				1			1			1		1
				LIGHT BLUE	10B 7/4	2			2				2			2			2		2
	HOUER:465 TER:SH5	ETVL	D898	MID BLUE	5PB 4/6	9			9				9			9			9		9
	HOUER:460 TER:SH5	ETVL	D899	INDIAN RED	2.5YR 3/8	11		1	10				10	1		11			10	1	11
				INDIAN RED ON GREEN CORE	7.5R 3/8	4			4				4			4			4		4
	HOUER:495 TER:NKW SH5	ETVL	D900	MEDIUM COPEN BLUE	5PB 6/8	5			5				5			5			5		5
	HOUER:498 TER:NKW SH5	ETVL	D901	KHAKI YELLOW	5Y 7/8	2		2							2	2			2		2
				OLIVE YELLOW	7.5Y 7/6	12		12							12	12			12		12
	HOUER:547 TER:NKW SH5	ETVL	D902	MELTED/FUSED BEADS																	1
	HOUER:521 TER:NKW SH5	ETVL	D903	MID BLUE	5PB 4/6	12			12				12			12			12		12
				MELTED/FUSED BEADS																	84
	HOUER:509 TER:NKW SH5	ETVL	D904	VASELINE YELLOW (TP)	7.5Y 8/8	2		2					2			2			2		2
				OLIVE YELLOW	7.5Y 7/6	83		83					83			83			83		83
				WEATHERED BEAD																	9
	HOUER:473 TER:NKW SH5	ETVL	D905	BLACK	N O.5/0.6% R	72		71	1				72			72			72		72
				MID BLUE	5PB 4/6	253		31	222				253			252	1		253		253
				OLIVE YELLOW	7.5Y 7/6	2			2				2			2			2		2
				WEATHERED BEAD																	13
	HOUER:490 TER:NKW SH5	ETVL	D906	BLACK	N O.5/0.6% R	4		2	2				4			4			4		4
				DEEP TURQUOISE	10BG 5/6	750		375	375				750			750			750		750
	HOUER:487 TER:SH5	ETVL	D907	MID BLUE	5PB 4/6	2			2				2			2			2		2
				MAUVE PINK	5RP 6/8	1			1				1			1			1		1
				BLACK	N O.5/0.6% R	33	302	302	33				335			335			335		335
				DROPLETS OF GLASS																	2
	HOUER:508 TER:NKW SH5	ETVL	D908	INDIAN RED	2.5YR 3/8	95			95				95			95			95		95
				INDIAN RED ON GREEN CORE	7.5R 3/8	859			859				859			859			859		859

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type IIIf	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
MAHLANGENI	HOUER:503 TER:NKW MAHLANGENI	ETVL	D909	INDIAN RED ON GREEN CORE	7.5R 3/8	9		1	8			9			9			9		9
	HOUER:458 TER:NKW MAHLANGENI	ETVL	D910	NEUTRAL WHITE	N9.5/90.0%R	5		5				5			5			5		5
	OPPERVLAKTE			OYSTER WHITE	5GY 9/1	1		1				1			1			1		1
	HOUER:546 TER:NKW MAHLANGENI	ETVL	D911	NEUTRAL WHITE	N9.5/90.0%R	9		9				9			9			9		9
	OPPERVLAKTE			OYSTER WHITE	5GY 9/1	10		9	1			10			10			10		10
				BLACK	N O.5/0.6% R	1		1				1			1			1		1
	HOUER:506 TER:NKW MAHLANGENI	ETVL	D912	BLACK	N O.5/0.6% R	17		2	15			17			17			17		17
	OPPERVLAKTE			DEEP TURQUOISE	10BG 5/6	4		1	3			4				3	1	4		4
				CELEDON TURQUOISE	5BG 5/6	1			1			1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	76		13	63			76				63	13	76		76
				MID BLUE	5PB 4/6	127		33	94			127			87	24	16			127
				DARK SHADOW BLUE	10B 4/4	10		10				10					10	10		10
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1			1			1			1		1
				DEEP RED BROWN	10R 2/4	1			1			1					1	1		1
				LIGHT BLUE	10B 7/4	2			2			2			2			2		2
	HOUER:505 TER:NKW MAHLANGENI	ETVL	D913	BLACK	N O.5/0.6% R	1		1				1			1			1		1
	OPPERVLAKTE			VASELINE YELLOW (TP)	7.5Y 8/8	1		1				1			1			1		1
				MEDIUM COPEN BLUE	5PB 6/8	1		1				1			1			1		1
				MAUVE PINK	5RP 6/8	2			2			2			2			2		2
				RUBY ON WHITE CORE	2.5R 3/10	1			1			1				1		1		1
				INDIAN RED ON GREEN CORE	7.5R 3/8	1427		77	1350			1427			1427			1427		1427
	HOUER:549 TER:NKW MAHLANGENI	ETVL	D914	BLACK	N O.5/0.6% R	1		1				1			1			1		1
	HOUER:516 TER:Ma2 Ma3	ETVL	D915	BLACK	N O.5/0.6% R	112		9	103			112			112			112		112
	STRAT: OPV. VERSAMELING			INDIAN RED	2.5YR 3/8	7		2	5			7			7			7		7
				DEEP RED BROWN	10R 2/4	1			1			1				1		1		1
				OLIVE YELLOW	7.5Y 7/6	1		1				1			1			1		1
	HOUER:536 TER:Ma2 Ma3 STRAT:OPV	ETVL	D916	BRIGHT NAVY	7.5PB 2/8	3			3			3				3		3		3
	VERSAMELING			MID BLUE	5PB 4/6	7			7			7			7			7		7
	HOUER:539 TER:Ma2 Ma3 OPV. VER.	ETVL	D917	BRIGHT NAVY (FACETTED)	7.5PB 2/8	2				2				2		2		2		2
	HOUER:471 TER:Ma2 Ma3 OPV. OP.	ETVL	D918	INDIAN RED	2.5YR 3/8	1			1			1			1			1		1
				MAUVE PINK	5RP 6/8	506			506			506			506			506		506
	HOUER:512 TER:Ma2 Ma3 ST:OPV. OP.	ETVL	D919	SOAPSTONE BEAD (TRIANG. X-SECTION)		296						296			296			296		296
	HOUER:528 TER:Ma2 Ma3 ST:OPV.	ETVL	D920	BLACK	N O.5/0.6% R	2			2			2			2			2		2
	OPNAME			TRANSPARENT TURQUOISE	10BG 6/8	58			58			58			58			58		58
				MEDIUM BRIGHT GREEN	2.5G 5/6	6			6			6			6			6		6
	HOUER:534 TER:Ma2 Ma3 ST:OPV. OP.	ETVL	D921	GREEN GREY	10G 6/2	1		1				1			1			1		1
	HOUER:468 TER:Ma2 Ma3	ETVL	D922	DEEP TURQUOISE	10BG 5/6	6			6			6			6			6		6
	HOUER:488 TER:Ma2 Ma3 STRAT:OPV	ETVL	D923	PALE PINK	10RP 8/4	10			10			10			10			10		10
	HOUER:486 TER:Ma2 Ma3 STRAT:OPV	ETVL	D924	DEEP TURQUOISE	10BG 5/6	328			328			328			328			328		328
				CELEDON TURQUOISE	5BG 5/6	3			3			3			3			3		3
				MEDIUM COPEN BLUE	5PB 6/8	5		1	4			5			5			5		5
	HOUER:497 TER:BKW Ma2 Ma3	ETVL	D925	DEEP TURQUOISE	10BG 5/6	9			9			9			9			9		9
				LIGHT BLUE	10B 7/4	317		317				317			317			317		317

Heading	Layer	Site	Page No.	Bead Colour	Number	Method		Structure Type			Size				Diaphaneity			Lusture		Total
						D	W	Ia	IIa	IIIf	VS	S	M	L	O	TL	TP	D	S	
	HOUER:499 TER:Ma2 Ma3 STRAT:OPV	ETVL	D926	DEEP TURQUOISE	10BG 5/6	5			5			5			5			5		5
				MEDIUM BRIGHT GREEN	2.5G 5/6	1			1			1			1			1		1
	HOUER:504 TER:Ma2 Ma3 STRAT:OPV	ETVL	D927	INDIAN RED	2.5YR 3/8	3			3			3			3			3		3
				BRIGHT NAVY	7.5PB 2/8	1			1			1				1		1		1
				MID BLUE	5PB 4/6	1			1			1			1			1		1
				RUBY ON WHITE CORE	2.5R 3/10	3			3			3				3		3		3
				INDIAN RED ON GREEN CORE	7.5R 3/8	671			671			671			671			671		671
	HOUER:523 TER:NKW Ma2 Ma3	ETVL	D928	OYSTER WHITE	5GY 9/1	5		5			2	3			5			5		5
	STRAT:OPPERVLAKTE			BLACK	N O.5/0.6% R	1			1			1			1			1		1
				VASELINE YELLOW (TP)	7.5Y 8/8	2		2				2			2			2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	3			3			3			3			3		3
				STRIPED BEADS		45		8	37			45			45			45		45
				GREEN GREY	10G 6/2	1			1			1				1		1		1
	HOUER:545 TER:NKW Ma2 Ma3	ETVL	D929	LIGHT MARIGOLD	2.5Y 6/10	2			2			2				2		2		2
	STRAT:OPPERVLAKTE			INDIAN RED ON GREEN CORE	7.5R 3/8	2			2			2			2			2		2
				GREEN GREY	10G 6/2	1			1			1				1		1		1
	HOUER:570 TER:NKW Ma2 Ma3	ETVL	D930	BLACK	N O.5/0.6% R	5			5			5			5			5		5
	HOUER:574 TER:NKW Ma2 ST:OPV.	ETVL	D931	BRIGHT NAVY (FACETTED)	7.5PB 2/8	1				1				1		1			1	1
	HOUER:544 TER:NKW Ma2 ST:OPV.	ETVL	D932	METAL BEAD										1						1
	HOUER:467 TER:NKW Ma2	ETVL	D933	OYSTER WHITE	5GY 9/1	1		1				1			1			1		1
				DEEP TURQUOISE	10BG 5/6	2			2				2			2		2		2
	HOUER:527 TER:NKW Ma2	ETVL	D934	LIGHT BLUE	10B 7/4	7			7			7			7			7		7
	Site: Olifants Rivier																			
	HOUER:411 TER:OL 20.5	ETVL	D935	GREEN	5GY 5/6	1			1			1						1		1
	HOUER:382 TER:OL TERREIN 0120	ETVL	D936	DARK SHADOW BLUE	10B 4/4	1		1				1				1		1		1
	BLOK: TOETSOPGRAWING STRAT: Lg3																			
	LOCATION: Ndebele Project																			
	SITE: Kwamnyamana																			
KWA 2	HOUER:524 TER:KWA 2	ETVL	D937	NEUTRAL WHITE	N9.5/90.0%R	411			411			411			411			411		411
	MIDDEN SURFACE TO 17cm			OYSTER WHITE	5GY 9/1	400			400			399	1		400			400		400
				BLACK	N O.5/0.6% R	3			3			3			3			3		3
				TRANSPARENT TURQUOISE	10BG 6/8	4			4			4			4			4		4
				DEEP TURQUOISE	10BG 5/6	16			16			16			16			16		16
				BRIGHT ORANGE	8.75R 6/14	12			12			12			2		10	12		12
				DEEP SCARLET	2.5YR 3/10	179			179			179				179		179		179
				GREEN GREY	10G 6/6	1			1			1					1	1		1
				DARK GREEN	2.5G 3/6	2			2			2				2		2		2
				MEDIUM BRIGHT GREEN	2.5G 5/6	20			20			20					20	20		20
				YELLOW	7.5Y 8.5/10	1			1			1			1			1		1
				LIGHT MARIGOLD	2.5Y 6/10	4			4			4					4	4		4
				DARK MARIGOLD	7.5YR 6/10	9			9			9					9	9		9
				BRIGHT NAVY	7.5PB 2/8	227			227			227			227			227		227
				MID BLUE	5PB 4/6	1			1			1			1			1		1
				MEDIUM COPEN BLUE	5PB 6/8	2			2			2			2			2		2
				PALE PINK	10RP 8/4	8			8			8			8			8		8
				MAUVE PINK	5RP 6/8	18			18			18			18			18		18
				RUBY ON WHITE CORE	2.5R 3/10	6			6			6				6		6		6

Heading	LOCATION: Eastern Transvaal SITE: Satara	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type Wld	Structure Type If	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture D	Lusture S	Total
SATARA	HOUER:378 TER:SATARA	ETVL	D938	OYSTER WHITE	5GY 9/1	1		1					1			1			1		1
				DEEP TURQUOISE	10BG 5/6	1			1				1			1			1		1
				BLUE GREEN	5BG 6/4	1			1				1			1			1		1
				BRIGHT NAVY	7.5PB 2/8	4				1	3				4		4		4		4
				MID BLUE	5PB 4/6	1		1					1			1			1		1
				PALE PINK	10RP 8/4	1			1				1			1			1		1
				RUBY ON WHITE CORE	2.5R 3/10	2			2				2				2		2		2
				INDIAN RED ON GREEN CORE	7.5R 3/8	1			1				1			1			1		1
				STRIPED BEADS		1			1				1			1			1		1
	LOCATION: Eastern Transvaal SITE: Masorini																				
MASORINI	HOUER:480 TER:MASORINI ST:OPV.	ETVL	D939	BRIGHT NAVY (FACETTED)	7.5PB 2/8	183					183				183		183		183		183
	HOUER:482 TER:MASORINI ST:OPV.	ETVL	D940	BRIGHT NAVY (FACETTED)	7.5PB 2/8	176					176				176		176		176		176
	HOUER:481 TER:MASORINI ST:OPV.	ETVL	D941	BRIGHT NAVY (FACETTED)	7.5PB 2/8	159					159				159		159		159		159
	HOUER:483 TER:MASORINI ST:OPV.	ETVL	D942	BRIGHT NAVY (FACETTED)	7.5PB 2/8	187					187				187		187		187		187
	HOUER:475 TER:MASORINI ST:OPV.	ETVL	D943	BRIGHT NAVY (FACETTED)	7.5PB 2/8	183					183				183		183		183		183
	HOUER:474 TER:MASORINI ST:OPV.	ETVL	D944	BRIGHT NAVY (FACETTED)	7.5PB 2/8	89					89				89		89		89		89
	HOUER:476 TER:MASORINI ST:OPV.	ETVL	D945	BRIGHT NAVY (FACETTED)	7.5PB 2/8	25					25				25		25		25		25
	HOUER:484 TER:MASORINI	ETVL	D946	BRIGHT NAVY (FACETTED)	7.5PB 2/8	17					17				17		17		17		17

APPENDIX IId
Catalogue of beads from Botswana sites

BOTSWANA BEADS

		ALE	BOS	NQO	NYA	RAK	KGA	MAT	TORA	XARO	TOT	TOTAL
NEUTRAL WHITE	N9.5/90.0%R			1	1					3	1	6
OYSTER WHITE	5GY 9/1	1			9					1	1	12
GREEN GREY	10G 6/2		1	1								2
BLACK	N0.5/0.6%R		1	3	1	2	16					23
TRANSPARENT TURQUOISE	10BG 6/8			1			45					46
DEEP TURQUOISE	10BG 5/6				2		2					4
CELEDON TURQUOISE	5BG 5/6		4									4
BLUE GREEN	5BG 6/4		2				17					19
GREEN	5GY 5/6		5								1	6
MEDIUM BRIGHT GREEN	2.5G 5/6		1					1	1		1	4
INDIAN RED	2.5YR 3/8		9				488		22			519
INDIAN RED ON GREEN CORE	7.5R 3/8	1								1		2
YELLOW	7.5Y 8.5/10		1			3					1	5
VASELINE YELLOW	7.5Y 8/8		4						1			5
KHAKI YELLOW	5Y 7/8		1									1
OLIVE YELLOW	7.5Y 7/6		11						2			13
LIGHT MARIGOLD	2.5Y 6/10		2						4			6
DARK MARIGOLD	7.5YR 6/10		1									1
BRIGHT NAVY	7.5PB 2/8	2			6	1				1		10
BRIGHT NAVY (FACETTED)	7.5PB 2/8										10	10
MEDIUM COPEN BLUE	5PB 6/8	1								7	3	11
DARK SHADOW BLUE	10B 4/4	10	5	4						1		20
PALE PINK ON WHITE CORE	10RP 8/4										8	8
MAUVE PINK	5RP 6/8									2	5	7
GARDEN ROLLER BEAD			1									1
BLACK & WHITE STRIPES				2								2
RUBY ON WHITE CORE	2.5R 3/10									2	3	5
STRIPED BEADS					1					1	1	3
BEIGE											1	1
COMPLEX BEAD						3						3
SOAPSTONE BEAD									1			1
BONE BEAD						1						1
ANNULAR BEAD						1					2	3
DIAMOND BEAD						1						1
UNUSUAL COLOUR BEAD				5								5
WEATHERED BEAD				1								1
Total number of beads (n):		15	49	18	20	12	568	1	31	19	38	771

LOCATION: BOTSWANA

SITE: ALEX 2 / KWEBE	Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type WIc	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
Modern	LEVEL 3 25cm TO BASE	BOT	727	OYSTER WHITE	5GY 9/1	1		1						1		1				1	1
				BRIGHT NAVY	7.5PB 2/8	1		1					1				1			1	1
				DARK SHADOW BLUE	10B 4/4	1			1				1				1			1	1
				BRIGHT NAVY FRAGMENT	7.5PB 2/8																1
				MEDIUM COPEN BLUE FRAGMENT	5PB 6/8																1
Modern	LEVEL 2 10 - 25cm	BOT	728	DARK SHADOW BLUE	10B 4/4	7		7					6	1			7			7	7
				INDIAN RED ON GREEN CORE	7.5R 3/8	1		1					1			1				1	1
				DARK SHADOW BLUE FRAGMENT	10B 4/4																2
SITE: BOSUTSWE																					
	SURFACE	BOT	728	MEDIUM BRIGHT GREEN	2.5G 5/6						1				1	1				1	1
				GARDEN ROLLER (BROKEN)																1	1
"Trade wind"	1e-3s 90 - 100 cm	BOT	729	GREEN	5GY 5/6	1			1					1		1				1	1
"Trade wind"	1e-3s 110 - 120 cm	BOT	730	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
"Trade wind"	1e-4s 0 - 10 cm	BOT	731	CELEDON TURQUOISE (BROKEN)	5BG 5/6	1			1				1				1			1	1
"Trade wind"	1e-5s 60 - 70 cm	BOT	732	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
"Trade wind"	1e-6s 0 - 10 cm	BOT	733	INDIAN RED	2.5YR 3/8	1		1					1			1				1	1
"Trade wind"	1e-6s 10 - 20 cm	BOT	734	OLIVE YELLOW	7.5Y 7/6	1		1						1		1				1	1
"Trade wind"	2e-3s 0 - 10 cm	BOT	735	INDIAN RED	2.5YR 3/8	1			1					1		1				1	1
"Trade wind"	2e-3s 30 - 40 cm	BOT	736	KHAKI YELLOW	5Y 7/8	1			1					1		1				1	1
"Trade wind"	2e-4s 0 - 10 cm	BOT	737	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
				INDIAN RED (BROKEN)	2.5YR 3/8	1			1					1		1				1	1
"Trade wind"	2e-5s 20 - 30 cm	BOT	738	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
"Trade wind"	2e-5s 30 - 40 cm	BOT	739	LIGHT MARIGOLD	2.5Y 6/10	1			1					1		1				1	1
"Trade wind"	2e-4s 60 - 70 cm	BOT	740	GREEN	5GY 5/6	1			1					1		1				1	1
?	2e-5s 100 - 110 cm	BOT	741	YELLOW	7.5Y 8.5/10	1		1					1					1		1	1
"Trade wind"	2e-6s 20 - 30 cm	BOT	742	LIGHT MARIGOLD	2.5Y 6/10	1			1					1		1				1	1
?	2e-6s 20 - 30 cm	BOT	743	GREEN	5GY 5/6	1			1					1		1				1	1
?	2e-6s 110 - 120 cm	BOT	744	BLUE GREEN	5BG 6/4	1			1				1				1			1	1
"Trade wind"	4e-4s 40 - 50 cm	BOT	745	INDIAN RED	2.5YR 3/8	1			1				1			1				1	1
"Trade wind"	4e-4s 40 - 50 cm	BOT	746	OLIVE YELLOW	7.5Y 7/6	1			1				1				1			1	1
"Trade wind"	4e-4s 50 - 60 cm	BOT	746	DARK MARIGOLD	7.5YR 6/10	1			1				1			1			1		1
				LIGHT MARIGOLD	2.5Y 6/10	1			1					1		1			1		1
"Trade wind"	4e-5s 20 - 30 cm	BOT	747	INDIAN RED	2.5YR 3/8	1		1					1			1				1	1
"Trade wind"	4e-5s 50 - 60 cm	BOT	748	GREEN (BROKEN)	5GY 5/6	1			1				1			1				1	1
"Trade wind"	4e-5s 60 - 70 cm	BOT	749	OLIVE YELLOW	7.5Y 7/6	1			1				1			1				1	1
"Trade wind"	5e-4s 20 - 30 cm	BOT	750	INDIAN RED	2.5YR 3/8	1			1				1			1				1	1
"Trade wind"	5e-4s 20 - 30 cm	BOT	751	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
"Trade wind"	5e-5s 0 - 10 cm	BOT	752	INDIAN RED	2.5YR 3/8	1			1				1			1				1	1
"Trade wind"	5e-4s 10 - 20 cm	BOT	753	OLIVE YELLOW	7.5Y 7/6	1		1						1		1				1	1
"Trade wind"	5e-4s 15-U-90	BOT	753	INDIAN RED	2.5YR 3/8	1			1				1			1				1	1
"Trade wind"	5e-5s 30 - 40 cm	BOT	754	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
"Trade wind"	19w-1s 30 - 40 cm	BOT	755	GREEN	5GY 5/6	1		1					1			1				1	1
"Trade wind"	20w-0 10 - 20 cm	BOT	756	CELEDON TURQUOISE (BROKEN)	5BG 5/6	1			1					1		1				1	1
"Trade wind"	20w-1s 0 - 10 cm 14-IV-90	BOT	756a	KHAKI YELLOW	5Y 7/8	1			1				1			1				1	1

Period	Layer	Site	UCT acc. No.	Bead Colour	Number	Method D	Method W	Structure Type Ia	Structure Type IIa	Structure Type WIIIb	Structure Type WIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
SITE: BOSUTSWE																					
"Trade wind"	59e-29s 0 - 10 cm	BOT	757	VASELINE YELLOW	7.5Y 8/8	1			1				1			1				1	1
"Trade wind"	59e-29s 0 - 10 cm	BOT	758	OLIVE YELLOW	7.5Y 7/6	1		1						1		1				1	1
Early Iron Age	59e-29s 80 - 90 cm	BOT	759	DARK SHADOW BLUE	10B 4/4	1		1						1						1	1
Early Iron Age	59e-29 120 - 130 cm 13-V-90	BOT	760	BLACK	N O.5/0.6% R	1							1			1				1	1
Early Iron Age	59e-60s 100 - 110 cm	BOT	761	DARK SHADOW BLUE	10B 4/4	1			1				1				1			1	1
Early Iron Age	59e-60s 100 - 110 cm	BOT	762	BLUE GREEN	5BG 6/4	1		1					1				1			1	1
"Trade wind"	60e-28s 30 - 40 cm	BOT	763	INDIAN RED	2.5YR 3/8	1		1					1			1				1	1
"Trade wind"	60e-28s 30 - 40 cm	BOT	764	OLIVE YELLOW	7.5Y 7/6	1			1					1		1				1	1
Early Iron Age	60e-28s 100 - 110 cm	BOT	765	DARK SHADOW BLUE	10B 4/4	1		1					1				1			1	1
				GREEN GREY	10G 6/2	1		1					1			1				1	1
Early Iron Age	60e-29s 70 - 80 cm	BOT	766	DARK SHADOW BLUE	10B 4/4	1		1					1				1			1	1
Early Iron Age	60e-29s 80 - 90 cm	BOT	766	DARK SHADOW BLUE	10B 4/4	1			1				1				1			1	1
BOSUTSWE KG I	10 - 20 cm	BOT	767	CELEDON TURQUOISE (BROKEN)	5BG 5/6	1			1					1		1				1	1
	I 10 - 20 cm	BOT	768	CELEDON TURQUOISE	5BG 5/6	1			1					1		1				1	1
SITE: NQOMA																					
Early Iron Age	232W 122N 0 - 10 cm	BOT	769	NEUTRAL WHITE	N9.5/90.0% R	1			1					1		1				1	1
Early Iron Age	41. 28S 20 - 30 cm	BOT	770	GREEN GREY	10G 6/2	1			1				1				1			1	1
Early Iron Age	180W 110N 20 - 30 cm	BOT	771	UNKNOWN COLOUR (BROKEN)		1			1				1			1				1	1
Early Iron Age	180. 90N 20 - 30 cm	BOT	772	DARK SHADOW BLUE	10B 4/4	1		1						1		1				1	1
Early Iron Age	180. 120N 40 - 50 cm	BOT	773	BLACK	N O.5/0.6% R	1		1						1		1				1	1
				UNIDENTIFIABLE BEAD																	1
Early Iron Age	80. 62S 40 - 50 cm	BOT	774	DARK SHADOW BLUE	10B 4/4	1		1						1				1		1	1
Early Iron Age	120W 60N 50 - 60 cm	BOT	775	UNKNOWN COLOUR (BROKEN)		1			1				1			1				1	1
Early Iron Age	180W 107N 60 - 70 cm	BOT	776	UNKNOWN COLOUR		1			1				1			1				1	1
Early Iron Age	181 - 105N 60 - 70 cm 18/6/83	BOT	777	DARK SHADOW BLUE	10B 4/4	1		1						1			1			1	1
Early Iron Age	00. 31N 60 -70 cm	BOT	778	DARK SHADOW BLUE	10B 4/4	1		1						1			1			1	1
				UNKNOWN COLOUR																	1
Early Iron Age	40.00 60 - 70 cm E1A	BOT	779	TRANSPARENT TURQUOISE	10BG 6/8	1		1					1					1		1	1
Early Iron Age	61W 59N 70 - 80 cm	BOT	780	BLACK	N O.5/0.6% R	2		2						2		2				2	2
Early Iron Age				DARK BROWN/BLACK WITH WHITE STRIPE																	2
	61W 59N 90 - 100 cm	BOT	781	UNKNOWN COLOUR																	1
SITE: NYAE NYAE																					
	SITE 13-A78 SURFACE	BOT	782	OYSTER WHITE	5GY 9/1	9			9				5	4		9				9	9
				BLACK	N O.5/0.6% R	1			1				1			1					1
	SITE A31-A36 SURFACE	BOT	783	NEUTRAL WHITE	N9.5/90.0% R	1			1				1			1				1	1
				DEEP TURQUOISE	10BG 5/6		2		2					1	1		2			2	2
				BRIGHT NAVY	7.5PB 2/8	6		6						6			6			6	6
				STRIPED BEADS		1			1					1		1				1	1
SITE: RAKOPS																					
Modern	SURFACE	BOT	784	BLACK	N O.5/0.6% R		2														2
Modern				ANNULAR BEAD	7.5PB 2/8		1		1						1		1				1
Modern				YELLOW	7.5Y 8.5/10		3	3							3	3					3
Modern				COMPLEX BEAD (BLACK WITH WHITE SPOTS)											2	2					2
Modern				COMPLEX BEAD (BLUE, WHITE, RUBY SQUIGGLES ON TQS)											1						1
Modern				BRIGHT NAVY	7.5PB 2/8		1			1					1			1			1
Modern				DIAMOND SHAPE BEAD	10BG 5/6										1						1
				BONE BEAD											1						1
SITE: KGASWE	B55 HUT FLOOR, IN POT. EARLY IRON AGE	BOT	785	BLACK	N O.5/0.6% R	16			6				6			6				6	6
				DEEP TURQUOISE	10BG 5/6	2		2					2				2			2	2
				INDIAN RED	2.5YR 3/8	488		488					•••			488				488	488
				TRANSPARENT TURQUOISE	10BG 6/8	13		13					13				13			13	13
				BLUE GREEN	5BG 6/4	17		17					17				17			17	17

Heading	Layer	Site	UCT Page No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type Ia	Structure Type IIa	Structure Type WIIIb	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
SITE: MATLAPENG																				
	281.275 55 - 65 cm EIA	BOT	786	MEDIUM BRIGHT GREEN	2.5G 5/6	1		1					1			1			1	1
SITE: TORA NJU																				
"Trade Wind"	1 0 - 10 cm	BOT	787	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 0 - 10 cm	BOT	788	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	1 10 - 20 cm	BOT	789	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 10 - 20 cm	BOT	790	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 10 - 20 cm	BOT	791	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 20 - 30 cm	BOT	792	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 20 - 30 cm	BOT	793	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	1 30 - 40 cm	BOT	794	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 30 - 40 cm	BOT	795	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	1 50 - 60 cm	BOT	796	OLIVE YELLOW	7.5Y 7/6	1			1			1			1				1	1
"Trade Wind"	1 100 - 110 cm	BOT	797	VASELINE YELLOW	7.5Y 8/8	1		1				1			1				1	1
"Trade Wind"	2 0 - 10 cm	BOT	798	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	2 0 - 10 cm	BOT	799	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	2 0 - 10 cm	BOT	800	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	2 20 - 30 cm	BOT	801	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	2 40 - 50 cm	BOT	802	LIGHT MARIGOLD	2.5Y 6/10	1			1			1			1				1	1
"Trade Wind"	2 50 - 60 cm	BOT	803	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	3 0 - 10 cm	BOT	804	OLIVE YELLOW	7.5Y 7/6	1		1				1			1				1	1
"Trade Wind"	3 10 - 20 cm	BOT	805	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
	3 20 - 30 cm	BOT	806	SOAPSTONE BEAD																1
"Trade Wind"	4 0 - 10 cm	BOT	807	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	4 10 - 20 cm	BOT	808	LIGHT MARIGOLD	2.5Y 6/10	1			1			1			1				1	1
"Trade Wind"	4 10 - 20 cm	BOT	809	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	4 10 - 20 cm	BOT	810	LIGHT MARIGOLD	2.5Y 6/10	1			1			1			1				1	1
"Trade Wind"	4 10 - 20 cm	BOT	811	MEDIUM BRIGHT GREEN	2.5G 5/6	1			1			1			1				1	1
"Trade Wind"	4 30 - 40 cm	BOT	812	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	5 0 - 10 cm	BOT	813	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	5 0 - 10 cm	BOT	814	INDIAN RED	2.5YR 3/8	1			1				1		1				1	1
"Trade Wind"	5 0 - 10 cm	BOT	815	INDIAN RED	2.5YR 3/8	1			1			1			1				1	1
"Trade Wind"	5 10 - 20 cm	BOT	816	LIGHT MARIGOLD	2.5Y 6/10	1			1			1			1				1	1
"Trade Wind"	5 10 - 20 cm	BOT	817	INDIAN RED	2.5YR 3/8	1		1				1			1				1	1
SITE: XARO																				
Modern	XARO 1 2 10 - 20 cm	BOT	818	INDIAN RED ON GREEN CORE	7.5R 3/8	1			1			1			1				1	1
Modern	Motor boat site	BOT	819	OYSTER WHITE	5GY 9/1	1			1						1				1	1
Modern	UNIT 3b 10 - 25 cm 26-02-86'			BRIGHT NAVY	7.5PB 2/8	1		1					1			1			1	1
				MEDIUM COPEN BLUE	5PB 6/8	6			6				6		6				6	6
				DARK SHADOW BLUE	10B 4/4	1		1					1		1				1	1
				MAUVE PINK	5RP 6/8	2			2			2			2				2	2
				RUBY ON WHITE CORE	2.5R 3/10	1			1				1			1		1		1
				NEUTRAL WHITE	N9.5/90.0%R		2			2				2			2			2
Modern	XARO 1 4 10 - 20 cm	BOT	820	NEUTRAL WHITE	N9.5/90.0%R	1		1				1			1				1	1
				MEDIUM COPEN BLUE	5PB 6/8	1			1			1			1				1	1
				STRIPED BEADS		1			1			1			1				1	1
Modern	XARO 1 11N 5W 30 - 40 cm	BOT	821	RUBY ON WHITE CORE	2.5R 3/10	1			1			1				1			1	1

	Layer	Site	UCT acc. No.	Bead Colour	Munsell Number	Manufacturing Method D	Manufacturing Method W	Structure Type IIa	Structure Type WId	Structure Type If	Structure Type WIIIa	Size VS	Size S	Size M	Size L	Diaphaneity O	Diaphaneity TL	Diaphaneity TP	Lusture S	Lusture D	Total
SITE: TOTENG																					
Modern	SURFACE	BOT	822	BRIGHT NAVY (FACETTED)	7.5PB 2/8										1						1
Modern	T.P.B. 60 - 80 cm	BOT	823	MEDIUM BRIGHT GREEN	2.5G 5/6	1		1					1				1			1	1
Modern	T.P.B. 40 - 60 cm	BOT	824	PALE PINK WITH WHITE CORE	10RP 8/4	1		1					1			1				1	1
Modern	T.P.C. 30 - 40 cm	BOT	825	PALE PINK WITH WHITE CORE	10RP 8/4	1		1					1			1				1	1
Modern	T.P.1. 50 - 60 cm	BOT	826	MEDIUM COPEN BLUE	5PB 6/8	1		1					1			1				1	1
Modern	T.P.2. 50 - 60 cm	BOT	827	BRIGHT NAVY (FACETTED) FRAG.	7.5PB 2/8																2
Modern	T.P.C. 60 - 80 cm	BOT	828	MAUVE PINK	5RP 6/8	1		1					1			1				1	1
Modern	T.P.B. 60 - 80 cm	BOT	829	PALE PINK WITH WHITE CORE	10RP 8/4	1		1					1			1				1	1
Modern	TRENCH:3 70 - 80 cm	BOT	830	GREEN FRAGMENTS	5GY 5/6																1
Modern	T.P.6. 70 - 80 cm	BOT	831	STRIPED BEADS		1		1					1			1				1	1
Modern	TRENCH:6 70 - 80 cm	BOT	832	RUBY ON WHITE CORE	2.5R 3/10	1		1					1				1			1	1
Modern	T.P.1. 80 - 90 cm	BOT	833	ANNULAR BEAD		1			1						1	.		1		1	1
				MAUVE PINK	5RP 6/8	2		2					2			2				2	2
Modern	T.P.2.B. 80 - 90 cm	BOT	834	BRIGHT NAVY (FACETTED)	7.5PB 2/8										1						1
Modern	T.P.C. 80 - 100 cm	BOT	835	PALE PINK WITH WHITE CORE	10RP 8/4	2		2					2			2				2	2
Modern	TRENCH:5 80 - 90 cm	BOT	836	PALE PINK WITH WHITE CORE	10RP 8/4	1		1					1			1				1	1
				MAUVE PINK	5RP 6/8	1		1					1			1				1	1
				BRIGHT NAVY (FACETTED) FRAG.	7.5PB 2/8										1						1
Modern	TRENCH:6 70 - 81 cm	BOT	837	BRIGHT NAVY (FACETTED)	7.5PB 2/8										1						1
Modern	T.P.9. 80 - 90 cm	BOT	838	BRIGHT NAVY (FACETTED)	7.5PB 2/8	2				•					2		2			2	2
Modern	T.P.1. 80 - 90 cm	BOT	839	OYSTER WHITE	5GY 9/1	1		1					1			1				1	1
				PALE PINK WITH WHITE CORE	10RP 8/4	1		1					1			1				1	1
				MAUVE PINK	5RP 6/8	1		1					1			1				1	1
Modern	TOM'S HOLE 80 - 100 cm	BOT	840	BRIGHT NAVY (FACETTED)	7.5PB 2/8	1				•					1		1			1	1
Modern	TRENCH:3 80 - 90 cm	BOT	841	RUBY ON WHITE CORE	2.5R 3/10		2				2				2	2				2	2
Modern	TRENCH:2 90 - 100 cm	BOT	842	BRIGHT NAVY (FACETTED)	7.5PB 2/8										1						1
				BEIGE											1						1
				WOUND BEAD FRAGMENT																	
Modern	T.P.1. 90 - 100 cm	BOT	843	MEDIUM COPEN BLUE	5PB 6/8	2		2					2			2				2	2
Modern	TRENCH:5 90 - 100 cm	BOT	844	NEUTRAL WHITE	N9.5/90.0%R		1								1					1	1
Modern	TRENCH:6 90 - 100 cm	BOT	845	GREEN FRAGMENTS	5GY 5/6																
Modern	T.P.C. 100 - 120 cm	BOT	846	PALE PINK WITH WHITE CORE	10RP 8/4		1	1						1		1				1	1
Modern	T.P.1. 80 - 90 cm	BOT	847	ANNULAR BEAD FRAGMENT																	1
Modern	UNIT 4 120 - 130 cm	BOT	848	YELLOW	7.5Y 8.5/10	1		1							1	1				1	1
	TRENCH:2 40 - 50 cm	BOT	849	FRAGMENTS OF UNIDENTIFIABLE COLOUR																	

APPENDIX III. A summary of Claire Davison's (1972) neutron activation analyses of glass beads

East Coast & Indian Ocean

Gedi (*ca* 1399)	GED	Tanzania
Kaole House (*ca.* 1400)	KAO	Tanzania
Engaruka (1400-1500)	ENG	Tanzania
Kilwa (1150-1300)	KIL	East Africa
Kilwa (Gereza)(1800)	GER	East Africa
Fort Jesus (1800-1900)	FJE	East Africa
Zanzibar	ZAN	East Africa
Siraf	SIR	Iran
Vohemar (1550-1570)	VOH	North East Madagascar
Kab'wan	KAB	Philippines
Manunggol	MAN	Philippines
Santa Ana	STA	Philippines
Porac	POR	Philippines
Butong	BUT	Philippines
Calatagan	CAL	Philippines

Southern Africa

Makoli	MAK	Botswana?
Lusaka	LUS	Zambia
Ingombe Iledi (1340-1445)	ING	Zimbabwe
Dambarare (1570-1750)	DAM	Zimbabwe
Luanze	LUA	Zimbabwe/Moçambique
Nyangwe Fort (1500-1600)	NYA	Zimbabwe
Matendere	MAT	Zimbabwe
Chibvumani	CHI	Zimbabwe
Dhlo-Dhlo (1800)	DHL	Zimbabwe
Khami (1600-!700)	KHA	Zimbabwe
Mjelele Valley (1800)	MJE	Zimbabwe
Sofala	SOF	Mocambique
Bambandyanalo (950-1050)	BAM	N. Transvaal, South Africa
Mapungubwe (1150-)	MAP	N. Transvaal, South Africa
Modjadje (1937)	MOD	N. Transvaal, South Africa

West Africa

Ife (800-900)+(1300)	IFE	Nigeria
Igbu Ukwu (800)	IGB	Nigeria
Ita Yemoo	ITA	Nigeria
Orun Oba Ado	ORU	Nigeria
Olokun	OLO	Nigeria

	1 Mapungubwe "Mapungubwe Chemical Group"	2 Bambandyanalo "Mapungubwe Chemical Group"	3 Bambandyanalo "M1 Chemical Group" Skeletons No's 43 & 45	4 Bambandyanalo "M1 Chemical Group" Garden Roller	5 N.Transvaal & Dhlo-Dhlo Series A Heirloom Beads	6 N.Transvaal & Dhlo-Dhlo Series B Heirloom Beads	7 TWBCG Trade Wind East Africa Coast	8 TWBCG Resembling Trade Wind	9 Ife Group 1	10 Ife Class II	11 Igbo Ukw Class I	12 Igbo Ukw Class II	13 Igbo Ukw Class III	14 Igbo Ukwu Class IV
	Table 2a	Table 2	Table 4a	Table 4b	Table 5b	Table 5c	Table 6	Table IIa	Table 17a	Table 20	Table 22a	Table 22b	Table 22c	Table 23
	n=17	n=8	n=29	n=5	n=23	n=17	n=130	n=20	n=3	n=9	n=36	n=7	n=3	n=3
Na	11.66	11.97	13.45	13.73	15.16	9.15	14.06	11.04	1.92	8.22	10.22	6.10	9.12	3.34
K%	2.00	3.25	3.00	3.00	2.00	4.00	2.30	6.00	4.74	6.00	2.80	3.20	3.00	3.20
Cl	1.13	0.57	0.74	0.87	1.57	1.41	1.33	0.60	0.20	0.75	0.64	0.50	1.30	0.16
Al	4.66	3.44	4.29	3.82	3.44	0.83	3.52	3.04	5.81	2.78	0.02	4.24	2.01	7.26
Fe	0.90	1.08	1.04	1.01	1.26	0.52	1.84	1.22	1.13	0.79	0.55	2.20	0.85	0.27
Mg	3.00	5.00	3.00	3.00	2.00	0.73	5.00	4.00	3.60	3.00	6.00	3.20	ND	2.00
Ca	8.05	5.33	4.93	3.82	4.52	7.52	4.42	9.00	10.00	7.70	4.63	3.20	2.01	14.88
Pb	4.80	0.05	0.15	0.10	0.03	0.09	0.21	0.00	0.05	0.05	0.00	0.00	0.00	0.00
Sc	3.33	4.36	4.26	4.07	4.43	1.42	5.60	3.23	1.74	2.44	1.61	2.83	3.09	0.88
Cr	30.51	0.00	0.00	0.00	25.04	20.88	66.00	0.00	95.00	52.78	106.00	104.00	40.80	27.00
Mn	1358.10	7340.90	292.20	232.60	303.80	837.60	430.80	499.20	2520.00	475.30	6143.00	608.00	530.00	554.30
Co	7.00	10.28	6.66	5.30	613.27	2607.00	193.90	36.86	344.60	2424.05	277.58	43.41	24.35	9.02
Cu	3296.10	375.00	5031.10	5180.20	2685.50	49488.80	2451.00	6246.00	275.10	8614.00	3040.00	6139.00	1058.00	233.00
Zn	191.06	197.55	98.72	92.67	170.00	100.00	181.30	41.66	300.00	135.10	200.00	452.00	460.00	75.00
Ag	10.09	2.00	4.70	4.10	3.00	3.00	60.00	29.00	0.00	ND	4.70	4.50	12.00	2.00
Sn	2250.03	1082.65	321.80	205.80	63.60	82.60	1136.00	400.00	107.50	130.00	4875.00	172.80	121.10	110.00
Sb	136.54	8.96	21.78	17.50	5.44	804.10	11.66	17.87	22.10	31.13	7.86	19.01	19.54	1.20
Cs	0.60	0.83	2.10	1.10	1.50	3.70	1.30	1.20	6.42	11.00	0.76	5.53	3.38	2.63
Ba	347.50	458.70	17.70	ND	ND	ND	ND	ND	251.40	450.00	203.00	2.32	184.20	156.30
Hf	2.41	3.04	12.40	11.69	4.29	2.00	5.59	8.78	1.13	2.48	3.23	2.21	2.48	0.97
Ta	0.79	0.76	0.55	92.67	0.54	0.22	0.63	0.36	0.87	0.53	0.25	0.82	0.61	1.21
La	6.32	5.03	0.00	0.00	0.00	5.31	0.00	0.00	10.12	8.64	6.90	16.48	8.24	4.09
Sm	1.43	1.80	4.28	4.22	2.95		4.26	2.06	2.60	1.93	1.04	1.62	1.50	1.22
Ce	13.32	22.26	0.00	0.00	0.00	6.00	0.00	0.00	26.60	30.00	12.70	20.27	20.80	16.83
Eu	3.08	0.46	0.72	0.61	0.55	0.90	0.80	0.20	0.80	0.60	0.25	0.38	0.48	0.27
Yb	1.11	1.35	1.59	1.65	0.92	5.00	1.30	0.88	0.81	0.96	0.69	0.88	1.54	0.82
U	0.80	1.12	33.15	63.21	69.12	4.11	104.00	3.86	1.27	0.70	0.83	1.02	0.83	0.82

Mapungubwe Oblates

"Mapungubwe Chemical Group". TABLE 2a (pp. 81-87)

Blue/Green	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
MAP 16	13.16	8.05	2.87	3.00	2.00	1.04	<0.1	1.13	411.0	6123.0	1.35	6.32	1.52	1.45	0.6	0.39	7.91	3.85	3.67	517.0	111.00	7040.0	42.70	3.12	54.0	4.6	17.00	0.46
MAP 17	12.79	8.05	2.73	3.00	2.00	0.81	<0.1	1.13	417.0	6699.0	0.70	6.32	1.46	1.43	0.6	0.94	10.77	3.88	3.42	400.0	113.00	6441.0	41.70	2.47	37.0	4.6	17.80	0.41
MAP-18	12.95	8.05	2.76	3.00	2.00	2.16	<0.1	1.13	417.0	6985.0	1.69	6.32	3.66	1.34	0.6	2.16	8.07	79.67	7.59	170.0	22.20	<200	46.70	3.84	344.0	4.6	33.40	0.88
MAP 19	13.31	8.05	3.39	3.00	2.00	1.02	<0.1	1.13	423.0	7345.0	0.85	6.32	1.51	1.26	0.6	0.37	11.76	5.05	3.72	644.0	131.20	7634.0	38.50	2.35	70.0	4.6	17.60	0.24
MAP 20	12.70	8.05	2.53	3.00	2.00	0.98	<0.1	1.13	371.0	5993.0	0.80	6.32	1.59	1.06	0.6	0.24	9.96	3.24	3.74	371.0	200.00	7355.0	43.50	2.34	66.0	4.6	15.20	0.24
MEAN	12.98	8.05	2.86	0.00	0.00	1.27	0.00	0.00	0.0	0.0	0.0	6.32	0.00	0.00	0.0	0.82	9.69	19.14	4.43	420.4	115.48	5694.0	42.62	2.82	114.2	4.6	20.20	12.98
STD	0.23	0.00	0.29	0.00	0.00	0.60	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.71	1.50	30.27	1.59	158.0	56.78	2874.5	2.66	0.58	115.5	0.0	6.66	0.23
Black																												
MAP-10	12.78	8.05	2.91	3.00	2.00	0.70	0.02	1.13	388.0	600.0	0.47	6.32	1.05	0.63	0.6	0.27	2.96	2.98	2.40	297.0	1.20	ND	26.00	1.94	35.0	0.7	12.40	0.37
MAP-11	13.03	8.05	3.55	3.00	2.00	0.74	0.02	1.13	387.0	600.0	0.86	6.32	1.23	0.73	0.6	0.33	4.33	3.53	2.78	320.0	1.30	ND	28.50	1.74	48.0	0.7	14.90	0.32
MAP-12	12.78	8.05	2.80	3.00	2.00	0.72	0.02	1.13	484.0	600.0	0.85	6.32	1.40	1.00	0.6	0.87	6.47	3.87	3.33	302.0	6.40	ND	28.70	2.14	57.0	0.7	15.10	0.42
MAP 13	11.66	8.05	3.54	3.00	2.00	0.70	0.02	1.13	535.0	600.0	0.77	6.32	1.16	0.82	0.6	0.31	6.94	5.19	2.89	317.0	5.10	ND	33.40	2.30	52.0	0.7	15.40	0.36
MAP-14	12.39	8.05	3.28	3.00	2.00	0.93	0.02	1.13	498.0	600.0	1.05	6.32	1.75	1.31	0.6	0.57	12.71	3.37	3.88	340.0	9.70	ND	58.90	2.29	63.0	0.7	21.60	0.46
MAP-15	12.26	8.05	4.59	3.00	2.00	0.94	0.02	1.13	408.0	600.0	1.00	6.32	1.81	1.06	0.6	0.88	13.13	4.69	4.04	515.0	4.10	ND	48.60	2.88	81.0	0.7	20.00	0.58
MEAN	12.48	8.05	3.45	3.00	2.00	0.79	0.02	1.13	450.0	600.0	0.83	6.32	1.40	0.93	0.6	0.54	7.76	3.94	3.22	348.5	4.63	ND	37.35	2.22	56.0	0.7	16.57	0.42
STD	0.45	0.00	0.59	0.00	0.00	0.10	0.00	0.00	58.1	0.0	0.19	0.00	0.29	0.23	0.0	0.26	3.88	0.77	0.59	75.7	2.95	0.0	12.17	0.36	14.1	0.0	3.18	0.09
Green (5GY 5/																												
MAP-27	9.80	8.05	3.12	3.00	2.00	0.95	6.70	1.13	418.0	8644.0	0.69	6.32	1.38	1.37	0.6	1.37	16.92	5.53	3.33	353.0	167.50	10.7	34.90	2.75	667.0	23.0	16.30	1.37
MAP-28	9.67	8.05	2.81	3.00	2.00	0.85	6.70	1.13	379.0	8659.0	0.81	6.32	1.44	1.47	0.6	1.47	7.85	4.37	3.38	502.0	185.50	12.1	52.30	3.65	809.0	23.0	17.10	1.47
MEAN	9.74	8.05	2.98	3.00	2.00	0.90	6.70	1.13	398.5	8651.5	0.75	6.32	1.41	1.42	0.6	1.42	12.39	4.95	3.36	427.5	176.50	11.4	43.60	3.20	738.0	23.0	16.70	1.42
STD	0.06	0.00	0.14	0.00	0.00	0.05	0.00	0.00	19.5	7.5	0.06	0.00	0.03	0.05	0.0	0.05	4.54	0.58	0.03	74.5	9.00	0.7	8.70	0.45	71.0	0.0	0.40	0.05
Yellow (5Y 7/1)																												
MAP-23	12.47	8.05	3.39	3.00	2.00	0.61	6.30	ND	2383.0	600.0	0.40	6.32	0.79	0.43	0.6	0.21	3.62	3.31	1.89	283.0	18.90	3815.0	17.00	1.28	33.0	7.0	8.40	0.29
MAP-24	12.41	8.05	3.93	3.00	2.00	1.03	6.30	ND	2169.0	600.0	0.79	6.32	1.45	1.15	0.6	0.45	7.52	4.94	3.61	478.0	40.90	7214.0	37.10	2.49	40.0	7.0	17.30	0.51
MEAN	12.44	8.05	3.66	3.00	2.00	0.82	6.30	ND	2276.0	600.0	0.60	6.32	1.12	0.79	0.6	0.33	5.57	4.13	2.75	380.5	29.90	5514.5	27.05	1.89	36.5	7.0	12.85	0.40
STD	0.03	0.00	0.27	0.00	0.00	0.21	0.00	0.00	107.0	0.0	0.19	6.32	0.33	0.36	0.0	0.12	1.95	0.82	0.86	97.5	11.00	1699.5	10.05	0.60	3.5	0.0	4.45	0.11
Orange (10YR 5/6)																												
MAP-25	11.28	8.05	2.49	3.00	2.00	0.82	10.00	ND	3352.0	600.0	0.88	6.32	1.31	1.00	0.6	0.44	8.49	4.51	2.84	471.0	78.60	14928.0	29.90	2.40	7167.0	10.6	14.40	0.25
MAP-26	10.64	8.05	2.14	3.00	2.00	0.70	10.00	ND	3165.0	600.0	0.64	6.32	1.23	1.15	0.6	1.20	6.78	5.81	2.89	426.0	73.50	14806.0	30.60	1.48	6912.0	10.6	15.90	0.27
MEAN	10.96	8.05	2.32	3.00	2.00	0.76	10.00	ND	3258.5	600.0	0.76	6.32	1.27	1.08	0.6	0.82	7.64	5.16	2.87	448.5	76.05	14867.0	30.25	1.94	7039.5	10.6	15.15	0.26
STD	0.32	0.00	0.17	0.00	0.00	0.06	0.00	0.00	93.5	0.0	0.12	0.00	0.04	0.07	0.0	0.38	0.85	0.65	0.02	22.5	2.55	61.0	0.35	0.46	127.5	0.0	0.75	0.01
Bambandyanalo																												
"Mapungubwe Chemical Group". TABLE 2 (pp. 88-94)																												
Black																												
BAM-S18a	13.44	7.03	2.90	5.00	2.50	1.10	<0.04	1.06	387.0	400.0	1.19	8.95	1.75	1.12	0.8	0.86	12.15	4.42	4.08	375.0	3.00	180.0	259.30	3.29	72.0	1.0	19.00	0.47
BAM-S18b	13.17	7.03	2.54	5.00	2.50	0.86	<0.04	1.06	530.0	400.0	1.11	8.95	1.60	1.00	0.8	0.47	6.90	3.65	3.86	441.0	1.20	180.0	37.50	2.46	45.0	1.0	19.00	0.47
BAM-S18c	13.52	7.03	1.98	5.00	2.50	0.83	<0.04	1.06	472.0	400.0	0.62	8.95	1.46	0.81	0.8	0.38	4.41	4.66	3.42	462.0	1.60	180.0	33.20	2.23	48.0	1.0	16.90	0.47
BAM S21a	12.98	7.03	2.52	5.00	2.50	0.83	<0.04	1.06	554.0	400.0	0.73	8.95	1.52	0.89	0.8	0.61	8.39	8.92	3.67	423.0	3.60	180.0	39.80	2.50	48.0	1.0	18.20	0.42
BAM-21b	12.96	7.03	3.73	5.00	2.50	1.10	<0.04	1.06	581.0	400.0	0.63	8.95	1.57	1.12	0.8	0.72	8.50	11.49	3.64	451.0	8.00	180.0	42.80	2.85	51.0	1.0	16.40	0.50
MEAN	13.21	7.03	2.73	5.00	2.50	0.94	<0.04	1.06	504.8	400.0	0.86	8.95	1.58	0.99	0.8	0.61	8.07	6.63	3.73	430.4	3.48	180.0	82.52	2.67	52.8	1.0	17.90	0.46
STD	0.23	0.00	0.58	0.00	0.00	0.13	0.00	0.00	69.0	0.0	0.24	0.00	0.09	0.12	0.0	0.17	2.52	3.05	0.22	30.5	2.43	0.0	88.45	0.37	9.8	0.0	1.07	0.02
Purple																												
BAM S29b1	10.00	3.62	3.84	5.00	4.00	1.12	0.50	0.74	13378.0	350.0	1.28	11.11	1.83	1.22	1.7	0.69	21.12	14.26	4.49	631.0	12.70	1849.0	45.10	3.54	343.0	3.0	22.40	0.54
BAM-S29b2	11.45	3.62	4.25	5.00	4.00	1.25	0.50	0.74	15079.0	350.0	1.29	11.11	2.07	1.63	1.7	0.81	29.15	15.35	5.18	741.0	13.70	1977.0	60.40	3.12	335.0	3.0	27.70	0.48
BAM-S29b3	10.76	3.62	4.39	5.00	4.00	1.30	0.50	0.74	14074.0	350.0	1.53	11.11	2.16	2.25	1.7	1.21	35.01	12.18	5.32	602.0	16.90	2130.0	76.70	3.54	349.0	3.0	29.80	0.31
MEAN	10.74	3.62	4.16	5.00	4.00	1.22	0.50	0.07	14177.0	350.0	1.37	1.11	2.02	1.70	1.7	0.90	28.43	13.93	5.00	658.0	14.43	1985.3	60.73	3.40	342.3	3.0	26.63	0.44
STD	0.59	0.00	0.23	0.00	0.00	0.08	0.00	0.00	698.2	0.0	0.12	0.00	0.14	0.42	0.0	0.22	5.69	1.32	0.36	59.9	1.79	114.9	12.90	0.20	5.7	0.0	3.11	0.10

Bambandyanalo Skeletons No's 43 & 45

"MI Chemical Chemical Group" TABLE 4a (pp. 100-105)

Blue/Green TP	Na%	Ca%	Al%	Mg%	K%	Fe%	Pb%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
BAM S43a	14.58	4.83	4.21	3.00	3.00	0.89	<.08	0.75	256.0	3245.0	16.47	ND	4.25	1.40	2.1	0.47	38.18	4.40	3.59	ND	16.70	431.0	ND	11.10	119.0	4.7	ND	0.72
BAM S43b	14.89	4.83	4.95	3.00	3.00	1.03	<.08	0.78	279.0	3073.0	19.62	ND	4.27	1.55	2.1	0.46	36.76	5.34	3.85	ND	18.60	439.0	ND	10.36	124.0	4.7	ND	0.72
BAM S43c	14.76	4.83	3.93	3.00	3.00	1.05	<.08	0.97	267.0	3355.0	19.14	ND	4.03	1.39	2.1	0.38	37.03	4.41	3.69	ND	18.00	436.0	ND	10.77	117.0	4.7	ND	0.72
BAM S43d	15.15	4.83	5.53	3.00	3.00	0.90	<.08	0.82	262.0	3742.0	16.05	ND	4.46	1.49	2.1	0.44	40.48	4.98	3.89	ND	19.20	493.0	ND	12.07	118.0	4.7	ND	0.72
BAM S43e	14.76	4.83	4.45	3.00	3.00	0.97	<.08	0.50	263.0	3338.0	17.79	ND	4.46	1.42	2.1	0.37	38.48	5.34	3.71	ND	18.20	485.0	ND	9.05	97.0	4.7	ND	0.72
BAM S43f	15.41	4.83	4.91	3.00	3.00	1.04	<.08	0.65	262.0	3724.0	19.56	ND	4.29	1.42	2.1	0.44	38.74	5.58	4.11	ND	18.00	455.0	ND	10.31	102.0	4.7	ND	0.72
BAM S43g	14.61	4.83	3.82	3.00	3.00	1.16	<.08	0.89	263.0	3392.0	21.33	ND	4.20	1.57	2.1	0.56	31.17	5.17	3.82	ND	21.00	480.0	ND	9.64	122.0	4.7	ND	0.72
BAM S43h	14.85	4.83	4.50	3.00	3.00	1.04	<.08	0.66	239.0	3426.0	20.22	ND	4.28	1.76	2.1	0.43	30.49	5.37	3.76	ND	20.00	479.0	ND	12.50	126.0	4.7	ND	0.72
BAM S43i	11.76	4.83	3.77	3.00	3.00	0.95	<.08	0.70	254.0	3470.0	20.48	ND	4.12	1.55	2.1	0.41	28.83	5.45	3.72	ND	28.90	485.0	ND	10.94	108.0	4.7	ND	0.72
BAM S43j	14.51	4.83	4.25	3.00	3.00	1.03	<.08	0.53	253.0	3298.0	19.06	ND	4.39	1.43	2.1	0.45	29.74	5.60	3.98	ND	22.40	489.0	ND	11.65	107.0	4.7	ND	0.72
BAM S43k	14.78	4.83	4.22	3.00	3.00	1.01	<.08	0.33	251.0	3271.0	18.63	ND	4.41	1.33	2.1	0.43	29.11	5.49	4.00	ND	22.00	477.0	ND	10.62	92.0	4.7	ND	0.72
BAM S43l	14.85	4.83	4.20	3.00	3.00	1.00	<.08	0.41	229.0	3098.0	19.81	ND	4.02	1.45	2.1	0.40	31.18	5.44	3.80	ND	21.20	461.0	ND	9.46	105.0	4.7	ND	0.72
BAM S43m	15.02	4.83	4.09	3.00	3.00	1.03	<.08	0.44	242.0	3784.0	18.07	ND	4.61	1.25	2.1	0.49	32.93	5.70	3.93	ND	20.50	490.0	ND	12.11	121.0	4.7	ND	0.72
BAM S43n	11.69	4.83	3.89	3.00	3.00	1.07	<.08	0.22	168.0	9297.0	26.04	ND	6.39	1.66	2.1	0.44	44.55	13.82	4.12	ND	18.30	99.0	ND	12.22	42.0	4.7	ND	0.72
BAM S43p	14.56	4.83	5.82	3.00	3.00	1.15	<.08	0.79	475.0	6873.0	24.03	ND	3.94	1.48	2.1	0.46	28.27	6.38	4.22	ND	30.00	133.0	ND	7.46	133.0	4.7	ND	0.72
BAM S43q	13.71	4.83	3.39	3.00	3.00	0.93	<.08	0.66	242.0	5581.0	25.11	ND	3.90	1.72	2.1	0.42	24.78	4.95	3.71	ND	17.60	76.0	ND	7.42	38.0	4.7	ND	0.72
BAM S45a	14.52	4.83	5.04	3.00	3.00	1.09	<.13	0.66	279.0	4631.0	67.19	ND	5.87	2.53	2.1	0.74	70.35	6.34	5.70	ND	22.80	297.0	ND	21.92	103.0	4.7	ND	0.72
BAM-S45b	13.42	4.83	5.76	3.00	3.00	1.14	<.13	0.71	332.0	5568.0	23.53	ND	2.91	1.69	2.1	0.78	49.86	5.08	6.32	ND	15.60	145.0	ND	24.86	38.0	4.7	ND	0.72
BAM-S45c	12.99	4.83	4.73	3.00	3.00	0.99	<.13	0.68	324.0	5023.0	21.97	ND	2.84	1.18	2.1	0.72	44.92	4.65	5.94	ND	16.60	174.0	ND	14.70	41.0	4.7	ND	0.72
BAM S45d	14.09	4.83	4.09	3.00	3.00	1.11	<.13	0.64	224.0	5110.0	41.19	ND	2.71	1.25	2.1	0.63	18.02	6.07	4.84	ND	29.00	399.0	ND	8.48	117.0	4.7	ND	0.72
BAM-S45e	12.97	4.83	4.22	3.00	3.00	1.56	<.13	0.68	285.0	8169.0	33.04	ND	4.03	1.54	2.1	0.63	20.16	8.34	4.83	ND	18.60	208.0	ND	11.21	82.0	4.7	ND	0.72
BAM S45f	11.27	4.83	3.61	3.00	3.00	0.96	<.13	1.70	485.0	4807.0	122.74	ND	3.89	1.26	2.1	0.57	24.02	6.69	4.32	ND	22.70	255.0	ND	8.98	127.0	4.7	ND	0.72
BAM-S45g	13.56	4.83	4.68	3.00	3.00	1.29	<.13	0.97	323.0	9846.0	27.96	ND	4.65	2.03	2.1	0.66	29.68	7.28	4.82	ND	35.90	190.0	ND	13.67	88.0	4.7	ND	0.72
BAM-S45h	13.74	4.83	3.23	3.00	3.00	1.16	<.13	1.12	336.0	9570.0	27.03	ND	4.51	1.07	2.1	0.61	27.01	7.26	5.13	ND	33.00	168.0	ND	12.37	79.0	4.7	ND	0.72
BAM-S45i	12.54	4.83	4.59	3.00	3.00	0.76	<.13	0.38	219.0	6905.0	23.23	ND	7.79	2.77	2.1	0.57	31.82	18.02	3.53	ND	26.60	334.0	ND	19.37	207.0	4.7	ND	0.72
BAM-S45j	7.37	7.70	4.83	3.00	6.00	0.51	0.12	0.88	365.0	11361.0	0.39	ND	2.29	1.01	2.1	0.45	2.61	7.21	1.75	450.0	28.20	130.0	ND	3.26	22.0	4.7	ND	0.72
BAM S45k	11.70	4.83	4.82	3.00	3.00	1.16	<.13	1.08	394.0	3179.0	84.85	ND	4.06	1.61	2.1	0.56	21.98	7.07	4.70	ND	21.10	250.0	ND	11.11	124.0	4.7	ND	0.72
BAM-S45l	11.46	4.83	3.31	3.00	3.00	1.10	<.13	0.65	319.0	2791.0	82.24	ND	4.34	2.64	2.1	1.48	16.96	7.59	4.78	ND	11.50	116.0	ND	30.28	43.0	4.7	ND	0.72
BAM-S45m	11.60	4.83	4.45	3.00	3.00	1.18	<.13	1.22	384.0	2975.0	84.65	ND	4.10	1.74	2.1	0.62	22.69	8.03	4.90	ND	19.50	259.0	ND	11.59	121.0	4.7	ND	0.72
MEAN	13.57	4.93	4.29	3.00	3.00	1.04	0.00	0.74	292.2	5031.1	33.15	ND	4.27	1.59	2.1	0.55	31.75	6.66	4.26	15.5	21.78	321.8	ND	12.40	98.7	4.7	ND	0.72
STD	1.71	0.52	0.80	0.00	0.00	0.17	0.02	0.29	71.6	2402.9	27.09	ND	1.03	0.42	0.0	0.21	11.97	2.79	0.86	82.1	5.47	148.6	0.00	5.35	38.4	0.0	0.00	0.00

Bambandyanalo

"MI Chemical Group" Garden Roller. TABLE 4b (pp. 106-111)

Blue/Green	Na%	Ca%	Al%	Mg%	K%	Fe%	Pb%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
BAM P18a	13.67	3.60	3.83	3.00	3.00	1.09	<0.1	1.20	249.0	3629.0	101.93	ND	4.81	1.53	1.1	0.53	23.34	5.62	3.63	ND	20.00	211.00	ND	8.21	154.0	4.1	ND	0.61
BAM P18b	13.74	3.60	3.75	3.00	3.00	1.21	<0.1	0.71	276.0	6200.0	44.70	ND	4.70	2.61	1.1	0.74	53.40	5.07	5.49	ND	14.30	112.0	ND	22.20	67.0	4.1	ND	0.61
MST-1	14.87	3.60	3.75	3.00	3.00	0.90	<0.1	0.69	191.0	6160.0	25.36	ND	4.45	1.31	1.1	0.36	33.81	4.04	3.48	ND	12.20	62.0	ND	8.11	110.0	4.1	ND	0.61
MAP GRX	10.48	3.60	4.06	3.00	3.00	1.04	<0.1	0.96	250.0	5055.0	95.11	ND	4.13	1.53	1.1	0.56	29.43	5.96	4.15	ND	19.80	285.0	ND	10.02	108.0	4.1	ND	0.61
MAP-GRX2	15.88	3.60	3.73	3.00	3.00	0.82	<0.1	0.81	197.0	4857.0	48.95	ND	3.02	1.25	1.1	0.66	24.21	5.83	3.59	ND	21.20	359.0	ND	9.92	117.0	4.1	ND	0.61
MEAN	13.73	3.60	3.82	3.00	3.00	1.01	<0.1	0.87	232.6	5180.2	63.21	ND	4.22	1.65	1.1	0.57	32.84	5.30	4.07	ND	17.50	205.8	ND	11.69	92.7	4.1	ND	0.61
STD	1.82	0.00	0.12	0.00	0.00	0.14	0.00	0.19	33.0	951.5	29.98	0.00	0.65	0.50	0.0	0.13	10.95	0.70	0.75	0.0	3.57	108.9	0.00	5.32	27.7	0.0	0.00	0.00

TWBCG "Trade Wind Beads" East African Coast
TABLE 6 (pp. 177-197) Continued

"Indian" red	Na_2O	CaO%	Al_2O_3%	MgO	K_2O	Fe_2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)
LHA 4a	14.11	4.42	3.88	5.00	2.30	2.66	0.32	1.42	510.0	4250.0	69.89	ND	5.13	1.62	1.3	0.65	79.24
DAM 1a	16.16	4.42	3.72	5.00	2.30	2.66	ND	1.51	766.0	5443.0	131.64	ND	3.74	1.28	1.3	0.48	27.82
DAM 1b	16.34	4.42	3.55	5.00	2.30	2.47	ND	1.02	534.0	5002.0	138.07	ND	3.16	1.04	1.3	0.44	23.55
DAM 1c	15.77	4.42	3.12	5.00	2.30	2.69	ND	1.73	555.0	4846.0	140.38	ND	3.90	1.48	1.3	0.45	25.72
DAM 2a	13.50	4.12	3.70	5.00	2.30	2.57	ND	1.03	517.0	6407.0	98.00	ND	4.85	1.86	1.3	0.73	62.67
DAM 2b	14.97	4.42	4.16	5.00	2.30	3.80	ND	1.39	539.0	5163.0	89.50	ND	4.04	1.35	1.3	0.50	17.90
MAT-1	14.06	4.42	4.40	5.00	2.30	3.75	ND	1.61	312.0	5347.0	99.27	ND	4.06	1.41	1.3	0.54	28.13
VOH 1	12.76	4.42	4.28	5.00	2.30	3.21	ND	0.56	429.0	6312.0	87.81	ND	4.96	2.01	1.3	0.65	20.33
VOH 2	12.89	4.42	4.19	5.00	2.30	3.13	ND	0.61	436.0	6470.0	89.25	ND	5.01	2.02	1.3	0.63	20.11
KIL-IR11	13.04	4.42	3.62	5.00	2.30	4.20	ND	1.12	404.0	5542.0	69.73	ND	4.54	3.61	1.3	1.93	40.36
KIL-IR12	16.84	4.42	4.74	5.00	2.30	2.41	ND	1.53	582.0	1740.0	175.53	ND	6.37	2.26	1.3	1.11	32.81
KIL-IR14	13.82	4.42	4.58	5.00	2.30	2.73	ND	1.16	267.0	2585.0	84.70	ND	27.73	1.51	1.3	1.37	24.70
KIL-IR15	16.69	4.42	3.26	5.00	2.30	2.83	ND	1.47	346.0	2227.0	121.95	ND	3.73	1.14	1.3	0.63	18.07
KIL-IR16	16.79	4.42	3.22	5.00	2.30	2.81	ND	1.58	352.0	2210.0	120.60	ND	3.80	1.08	1.3	0.51	17.91
KIL-IR17	14.17	4.42	4.27	5.00	2.30	2.36	ND	1.12	513.0	1339.0	191.30	ND	5.90	1.93	1.3	0.90	32.22
KIL-IR18	16.84	4.42	3.32	5.00	2.30	3.02	ND	1.40	506.0	1440.0	113.00	ND	3.79	1.08	1.3	0.51	17.36
BAM-S38a	13.12	4.42	4.47	5.00	2.30	3.82	ND	1.14	597.0	6173.0	83.98	ND	6.01	2.55	1.3	1.12	29.36
BAM-S38b	12.96	4.42	4.42	5.00	2.30	2.60	ND	1.26	387.0	3749.0	169.50	ND	4.65	2.19	1.3	0.80	69.92
BAM-S38c	9.73	4.42	4.86	5.00	2.30	2.41	ND	0.68	532.0	4107.0	73.30	ND	5.54	2.92	1.3	1.55	25.29
BAM-S38d	12.33	4.42	4.44	5.00	2.30	2.76	ND	1.03	405.0	4383.0	98.16	ND	3.73	2.14	1.3	0.80	32.18
CHI-2	16.23	4.42	3.10	5.00	2.30	1.25	ND	1.49	267.0	6765.0	121.60	ND	2.39	0.98	1.3	0.54	10.30
KHA-4770a	14.60	4.42	3.27	5.00	2.30	3.38	ND	1.30	540.0	4873.0	141.90	ND	5.47	1.37	1.3	0.59	15.36
KHA-4770b	16.18	4.42	4.48	5.00	2.30	3.66	ND	1.43	543.0	7624.0	27.80	ND	4.64	1.80	1.3	0.57	19.98
ENG-IR10	13.20	4.42	ND	5.00	2.30	3.04	ND	ND	502.0	5275.0	151.50	ND	8.91	2.29	1.3	0.93	25.51
MAN-23a1	8.75	4.42	3.97	5.00	2.30	3.97	ND	0.48	818.0	22632.0	89.30	ND	4.72	2.16	1.3	1.00	12.98
MAN-23a2	8.64	4.42	3.86	5.00	2.30	3.86	ND	0.50	817.0	25381.0	87.20	ND	4.64	2.18	1.3	0.81	12.68
POR-34	ND	4.42	5.09	5.00	2.30	5.09	ND	1.00	ND	<500	54.50	ND	4.00	1.86	1.3	0.81	21.52
MEAN	13.72	4.42	3.83	5.00	2.30	3.01	ND	1.16	489.4	5994.0	110.80	ND	5.38	1.77	1.3	0.78	27.50
STD	3.46	0.00	0.91	0.00	0.00	0.78	0.00	0.42	167.9	5282.6	37.65	0.00	4.40	0.62	0.0	0.35	16.36
Beads Resembling TWCG. TABLE IIa (pp.209-215).																	
Blue/Green																	
KIL-GM1	12.98	9.00	2.99	4.00	6.00	0.77	ND	0.99	427.0	6269.0	0.59	ND	1.10	0.52	1.2	0.25	2.09
BUT-175A	14.37	9.00	5.06	4.00	6.00	0.86	ND	0.28	760.0	6952.0	5.44	ND	2.76	1.58	1.2	0.50	7.10
BUT-175B	14.57	9.00	4.84	4.00	6.00	0.93	ND	0.13	743.0	7086.0	5.27	ND	2.70	1.74	1.2	0.50	7.29
MEAN	13.97	9.00	4.30	4.00	6.00	0.85	ND	0.47	643.3	6769.0	3.77	ND	2.19	1.28	1.2	0.42	5.49
STD	0.71	0.00	0.93	0.00	0.00	0.07	0.00	0.38	153.1	357.8	2.25	0.00	0.77	0.54	0.0	0.12	2.41
Blue																	
KIL-HKCV3	10.26	9.00	ND	4.00	6.00	1.59	ND	ND	1322.0	700.0	1.31	ND	1.35	0.64	1.2	0.31	1.70
ING-B8	13.64	9.00	ND	4.00	6.00	0.54	ND	ND	484.0	6325.0	0.13	ND	0.93	0.34	1.2	0.23	0.89
MEAN	11.95	9.00	ND	4.00	6.00	1.07	ND	ND	903.0	3512.5	0.72	ND	1.14	0.49	1.2	0.27	1.30
STD	1.69	0.00	0.00	0.00	0.00	0.53	0.00	0.00	419.0	2812.5	0.59	0.00	0.21	0.15	0.0	0.04	0.41
Black																	
MIF-15B	12.06	9.00	3.13	4.00	6.00	1.01	ND	0.81	610.0	700.0	1.19	ND	1.46	0.71	1.2	0.36	1.92
Green																	
SIR-3295	12.30	9.00	4.29	4.00	6.00	1.17	ND	0.63	661.0	4323.0	7.76	ND	3.28	1.17	1.2	0.52	8.01
BUT-174A	13.10	9.00	3.90	4.00	6.00	1.19	ND	0.25	574.0	5566.0	8.35	ND	3.33	1.19	1.2	0.53	8.23
BUT-174B	13.32	9.00	4.39	4.00	6.00	1.12	ND	0.88	534.0	4818.0	8.34	ND	3.27	1.12	1.2	0.53	7.86
MEAN	12.91	9.00	4.19	4.00	6.00	1.12	ND	0.59	589.7	4902.3	8.15	ND	3.29	1.16	1.2	0.53	8.03
STD	0.14	0.00	0.21	0.00	0.00	0.03	0.00	0.26	53.0	510.9	0.28	0.00	0.03	0.03	0.00	0.00	0.15

"Indian" red	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
LHA 4a	9.90	6.16	ND	5.00	852.0	66.00	14.74	208.0	60.0	ND	0.80
DAM 1a	30.86	5.20	ND	4.80	1003.0	66.00	5.64	182.0	60.0	ND	0.80
DAM 1b	26.95	5.45	ND	4.80	63.0	66.00	5.08	153.0	60.0	ND	0.80
DAM 1c	27.95	5.52	ND	5.00	868.0	66.00	6.65	134.0	60.0	ND	0.80
DAM 2a	17.05	5.91	ND	7.60	990.0	66.00	12.72	151.0	60.0	ND	0.80
DAM 2b	34.56	8.84	ND	3.10	<200	66.00	5.32	86.0	60.0	ND	0.80
MAT-1	11.59	7.47	ND	14.80	<200	66.00	6.96	39.0	60.0	ND	0.80
VOH 1	29.21	8.01	ND	19.90	235.0	66.00	7.46	426.0	60.0	ND	0.80
VOH 2	28.05	7.94	ND	20.90	286.0	66.00	5.31	411.0	60.0	ND	0.80
KIL-IR11	18.06	10.66	ND	33.50	2665.0	66.00	43.22	239.0	60.0	ND	0.80
KIL-IR12	17.13	8.76	ND	4.00	281.0	66.00	6.56	293.0	60.0	ND	0.80
KIL-IR14	5.78	5.65	ND	7.30	<200	66.00	11.82	37.0	60.0	ND	0.80
KIL-IR15	21.74	6.97	ND	7.20	296.0	66.00	2.89	154.0	60.0	ND	0.80
KIL-IR16	21.71	6.92	ND	7.20	311.0	66.00	2.94	147.0	60.0	ND	0.80
KIL-IR17	17.36	7.77	ND	3.70	344.0	66.00	6.02	91.0	60.0	ND	0.80
KIL-IR18	14.31	7.40	ND	7.60	299.0	66.00	2.38	52.0	60.0	ND	0.80
BAM-S38a	12.11	7.97	ND	38.70	546.0	66.00	18.15	308.0	60.0	ND	0.80
BAM-S38b	7.53	5.80	ND	19.30	261.0	66.00	15.66	168.0	60.0	ND	0.80
BAM-S38c	7.29	6.72	ND	22.90	394.0	66.00	33.08	164.0	60.0	ND	0.80
BAM-S38d	8.89	6.83	ND	31.00	214.0	66.00	18.75	155.0	60.0	ND	0.80
CHI-2	17.75	4.14	ND	24.60	1355.0	66.00	2.31	180.0	60.0	ND	0.80
KHA-4770a	23.25	8.18	ND	13.20	177.0	66.00	3.51	86.0	60.0	ND	0.80
KHA-4770b	44.47	8.64	ND	10.00	321.0	66.00	7.14	96.0	60.0	ND	0.80
ENG-IR10	22.59	8.70	ND	27.60	<200	66.00	5.24	74.0	60.0	ND	0.80
MAN-23a1	26.15	7.16	ND	8.10	<200	66.00	4.79	130.0	60.0	ND	0.80
MAN-23a2	63.12	7.15	ND	4.80	<200	66.00	4.98	130.0	60.0	ND	0.80
POR-34	5.97	6.75	ND	4.80	<200	66.00	14.68	36.0	60.0	ND	0.80
MEAN	22.62	6.99	ND	12.77	411.1	66.00	9.70	159.3	60.0	ND	8.80
STD	13.39	1.53	0.0	10.18	539.3	0.00	9.17	96.9	0.0	0.00	0.00
Beads Resembling TWCG. TABLE IIa (pp.209-215).											
Blue/Green											
KIL-GM1	6.97	2.63	ND	14.10	1767.0	ND	1.88	68.0	29.0	ND	0.20
BUT-175A	8.65	3.69	ND	10.60	480.0	ND	14.56	33.0	29.0	ND	0.20
BUT-175B	8.45	3.49	ND	11.10	480.0	ND	15.59	30.0	29.0	ND	0.20
MEAN	8.02	3.27	ND	11.93	909.0	ND	10.68	43.7	29.0	ND	0.20
STD	0.75	0.46	0.0	1.55	606.7	0.00	6.23	17.2	0.0	0.00	0.00
Blue											
KIL-HKCV3	392.26	3.11	ND	1.50	480.0	ND	2.52	<1.00	29.0	ND	0.20
ING-B8	3.84	1.91	ND	13.90	2373.0	ND	1.48	72.0	29.0	ND	0.20
MEAN	198.05	2.51	ND	7.70	1426.5	ND	2.00	36.0	29.0	ND	0.20
STD	194.21	0.60	0.00	6.20	946.5	0.00	0.52	36.0	0.00	0.00	0.00
Black											
MIF-15B	8.59	3.48	ND	7.10	400.0	ND	2.40	58.0	29.0	ND	0.20
Green											
SIR-3295	13.54	4.81	ND	1.90	1820.0	ND	15.04	28.0	29.0	ND	0.20
BUT-174A	17.14	4.16	ND	9.30	2414.0	ND	15.78	59.0	29.0	ND	0.20
BUT-174B	15.67	4.07	ND	4.70	2368.0	ND	18.29	63.0	29.0	ND	0.20
MEAN	15.45	4.35	ND	5.30	2200.7	ND	16.37	50.0	29.0	ND	0.20
STD	1.48	0.33	0.00	3.05	269.8	0.0	1.39	15.6	0.0	0.0	0.0

TWBCG "Trade Wind Beads" East African Coast

TABLE 6 (pp. 177-197) Continued

Black	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
KIL GRY10	15.28	4.42	4.17	5.00	2.30	2.17	ND	1.81	450.0	<500	238.38	ND	6.20	2.09	1.3	1.36	35.60	12.61	8.00	ND	0.70	<200	66.00	5.57	48.0	60.0	ND	0.80
KIL GRY11	16.71	4.42	4.09	5.00	2.30	2.20	ND	1.55	466.0	<500	147.37	ND	6.12	2.13	1.3	1.15	47.79	11.50	8.86	ND	4.40	550.0	66.00	7.08	78.0	60.0	ND	0.80
KIL GRY12	15.50	4.42	4.28	5.00	2.30	2.31	ND	1.58	288.0	<500	102.24	ND	3.56	1.06	1.3	0.55	17.54	7.26	6.22	ND	3.80	1441.0	66.00	3.82	20.0	60.0	ND	0.80
CHI GRY17	17.18	4.42	3.35	5.00	2.30	1.79	ND	1.78	404.0	<500	89.48	ND	4.00	1.11	1.3	0.50	28.63	9.13	5.67	ND	3.80	922.0	66.00	2.86	50.0	60.0	ND	0.80
CHI GRY18	9.60	4.42	2.15	5.00	2.30	1.39	ND	0.80	240.0	<500	60.48	ND	2.72	0.98	1.3	0.41	11.41	5.52	4.54	ND	0.70	1104.0	66.00	2.85	32.0	60.0	ND	0.80
CHI GRY19	11.69	4.42	5.21	5.00	2.30	2.40	ND	1.71	517.0	<500	307.58	ND	8.14	2.51	1.3	1.47	30.87	13.12	9.97	ND	3.50	1643.0	66.00	6.42	87.0	60.0	ND	0.80
NYA GRY16	17.21	4.42	4.09	5.00	2.30	2.65	ND	1.48	442.0	<500	277.64	ND	6.41	2.31	1.3	0.91	26.02	15.68	8.29	ND	1.70	1698.0	66.00	4.96	126.0	60.0	ND	0.80
ING GRY2	13.91	4.42	ND	5.00	2.30	2.37	ND	ND	300.0	<500	100.45	ND	6.03	1.51	1.3	0.89	20.96	8.60	8.06	ND	16.10	2052.0	66.00	6.81	93.0	60.0	ND	0.80
ING GRY13	16.57	4.42	3.51	5.00	2.30	2.04	ND	1.33	505.0	<500	127.71	ND	5.94	2.08	1.3	1.01	22.00	11.74	7.89	ND	0.40	1974.0	66.00	4.82	32.0	60.0	ND	0.80
ING GRY14	11.70	4.42	3.50	5.00	2.30	1.52	ND	1.57	352.0	<500	325.57	ND	4.39	1.28	1.3	0.66	18.67	10.25	5.20	ND	1.40	2269.0	66.00	4.38	45.0	60.0	ND	0.80
MEAN	15.43	4.42	3.77	5.00	2.30	1.83	0.00	1.39	416.3	0.0	132.83	ND	5.11	1.70	1.3	0.87	27.45	9.86	6.68	ND	5.05	798.1	66.00	5.08	50.5	60.0	ND	0.80
STD	1.61	0.00	1.31	0.00	0.00	0.58	0.00	0.52	80.8	0.0	92.90	0.00	0.00	0.00	0.0	0.38	11.07	3.42	2.23	0.0	12.40	787.4	0.00	1.85	26.8	0.0	0.00	0.00
Orange																												
FIE A7-1	14.14	4.42	2.69	5.00	2.30	1.04	7.30	1.32	1041.0	<500	125.11	ND	2.62	0.98	1.3	0.35	18.47	7.72	3.63	ND	89.50	12419.0	66.00	5.03	3080.0	60.0	ND	0.80
KIL MBG5	13.35	4.42	3.22	5.00	2.30	1.29	ND	1.58	316.0	<500	213.45	ND	3.98	1.02	1.3	0.54	14.30	14.91	4.74	ND	9.60	7140.0	66.00	2.90	2383.0	60.0	ND	0.80
MAK-1	15.05	4.42	3.69	5.00	2.30	0.83	ND	1.10	437.0	<500	179.12	ND	2.78	1.06	1.3	0.46	11.24	9.99	3.17	ND	138.00	9010.0	66.00	3.30	2231.0	60.0	ND	0.80
MEAN	14.18	4.42	3.20	5.00	2.30	1.05	2.43	1.33	598.0	<500	172.56	ND	3.13	1.02	1.3	0.45	14.67	10.87	3.85	ND	79.03	9523.0	66.00	3.74	2564.7	60.0	ND	0.80
STD	0.69	0.00	0.41	0.00	0.00	0.19	3.44	0.20	317.1	0.0	36.36	0.00	0.61	0.03	0.0	0.08	2.96	3.00	0.66	0.0	52.94	2185.5	0.00	0.92	369.6	0.0	0.00	-
Pale Cobalt Blue																												
FIE X-1	14.17	4.42	2.95	5.00	2.30	1.32	0.02	1.57	872.0	<500	65.83	ND	2.56	1.09	1.3	0.33	14.11	229.64	4.20	ND	1.00	<200	66.00	6.40	ND	60.0	ND	0.80
Cobalt Blue																												
FIE-A-1	15.22	4.42	3.91	5.00	2.30	1.29	0.02	1.55	655.0	<500	84.47	ND	2.32	0.74	1.3	0.50	10.93	756.04	3.64	ND	2.70	<200	66.00	2.49	ND	60.0	ND	0.80
LUA-9a	14.32	4.42	5.01	5.00	2.30	2.25	0.08	1.11	431.0	1912.0	82.24	ND	3.18	0.90	1.3	0.52	21.60	1006.00	5.56	ND	3.50	846.0	66.00	4.00	ND	60.0	ND	0.80
LUA-9b	14.49	4.42	3.91	5.00	2.30	1.78	0.08	1.52	302.0	<500	173.21	ND	3.93	1.23	1.3	0.51	14.96	482.38	6.26	ND	0.60	<200	66.00	3.30	ND	60.0	ND	0.80
DAM-3	15.30	4.42	3.30	5.00	2.30	1.35	ND	1.18	322.0	<500	124.94	ND	3.76	0.82	1.3	0.36	20.49	323.32	3.53	ND	0.80	<200	66.00	3.41	ND	60.0	ND	0.80
MAT 10	14.53	4.42	4.05	5.00	2.30	1.41	ND	1.23	868.0	<500	59.50	ND	3.84	1.66	1.3	0.60	29.77	809.27	5.03	ND	0.90	<200	1.23	11.75	ND	60.0	ND	0.80
DHL-1352a	14.42	4.42	3.30	5.00	2.30	1.40	0.03	2.00	262.0	<500	80.33	ND	4.55	1.32	1.3	0.72	18.24	929.00	4.83	ND	3.70	99.1	36.60	4.30	ND	60.0	ND	0.80
DHL-1352b	15.29	4.42	3.56	5.00	2.30	1.01	0.03	1.70	299.0	<500	41.83	ND	2.26	0.81	1.3	0.41	14.06	879.00	3.24	ND	2.00	99.1	15.70	4.30	ND	60.0	ND	0.80
DHL-1352c	15.67	4.42	4.37	5.00	2.30	1.34	0.03	1.23	308.0	<500	64.17	ND	3.24	1.36	1.3	0.60	24.07	968.00	5.05	ND	3.10	99.1	35.20	4.30	ND	60.0	ND	0.80
DHL-1352d	16.10	4.42	4.42	5.00	2.30	1.70	0.03	1.91	311.0	<500	91.12	ND	3.68	0.61	1.3	0.57	21.08	1418.00	5.70	ND	4.00	99.1	30.00	4.30	ND	60.0	ND	0.80
DHL-1352e	15.34	4.42	2.95	5.00	2.30	1.21	0.03	1.52	367.0	<500	40.62	ND	2.05	0.42	1.3	0.45	14.38	780.00	4.26	ND	3.20	99.1	30.00	4.30	ND	60.0	ND	0.80
VOH-5	14.93	4.42	3.64	5.00	2.30	2.07	ND	2.06	401.0	<500	74.56	ND	4.53	0.85	1.3	0.57	21.96	1613.00	6.21	ND	3.00	<200	66.00	5.67	ND	60.0	ND	0.80
VOH 6	14.61	4.42	4.27	5.00	2.30	1.83	ND	1.52	399.0	<500	153.64	ND	4.40	0.97	1.3	0.74	29.49	1694.00	6.77	ND	3.50	328.0	66.00	5.84	ND	60.0	ND	0.80
GER-2a	16.27	4.42	3.81	5.00	2.30	1.63	ND	1.57	304.0	<500	79.14	ND	3.47	0.54	1.3	0.48	18.96	1339.00	5.33	ND	2.20	<200	66.00	3.61	ND	60.0	ND	0.80
GER-2b	15.85	4.42	3.64	5.00	2.30	1.50	ND	1.76	296.0	<500	74.93	ND	3.29	0.80	1.3	0.45	18.75	1274.00	5.22	ND	1.20	<200	66.00	3.14	ND	60.0	ND	0.80
GER-2c	16.04	4.42	3.72	5.00	2.30	1.70	ND	1.57	294.0	<500	77.17	ND	3.37	0.69	1.3	0.49	18.64	1334.00	5.14	ND	1.30	<200	66.00	3.48	ND	60.0	ND	0.80
GER-2d	16.19	4.42	3.24	5.00	2.30	1.53	ND	1.80	287.0	<500	77.54	ND	3.40	0.77	1.3	0.49	18.74	1344.00	5.03	ND	0.90	<200	66.00	4.10	ND	60.0	ND	0.80
GER-2e	16.05	4.42	2.83	5.00	2.30	1.58	ND	1.68	292.0	<500	76.68	ND	3.38	0.76	1.3	0.51	18.62	1316.00	4.97	ND	1.80	<200	66.00	4.18	ND	60.0	ND	0.80
MOD-5a	14.91	4.42	3.81	5.00	2.30	1.60	ND	1.60	365.0	<500	79.00	ND	4.17	1.12	1.3	0.58	25.07	1709.00	6.01	ND	2.90	<200	66.00	7.40	ND	60.0	ND	0.80
MOD-5b	15.05	4.42	3.45	5.00	2.30	1.59	ND	1.44	368.0	<500	98.45	ND	3.36	0.82	1.3	0.88	20.93	1400.00	4.93	ND	2.80	<200	66.00	5.48	ND	60.0	ND	0.80
MOD-5c	15.28	4.42	3.71	5.00	2.30	1.40	ND	2.69	272.0	<500	79.69	ND	3.45	0.52	1.3	0.62	36.72	1064.00	5.44	ND	2.20	<200	66.00	4.15	ND	60.0	ND	0.80
MEAN	15.30	4.20	3.75	5.00	2.30	1.56	ND	1.63	370.2	<500	85.66	ND	3.48	0.89	1.3	0.55	20.87	1121.90	5.11	ND	2.32	84.5	53.64	4.68	ND	60.0	ND	0.80
STD	0.62	0.00	0.51	0.00	0.00	0.28	0.00	0.35	142.1	0.0	31.42	0.00	0.68	0.30	0.0	0.12	5.86	374.99	0.89	0.0	1.05	195.4	20.09	1.95	0.0	0.0	0.00	0.00
"Indian" red																												
FJF-A6-1	16.88	4.42	3.61	5.00	2.30	2.82	0.25	1.80	704.0	6557.0	157.60	ND	4.28	1.53	1.3	0.54	23.66	33.56	7.08	ND	5.10	659.0	66.00	5.58	178.0	60.0	ND	0.80
FJF-A6-2	16.40	4.42	3.55	5.00	2.30	1.47	0.12	1.22	512.0	3991.0	136.20	ND	2.27	0.69	1.3	0.45	9.89	51.08	2.97	ND	3.80	323.0	66.00	1.70	113.0	60.0	ND	0.80

TWBCG "Trade Wind Beads" East African Coast
TABLE 6 (pp. 177-197) Continued.

Black	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
MIE 15a	15.57	4.12	3.36	5.00	2.30	1.37	ND	1.46	2720.0	<500	167.29	ND	33.20	0.96	1.3	0.46	12.06	18.97	4.72	ND	16.00	<200	66.00	3.88	74.0	60.0	ND	0.80
STA 139a	16.98	4.12	5.10	5.00	2.30	2.28	ND	2.12	368.0	<500	63.89	ND	4.30	1.37	1.3	0.65	23.01	23.81	7.24	ND	1.10	<200	66.00	4.92	53.0	60.0	ND	0.80
STA 139b	15.16	4.42	4.35	5.00	2.30	1.80	ND	2.20	311.0	<500	101.96	ND	4.04	1.67	1.3	1.04	11.90	10.85	6.26	ND	0.30	<200	66.00	3.13	53.0	60.0	ND	0.80
MEAN	15.08	4.12	3.63	5.00	2.30	1.87	0.01	1.38	616.4	<500	132.85	ND	7.24	1.42	1.3	0.70	17.94	22.45	6.34	ND	2.35	<200	66.00	4.78	55.8	60.0	ND	0.80
STD	0.94	0.00	1.32	0.00	0.00	0.50	0.02	0.58	668.9	0.0	43.55	0.00	8.30	0.24	0.0	0.21	6.10	9.99	0.90	0.0	4.34	0.0	0.00	1.28	51.6	0.0	0.00	0.00
Green																												
FIE-A4-1	14.88	4.42	2.98	5.00	2.30	1.74	2.10	1.67	684.0	6852.0	123.90	ND	3.74	1.74	1.3	0.55	14.49	11.58	7.41	ND	5.00	4560.0	66.00	9.92	33.0	60.0	ND	0.80
FIE-A4-2	15.34	4.42	3.17	5.00	2.30	1.11	2.10	1.27	340.0	3162.0	86.12	ND	2.10	1.11	1.3	0.42	11.55	13.13	3.11	ND	6.10	4567.0	66.00	2.92	233.0	60.0	ND	0.80
FIE-A4-3	15.11	4.42	3.50	5.00	2.30	2.66	0.60	1.34	519.0	4409.0	137.44	ND	3.83	2.66	1.3	0.54	22.56	182.71	6.50	ND	5.40	1285.0	66.00	4.85	304.0	60.0	ND	0.80
LUA-7	15.40	4.42	4.38	5.00	2.30	2.64	0.04	1.21	425.0	4763.0	71.18	ND	3.95	1.49	1.3	0.66	22.36	64.01	7.71	ND	3.00	<200	66.00	5.74	56.0	60.0	ND	0.80
DAM-1	15.50	4.42	4.22	5.00	2.30	2.37	ND	1.79	462.0	8464.0	208.10	ND	5.71	1.69	1.3	0.86	30.30	38.22	7.16	ND	11.20	3153.0	66.00	5.29	501.0	60.0	ND	0.80
KIL MBG1	16.82	4.42	4.02	5.00	2.30	1.77	ND	1.29	353.0	3043.0	178.57	ND	5.60	1.65	1.3	0.81	28.90	13.27	6.47	ND	8.10	492.0	66.00	4.12	481.0	60.0	ND	0.80
KIL MBG2	17.27	4.42	4.77	5.00	2.30	2.00	ND	1.77	421.0	2568.0	26.15	ND	6.96	1.87	1.3	0.92	38.08	11.87	7.24	ND	8.20	558.0	66.00	6.55	242.0	60.0	ND	0.80
GER-1a	15.50	4.42	4.21	5.00	2.30	2.92	ND	1.60	342.0	5931.0	86.54	ND	3.65	1.10	1.3	0.53	18.38	64.71	7.48	ND	8.50	<200	66.00	4.01	72.0	60.0	ND	0.80
GER-1b	15.15	4.12	3.86	5.00	2.30	2.86	ND	1.35	343.0	5910.0	84.29	ND	3.53	1.27	1.3	0.50	18.28	64.37	7.24	ND	7.90	<200	66.00	3.75	57.0	60.0	ND	0.80
GER 1c	15.10	4.12	4.08	5.00	2.30	2.93	ND	1.46	382.0	6184.0	129.90	ND	4.27	1.56	1.3	0.53	21.42	61.47	7.55	ND	10.00	<200	66.00	3.40	48.0	60.0	ND	0.80
GER-1d	15.38	4.42	3.82	5.00	2.30	3.01	ND	1.42	388.0	5705.0	86.06	ND	3.62	1.10	1.3	0.52	18.59	68.39	7.59	ND	8.50	<200	66.00	3.50	87.0	60.0	ND	0.80
GER-1e	15.43	4.12	4.62	5.00	2.30	2.96	ND	1.25	349.0	6069.0	88.58	ND	3.72	1.35	1.3	0.55	18.60	66.10	7.63	ND	9.20	<200	66.00	5.39	70.0	60.0	ND	0.80
MEAN	15.57	4.20	3.99	5.00	2.30	2.41	0.43	1.45	417.3	5255.0	108.90	0.00	4.22	1.55	1.3	0.62	21.96	54.99	6.92	0.0	7.59	1217.9	66.00	4.95	182.0	60.0	0.00	0.80
STD	0.69	0.00	0.49	0.00	2.30	0.59	0.83	0.20	96.4	1656.1	47.44	0.00	1.22	0.42	0.0	0.15	7.02	45.13	1.21	0.0	2.21	1732.0	0.00	1.82	162.7	0.0	0.00	0.00
Yellow																												
FIE-A3-1	15.81	4.42	3.16	5.00	2.30	0.68	3.20	1.70	516.0	<500	81.05	ND	1.67	0.57	1.3	0.37	11.05	5.68	2.23	ND	26.40	4577.0	66.00	1.49	438.0	60.0	ND	0.80
FIE-A3-2	11.98	4.42	3.56	5.00	2.30	0.78	3.50	1.12	486.0	<500	122.54	ND	2.11	0.66	1.3	0.47	11.60	8.33	2.62	ND	3.30	7292.0	66.00	2.20	941.0	60.0	ND	0.80
LUA-5b	15.75	4.42	3.98	5.00	2.30	1.67	2.30	1.62	306.0	<500	93.96	ND	3.69	1.49	1.3	0.56	19.79	12.88	6.09	ND	5.30	3994.0	66.00	6.08	523.0	60.0	ND	0.80
MAT-13	12.88	4.42	3.67	5.00	2.30	1.86	ND	1.25	331.0	<500	125.00	ND	5.24	1.61	1.3	0.63	24.41	9.77	6.46	ND	1.30	4072.0	66.00	3.68	617.0	60.0	ND	0.80
VOII-7	13.42	4.42	3.27	5.00	2.30	1.76	ND	1.08	321.0	<500	78.06	ND	3.14	1.23	1.3	0.48	14.58	11.52	5.95	ND	105.20	4550.0	66.00	3.36	400.0	60.0	ND	0.80
VOII-8	13.57	4.42	4.19	5.00	2.30	1.74	ND	1.41	330.0	<500	79.14	ND	3.29	1.34	1.3	0.53	15.04	13.64	6.10	ND	128.80	4978.0	66.00	3.84	386.0	60.0	ND	0.80
MAK-2	15.08	4.42	2.50	5.00	2.30	0.97	ND	1.24	660.0	<500	113.92	ND	2.45	1.14	1.3	0.51	10.88	11.60	3.77	ND	36.00	7432.0	66.00	5.53	50.0	60.0	ND	0.80
LUS-1	14.25	4.42	3.42	5.00	2.30	0.82	ND	1.17	379.0	<500	111.79	ND	1.98	0.66	1.3	0.43	8.70	7.93	2.66	ND	19.80	7176.0	66.00	2.29	942.0	60.0	ND	0.80
MOD-6	14.72	4.42	2.71	5.00	2.30	0.98	ND	1.34	229.0	<500	99.20	ND	2.46	1.03	1.3	0.39	11.00	11.25	3.82	ND	20.90	4667.0	66.00	2.20	686.0	60.0	ND	0.80
MIE-8a	12.68	4.42	4.61	5.00	2.30	1.85	ND	1.01	528.0	<500	86.21	ND	4.22	1.63	1.3	0.70	25.63	9.80	6.93	ND	3.70	5256.0	66.00	5.27	667.0	60.0	ND	0.80
KAB-10	15.16	4.42	3.70	5.00	2.30	1.10	ND	1.42	1487.0	<500	93.21	ND	3.01	1.92	1.3	0.86	17.25	6.97	4.91	ND	14.60	6509.0	66.00	19.65	19.0	60.0	ND	0.80
KAB 201	11.87	4.42	4.40	5.00	2.30	1.51	ND	1.30	384.0	<500	64.35	ND	5.76	2.11	1.3	0.98	23.25	7.25	6.30	ND	6.00	1448.0	66.00	20.43	29.0	60.0	ND	0.80
MEAN	11.18	4.42	3.62	5.00	2.30	1.31	0.75	1.31	496.4	<500	95.70	ND	3.25	1.28	1.3	0.58	16.10	9.72	4.82	0.0	30.94	5162.6	66.00	6.34	474.8	60.0	0.00	0.80
STD	1.23	0.00	0.60	0.00	0.00	0.44	1.32	0.20	320.1	0.0	18.40	0.00	1.23	0.48	0.0	0.18	5.65	2.41	1.64	0.0	40.10	1656.1	0.00	6.28	308.4	0.0	0.00	-
Greenish/Yellow																												
FIE-A8-1	15.36	4.42	3.99	5.00	2.30	1.11	0.02	1.17	407.0	<500	55.86	ND	2.33	1.03	1.3	0.57	13.51	8.08	3.60	ND	1.10	<200	66.00	2.44	53.0	60.0	ND	0.80
LUA-3a	15.71	4.42	3.92	5.00	2.30	1.21	<.02	1.93	334.0	<500	64.66	ND	3.79	1.63	1.3	0.57	27.98	6.48	4.59	ND	0.40	<200	66.00	8.34	48.0	60.0	ND	0.80
MAT-GRY20	15.72	4.42	3.86	5.00	2.30	1.67	ND	1.69	373.0	<500	28.78	ND	4.94	1.73	1.3	0.71	28.78	10.31	6.21	ND	0.70	<200	66.00	6.15	50.0	60.0	ND	0.80
MAT-GRY21	15.82	4.12	4.01	5.00	2.30	1.70	ND	1.91	384.0	<500	30.74	ND	4.93	1.60	1.3	0.68	30.74	10.11	6.22	ND	1.10	<200	66.00	5.04	51.0	60.0	ND	0.80
MAT-GRY22	15.31	4.12	3.71	5.00	2.30	1.67	ND	1.72	367.0	<500	29.48	ND	4.89	1.60	1.3	0.67	29.48	10.06	6.22	ND	0.90	<200	66.00	5.60	44.0	60.0	ND	0.80
KIL-GRY1	14.26	4.12	ND	5.00	2.30	1.95	ND	ND	488.0	<500	172.16	ND	7.19	1.88	1.3	1.31	34.20	10.51	7.80	ND	58.50	<200	66.00	5.79	26.0	60.0	ND	0.80
KIL-GRY4	15.46	4.42	5.03	5.00	2.30	1.74	ND	1.54	451.0	<500	180.28	ND	7.03	2.42	1.3	1.27	42.55	8.67	7.72	ND	2.00	602.0	66.00	6.56	38.0	60.0	ND	0.80
KIL-GRY5	15.18	4.12	5.32	5.00	2.30	2.62	ND	1.40	546.0	<500	178.92	ND	6.54	2.42	1.3	1.36	37.90	15.47	9.70	ND	1.10	1415.0	66.00	5.92	42.0	60.0	ND	0.80
KIL-GRY6	15.67	4.12	4.57	5.00	2.30	1.85	ND	1.30	453.0	<500	190.57	ND	7.08	2.53	1.3	1.37	42.38	8.57	7.72	ND	1.80	821.0	66.00	6.67	34.0	60.0	ND	0.80
KIL-GRY7	16.61	4.12	4.91	5.00	2.10	ND	ND	1.37	523.0	<500	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND	66.00	ND	ND	60.0	ND	0.80
KIL-GRY8	17.54	4.42	4.09	5.00	2.30	2.14	ND	1.49	452.0	<500	81.01	ND	5.00	1.87	1.3	0.94	29.53	13.34	7.77	ND	2.00	270.0	66.00	4.70	64.0	60.0	ND	0.80

Northern Transvaal & Dhlo Dhlo

Series B "Heirloom Beads", TABLE 5c (pp.139-145) Continued.

Cobalt Blue	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)
MOD 4h	10.82	7.91	1.02	0.73	1.00	0.35	0.09	1.32	2238.0	260.0	6.83	5.31
MIE 19	10.66	7.91	1.08	0.73	4.00	0.80	0.09	1.23	3066.0	260.0	41.14	5.31
MIE-1a	9.07	7.91	0.55	0.73	4.00	1.17	0.09	1.01	1015.0	260.0	ND	5.31
MIE-1b	9.26	7.91	0.42	0.73	1.00	0.54	0.09	0.73	2358.0	260.0	1.61	5.31
MIE-1c	9.54	7.91	0.70	0.73	4.00	0.55	0.09	1.35	339.0	260.0	2.58	5.31
MJE-1d	8.91	7.91	0.86	0.73	4.00	0.70	0.09	0.93	457.0	260.0	3.07	5.31
MEAN	9.52	7.91	0.83	0.73	4.00	0.67	0.08	1.10	1513.1	260.0	8.13	5.31
STD	0.84	0.00	0.26	0.00	0.00	0.24	0.00	0.21	967.2	0.0	13.62	0.00
TWBCG "Trade Wind Beads" East African Coast												
TABLE 6 (pp. 177-197)												
LUA (Luanze); DHL (Dhlo Dhlo); VOH (Vohemar); FJE (Fort Jesus); KIL (												
Blue/Green												
LUA 8a	15.76	4.42	3.06	5.00	2.30	1.54	0.03	1.29	309.0	4507.0	90.40	ND
DHL-1353a	14.93	4.42	4.55	5.00	2.30	1.45	ND	1.84	351.0	5192.0	87.16	ND
DHL-1353b	15.22	4.42	2.77	5.00	2.30	1.06	ND	1.41	286.0	4537.0	117.40	ND
DHL-1353c	14.69	4.42	3.91	5.00	2.30	0.69	ND	1.26	280.0	4977.0	19.58	ND
DHL-1353d	16.89	4.42	2.99	5.00	2.30	0.79	ND	1.98	376.0	5272.0	31.90	ND
DHL-1353e	14.02	4.42	2.06	5.00	2.30	0.62	ND	1.40	172.0	3487.0	38.30	ND
DHL-1353f	15.83	4.42	3.18	5.00	2.30	0.80	ND	1.55	253.0	5132.0	87.07	ND
VOH 3	15.15	4.42	3.42	5.00	2.30	1.55	ND	1.11	296.0	4726.0	95.23	ND
VOH 4	14.98	4.42	3.35	5.00	2.30	1.66	ND	1.48	296.0	4888.0	92.39	ND
KIL-LWK1	15.98	4.42	3.71	5.00	2.30	1.57	ND	1.23	371.0	5640.0	152.30	ND
KIL-LWK2	15.32	4.42	3.58	5.00	2.30	1.59	ND	1.88	420.0	5449.0	126.66	ND
Blue/Green												
CHI-1	16.23	4.42	3.10	5.00	2.30	1.25	ND	1.49	267.0	6765.0	121.58	ND
MOD 2a	14.93	4.42	3.57	5.00	2.30	1.30	ND	1.06	299.0	5725.0	102.66	ND
MOD 2b	15.45	4.42	3.73	5.00	2.30	1.38	ND	1.42	286.0	5205.0	58.15	ND
MOD 2c	14.42	4.42	2.21	5.00	2.30	1.30	ND	1.17	306.0	5447.0	93.82	ND
MOD 2d	14.06	4.42	3.30	5.00	2.30	0.78	ND	1.31	322.0	4217.0	30.22	ND
MOD 2e	15.11	4.42	3.47	5.00	2.30	1.22	ND	1.70	299.0	5358.0	76.22	ND
MOD 2f	16.32	4.42	3.13	5.00	2.30	1.36	ND	1.91	259.0	4354.0	31.11	ND
MIE 5	14.29	4.42	3.17	5.00	2.30	1.28	ND	1.37	247.0	3940.0	106.31	ND
MJE 3a1	14.56	4.42	3.17	5.00	2.30	1.27	ND	1.40	236.0	4841.0	53.45	ND
MJE 3a2	14.75	4.42	2.78	5.00	2.30	1.14	ND	1.89	272.0	4045.0	74.13	ND
MJE 3a3	15.42	4.42	3.08	5.00	2.30	1.27	ND	1.45	267.0	6207.0	66.72	ND
MEAN	15.20	4.42	3.24	5.00	2.30	1.22	ND	1.48	294.1	4996.0	79.67	ND
STD	0.73	0.00	0.52	0.00	0.00	0.30	0.00	0.27	51.6	742.6	34.71	0.00
Black												
FJE-A2-1	13.09	4.42	3.03	5.00	2.30	1.52	<.02	1.01	684.0	<500	78.48	ND
FJE A2-2	14.19	4.42	3.60	5.00	2.30	1.23	ND	1.06	340.0	<500	111.51	ND
LUA-1a	15.37	4.42	3.64	5.00	2.30	1.41	0.04	1.86	328.0	<500	192.50	ND
LUA-1c	14.15	4.42	4.38	5.00	2.30	2.67	0.04	1.52	562.0	<500	165.66	ND
MAT-3	15.29	4.42	4.69	5.00	2.30	2.67	ND	1.44	394.0	<500	95.94	ND
KIL-MBG	15.02	4.42	ND	5.00	2.30	1.60	ND	ND	337.0	<500	180.31	ND
KIL-MGB3	15.78	4.42	3.12	5.00	2.30	1.73	ND	1.26	386.0	<500	180.04	ND
KIL-MGB1	11.99	4.42	4.62	5.00	2.30	2.29	ND	1.27	680.0	<500	123.76	ND

Cobalt Blue	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
MOD 4h	0.54	5.00	3.7	0.12	3.38	404.00	1.17	ND	779.00	82.6	11.30	2.00	100.0	3.0	6.00	0.90
MIE 19	1.52	5.00	3.7	0.38	2.92	1355.00	2.09	ND	964.00	82.6	39.10	2.00	100.0	3.0	6.00	0.90
MIE-1a	ND	5.00	3.7	0.57	0.89	518.00	1.73	ND	6565.00	82.6	14.50	2.00	100.0	3.0	6.00	0.90
MIE-1b	0.70	5.00	3.7	0.22	1.69	383.00	1.64	ND	67.60	82.6	17.10	2.00	100.0	3.0	6.00	0.90
MIE-1c	0.69	5.00	3.7	0.33	1.29	514.00	1.27	ND	1701.00	82.6	9.00	2.00	100.0	3.0	6.00	0.90
MJE-1d	0.90	5.00	3.7	0.49	1.91	630.00	1.83	ND	2350.00	82.6	39.90	2.00	100.0	3.0	6.00	0.90
MEAN	0.73	5.00	3.7	0.33	2.51	599.86	1.61	ND	1572.33	82.6	20.31	2.00	100.0	3.0	6.00	0.90
STD	0.42	0.00	0.0	0.15	1.47	319.06	0.29	0.0	2086.55	0.0	12.37	0.00	0.0	0.0	0.00	0.00
TWBCG "Trade Wind Beads" East African Coast																
TABLE 6 (pp. 177-197)																
LUA (Luanze); DHL (Dhlo Dhlo); VOH (Vohemar); FJE (Fort Jesus); KIL (																
Blue/Green																
LUA 8a	3.23	1.23	1.3	0.50	17.59	183.98	5.58	ND	6.40	<200	66.00	4.22	59.0	60.0	ND	0.80
DHL-1353a	3.01	1.26	1.3	0.48	21.16	14.45	5.23	ND	9.10	<200	66.00	5.06	47.0	60.0	ND	0.80
DHL-1353b	2.35	0.89	1.3	0.46	18.18	138.23	4.00	ND	11.80	<200	66.00	2.41	47.0	60.0	ND	0.80
DHL-1353c	2.12	0.84	1.3	0.32	17.56	47.95	2.52	ND	2.70	<200	66.00	4.25	27.0	60.0	ND	0.80
DHL-1353d	1.93	0.69	1.3	0.31	12.77	48.18	2.56	ND	3.50	<200	66.00	2.00	41.0	60.0	ND	0.80
DHL-1353e	1.34	0.51	1.3	0.38	10.84	76.90	2.03	ND	7.50	<200	66.00	1.46	25.0	60.0	ND	0.80
DHL-1353f	1.74	0.63	1.3	0.34	9.95	28.12	2.77	ND	2.80	308.0	66.00	1.97	20.0	60.0	ND	0.80
VOH 3	3.23	1.04	1.3	0.51	16.75	142.62	5.48	ND	0.70	<200	66.00	3.26	33.0	60.0	ND	0.80
VOH 4	3.29	1.17	1.3	0.50	17.15	128.31	5.58	ND	0.90	<200	66.00	2.89	49.0	60.0	ND	0.80
KIL-LWK1	4.03	1.30	1.3	0.58	15.06	74.12	5.48	ND	15.10	1112.0	66.00	3.91	292.0	60.0	ND	0.80
KIL-LWK2	3.45	1.02	1.3	0.53	12.69	47.64	4.93	ND	14.90	1073.0	66.00	3.20	457.0	60.0	ND	0.80
Blue/Green																
CHI-1	2.39	0.98	1.3	0.54	10.30	17.75	4.14	ND	24.60	1355.0	66.00	2.31	242.0	60.0	ND	0.80
MOD 2a	3.58	1.30	1.3	0.57	23.49	48.43	4.82	ND	4.90	<200	66.00	7.04	49.0	60.0	ND	0.80
MOD 2b	2.98	1.18	1.3	0.55	18.01	71.02	5.05	ND	4.90	<200	66.00	4.21	41.0	60.0	ND	0.80
MOD 2c	3.14	0.89	1.3	0.42	19.56	42.72	4.46	ND	6.80	<200	66.00	3.31	60.0	60.0	ND	0.80
MOD 2d	1.49	0.61	1.3	0.31	7.84	63.98	2.70	ND	2.70	<200	66.00	1.73	28.0	60.0	ND	0.80
MOD 2e	2.75	1.04	1.3	0.47	15.08	136.32	4.31	ND	11.70	<200	66.00	3.36	71.0	60.0	ND	0.80
MOD 2f	3.05	0.88	1.3	0.99	16.91	51.23	5.00	ND	5.30	<200	66.00	3.30	42.0	60.0	ND	0.80
MIE 5	2.71	0.56	1.3	0.46	11.71	188.24	4.57	ND	6.90	<200	66.00	3.11	1.0	60.0	ND	0.80
MJE 3a1	2.67	1.09	1.3	0.62	14.95	38.31	4.69	ND	19.20	<200	66.00	3.40	46.0	60.0	ND	0.80
MJE 3a2	2.96	1.01	1.3	0.48	15.85	92.95	4.27	ND	16.50	<200	66.00	3.29	56.0	60.0	ND	0.80
MJE 3a3	3.37	1.27	1.3	0.54	22.80	62.54	4.81	ND	8.20	<200	66.00	5.80	70.0	60.0	ND	0.80
MEAN	2.76	0.97	1.3	0.49	15.74	79.27	4.32	ND	8.50	174.9	66.00	3.43	78.4	60.0	ND	0.80
STD	0.68	0.24	0.0	0.14	4.05	50.04	1.08	0.0	6.16	407.1	0.00	1.30	104.6	0.0	0.00	0.00
Black																
FJE-A2-1	2.66	1.21	1.3	0.53	11.33	14.28	5.49	ND	0.90	<200	66.00	5.48	82.0	60.0	ND	0.80
FJE A2-2	3.50	1.33	1.3	0.56	17.84	12.87	5.78	ND	1.00	<200	66.00	4.87	20.0	60.0	ND	0.80
LUA-1a	6.28	1.36	1.3	0.57	17.93	16.76	6.10	ND	0.70	<200	66.00	5.66	38.0	60.0	ND	0.80
LUA-1c	4.66	1.78	1.3	0.63	28.04	34.70	7.10	ND	0.70	<200	66.00	7.77	96.0	60.0	ND	0.80
MAT-3	3.72	1.37	1.3	0.58	21.71	46.98	6.77	ND	1.90	579.0	66.00	4.83	186.0	60.0	ND	0.80
KIL-MBG	7.33	1.45	1.3	1.12	12.96	24.11	5.97	ND	0.90	<200	66.00	3.31	3.3	60.0	ND	0.80
KIL-MGB3	4.46	1.30	1.3	0.67	12.65	20.64	6.11	ND	0.50	<200	66.00	3.43	3.4	60.0	ND	0.80
KIL-MGB1	5.48	1.84	1.3	0.93	27.93	23.00	8.19	ND	1.80	<200	66.00	5.25	5.3	60.0	ND	0.80

Northern Transvaal & Dhlo Dhlo
Series A "Heirloom Beads", TABLE 5b (pp. 132-138).
MOD (Modjadje); DHL (Dhlo Dhlo); MIF (Mjelele Valley)

Blue/Green	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
MOD 2a	14.93	4.52	3.57	2.00	2.00	1.30	0.03	1.06	299.0	5725.0	102.66	ND	3.58	1.30	1.5	0.57	23.90	48.43	4.82	ND	4.90	99.1	21.40	4.30	170.0	3.0	ND	0.55
MOD 2b	15.45	4.52	3.73	2.00	2.00	1.38	0.03	1.12	286.0	5205.0	58.15	ND	2.98	1.18	1.5	0.55	18.01	71.02	5.05	ND	4.90	99.1	16.80	4.30	170.0	3.0	ND	0.55
MOD 2c	14.42	4.52	2.21	2.00	2.00	1.30	0.03	1.17	306.0	5447.0	98.82	ND	3.14	0.89	1.5	0.42	19.56	42.72	4.46	ND	6.80	99.1	26.40	4.30	170.0	3.0	ND	0.55
MOD 2d	14.06	4.52	3.30	2.00	2.00	0.78	0.03	1.31	322.0	4217.0	30.22	ND	1.49	0.61	1.5	0.31	7.84	63.98	2.70	ND	2.70	99.1	14.00	4.30	170.0	3.0	ND	0.55
MOD 2e	15.11	4.52	3.18	2.00	2.00	1.22	0.03	1.70	299.0	5358.0	76.22	ND	2.75	1.04	1.5	0.47	15.08	136.32	4.31	ND	11.70	99.1	29.60	4.30	170.0	3.0	ND	0.55
MOD 2f	16.32	4.52	3.13	2.00	2.00	1.36	0.03	1.91	259.0	4354.0	31.11	ND	3.05	0.88	1.5	0.99	16.91	51.23	5.00	ND	5.30	99.1	26.20	4.30	170.0	3.0	ND	0.55
DHL-1353a	14.93	4.52	3.55	2.00	2.00	1.15	0.03	1.84	351.0	5192.0	87.16	ND	3.01	1.26	1.5	0.48	21.16	14.45	5.23	ND	9.10	<200	23.80	5.06	170.0	3.0	ND	0.55
DHL-1353b	15.22	4.52	2.77	2.00	2.00	1.06	0.03	1.41	286.0	4537.0	117.40	ND	2.35	0.89	1.5	0.46	18.18	138.23	4.00	ND	11.80	<200	26.00	2.41	170.0	3.0	ND	0.55
DHL-1353c	14.69	4.52	3.91	2.00	2.00	0.69	0.03	1.26	280.0	4977.0	19.58	ND	2.12	0.84	1.5	0.32	17.56	47.95	2.52	ND	2.70	<200	12.60	4.25	170.0	3.0	ND	0.55
DHL-1353d	16.89	4.52	2.99	2.00	2.00	0.79	0.03	1.98	376.0	5272.0	31.90	ND	1.93	0.69	1.5	0.31	12.77	48.18	2.56	ND	3.50	<200	15.40	2.00	170.0	3.0	ND	0.55
DHL-1353e	14.02	4.52	2.06	2.00	2.00	0.62	0.03	1.40	172.0	3487.0	38.30	ND	1.34	0.51	1.5	0.38	10.84	76.90	2.03	ND	7.50	<200	18.10	1.46	170.0	3.0	ND	0.55
DHL-1353f	15.83	4.52	3.18	2.00	2.00	0.80	0.03	1.55	253.0	5132.0	87.07	ND	1.74	0.63	1.5	0.34	9.95	28.12	2.77	ND	2.80	308.0	10.30	1.97	170.0	3.0	ND	0.55
MIF-3a1	14.56	4.52	3.17	2.00	2.00	1.27	0.03	1.40	236.0	4841.0	53.45	ND	2.67	1.09	1.5	0.62	14.95	38.31	4.69	ND	19.20	<200	21.40	3.40	170.0	3.0	ND	0.55
MIF-3a2	14.75	4.52	2.78	2.00	2.00	1.14	0.03	1.89	272.0	4045.0	74.13	ND	2.96	1.01	1.5	0.48	15.85	92.95	4.27	ND	16.50	<200	26.00	3.29	170.0	3.0	ND	0.55
MIF-3a3	15.42	4.52	3.08	2.00	2.00	1.27	0.03	1.35	267.0	6207.0	66.72	ND	3.37	1.27	1.5	0.54	22.80	62.54	4.81	ND	8.20	<200	40.30	5.80	170.0	3.0	ND	0.55
MIF-5	14.29	4.52	3.17	2.00	2.00	1.28	0.03	1.37	247.0	3940.0	106.31	ND	2.71	0.56	1.5	0.46	11.71	188.24	4.57	ND	6.90	<200	39.90	3.11	170.0	3.0	ND	0.55
MEAN	15.06	4.52	3.19	2.00	2.00	1.11	0.03	1.51	281.9	4871.0	67.45	ND	2.57	0.92	1.5	0.48	16.07	71.85	3.99	ND	7.78	56.4	23.01	3.66	170.0	3.0	ND	0.55
STD	0.77	0.00	0.59	0.00	0.00	0.27	0.00	0.27	45.8	698.7	30.12	ND	0.65	0.26	ND	0.16	4.48	44.73	1.04	ND	4.74	80.2	8.46	1.17	0.0	0.0	0.00	0.00
Cobalt Blue																												
MOD 5a	14.91	4.52	3.81	2.00	2.00	1.60	0.03	1.60	365.0	<500	79.00	ND	4.17	1.12	1.5	0.58	25.07	1709.00	6.01	ND	2.90	<200	9.40	7.40	170.0	3.0	ND	0.55
MOD 5b	15.05	4.52	3.35	2.00	2.00	1.59	0.03	1.44	368.0	<500	98.45	ND	3.36	0.82	1.5	0.88	20.93	1400.00	4.93	ND	2.80	<200	32.50	5.48	170.0	3.0	ND	0.55
DHL-1352a	14.12	4.52	3.30	2.00	2.00	1.40	0.03	2.00	262.0	<500	80.33	ND	4.55	1.32	1.5	0.72	18.24	929.00	4.83	ND	3.70	99.1	36.60	4.30	170.0	3.0	ND	0.55
DHL-1352b	15.29	4.52	3.56	2.00	2.00	1.04	0.03	1.70	299.0	<500	41.83	ND	2.26	0.81	1.5	0.41	14.06	879.00	3.24	ND	2.00	99.1	15.70	4.30	170.0	3.0	ND	0.55
DHL-1352c	15.67	4.52	3.37	2.00	2.00	1.34	0.03	1.23	308.0	<500	64.17	ND	3.24	1.36	1.5	0.60	24.07	968.00	5.05	ND	3.10	99.1	35.20	4.30	170.0	3.0	ND	0.55
DHL-1352d	16.10	4.52	4.12	2.00	2.00	1.70	0.03	1.91	311.0	<500	91.12	ND	3.68	0.61	1.5	0.57	21.08	1418.00	5.70	ND	4.00	99.1	30.00	4.30	170.0	3.0	ND	0.55
DHL-1352e	15.31	4.52	2.95	2.00	2.00	1.21	0.03	1.52	367.0	<500	40.62	ND	2.05	0.42	1.5	0.45	14.38	780.00	4.26	ND	3.20	99.1	30.00	4.30	170.0	3.0	ND	0.55
MEAN	15.26	4.52	3.70	2.00	2.00	1.41	0.03	1.63	325.7	<500	70.79	ND	3.33	0.92	1.5	0.60	19.69	1154.71	4.86	ND	3.10	70.8	27.06	4.91	170.0	3.0	ND	0.55
STD	0.50	0.00	0.51	0.00	0.00	0.22	0.00	0.25	38.4	0.0	21.14	0.00	0.85	0.33	0.0	0.15	4.03	324.91	0.85	0.0	0.60	44.8	9.60	[illegible]	0.0	0.0	0.00	0.00
MOD 1a	9.57	7.94	1.08	0.73	4.00	0.78	0.09	1.52	503.0	9049.0	1.80	5.31	0.74	5.00	3.7	0.20	4.00	64.53	1.82	ND	663.70	82.6	39.30	2.00	100.0	3.0	6.00	0.90
MOD 1b	9.60	7.94	1.09	0.73	4.00	0.54	0.09	1.45	308.0	11512.0	1.33	5.31	0.67	5.00	3.7	0.13	5.09	87.58	1.48	ND	22.75	82.6	11.70	2.00	100.0	3.0	6.00	0.90
MOD 1c	9.31	7.94	0.98	0.73	4.00	0.31	0.09	1.97	567.0	8819.0	1.45	5.31	0.62	5.00	3.7	0.16	3.17	75.33	1.38	ND	333.80	82.6	21.80	2.00	100.0	3.0	6.00	0.90
MOD 1d	10.87	7.94	0.87	0.73	4.00	0.28	0.09	1.78	584.0	9670.0	1.54	5.31	0.53	5.00	3.7	0.19	2.19	43.85	1.09	ND	140.40	82.6	21.80	2.00	100.0	3.0	6.00	0.90
MOD 1e	10.12	7.94	0.96	0.73	4.00	0.43	0.09	1.60	350.0	7541.0	1.31	5.31	0.71	5.00	3.7	0.19	3.35	75.03	1.55	ND	210.70	82.6	21.20	2.00	100.0	3.0	6.00	0.90
MOD 1f	9.51	7.94	0.93	0.73	4.00	0.45	0.09	1.95	315.0	10389.0	1.55	5.31	0.62	5.00	3.7	0.21	3.57	60.42	1.38	ND	300.20	82.6	25.10	2.00	100.0	3.0	6.00	0.90
MIF-3b1	8.50	7.94	0.79	0.73	4.00	0.49	0.09	1.55	980.0	10533.0	2.69	5.31	0.60	5.00	3.7	0.19	1.40	91.11	1.39	ND	534.90	82.6	20.50	2.00	100.0	3.0	6.00	0.90
MIF-3b2	9.88	7.94	0.66	0.73	4.00	0.56	0.09	1.94	296.0	9299.0	2.31	5.31	0.67	5.00	3.7	0.17	1.73	61.90	1.46	ND	204.60	82.6	28.80	2.00	100.0	3.0	6.00	0.90
MIF-3b3	9.81	7.94	0.89	0.73	4.00	0.47	0.09	1.92	484.0	10520.0	3.46	5.31	0.62	5.00	3.7	0.15	1.46	43.42	1.36	ND	203.00	82.6	19.50	2.00	100.0	3.0	6.00	0.90
MIF-3b4	9.67	7.94	0.76	0.73	4.00	0.17	0.09	1.60	266.0	9044.0	1.17	5.31	0.58	5.00	3.7	0.18	1.45	69.10	1.25	ND	405.50	82.6	15.10	2.00	100.0	3.0	6.00	0.90
MEAN	9.70	7.94	0.90	0.73	4.00	0.48	0.09	1.73	465.3	9637.6	1.86	5.31	0.64	5.00	3.7	0.18	2.74	67.23	1.42	ND	301.96	82.6	22.48	2.00	100.0	3.0	6.00	0.90
STD	0.55	0.00	0.13	0.00	0.00	0.13	0.00	0.19	205.0	1074.2	0.70	0.00	0.06	0.00	0.0	0.02	1.22	15.20	0.18	0.0	181.25	0.0	7.18	0.00	0.0	0.0	0.00	0.00
Northern Transvaal & Dhlo Dhlo																												
Series B "Heirloom Beads", TABLE 5c (pp.139-145).																												
MOD (Modjadje); DHL (Dhlo Dhlo); MIF (Mjelele Valley)																												
Cobalt Blue																												
MOD 4a	8.30	7.94	1.17	0.73	4.00	0.56	0.09	1.13	1119.0	260.0	1.69	5.31	0.77	5.00	3.7	0.17	5.51	395.00	1.54	ND	152.00	82.6	11.30	2.00	100.0	3.0	6.00	0.90

Beads Resembling IWCG TABLE IIa (pp.209-215) Continued.

Green/Yellow	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
KIL GRY9	15.73	9.00	3.53	4.00	6.00	1.39	ND	1.15	313.0	700.0	6.02	ND	3.91	1.52	1.2	0.71	12.87	6.86	4.04	ND	1.90	1424.0	ND	24.16	27.0	29.0	ND	0.20
Grey/Green																												
KIL GM2	15.68	9.00	3.61	4.00	6.00	3.31	ND	1.48	331.0	700.0	9.06	ND	3.42	1.15	1.2	0.64	13.94	6.76	3.92	ND	2.90	400.0	ND.	19.84	59.0	29.0	ND	0.20
"Indian" red																												
KIL-IR13	13.50	9.00	2.59	4.00	6.00	2.06	ND	0.89	422.0	10743.0	0.45	ND	1.03	0.48	1.2	0.27	1.58	10.01	2.44	ND	22.00	400.0	ND	1.76	54.0	29.0	ND	0.20
KAO-183H	13.03	9.00	2.78	4.00	6.00	1.93	ND	0.67	441.0	10386.0	0.97	ND	1.38	0.62	1.2	0.33	2.01	9.79	3.31	ND	162.20	400.0	ND	2.28	84.0	29.0	ND	0.20
KAO-183G	13.31	9.00	2.88	4.00	6.00	1.96	ND	0.71	433.0	12042.0	0.52	ND	1.36	0.54	1.2	0.39	0.67	8.15	3.28	ND	35.80	400.0	ND	2.28	54.0	29.0	ND	0.20
KAO-172A	14.19	9.00	2.78	4.00	6.00	1.76	ND	1.08	423.0	10377.0	0.61	ND	1.13	0.57	1.2	0.30	1.45	3.30	2.91	ND	114.60	400.0	ND	1.96	31.0	29.0	ND	0.20
BUT-102A1	11.24	9.00	4.79	4.00	6.00	1.32	ND	0.95	449.0	18420.0	7.01	ND	3.63	1.87	1.2	0.62	10.08	11.02	4.35	ND	10.10	400.0	ND	16.45	41.0	29.0	ND	0.20
BUT-102A2	10.92	9.00	4.94	4.00	6.00	1.26	ND	0.89	443.0	22375.0	7.26	ND	3.72	1.69	1.2	0.64	10.41	11.57	4.35	ND	8.10	400.0	ND	17.77	41.0	29.0	ND	0.20
"Indian" red on a green core																												
CAL-102B1	9.31	9.00	6.94	4.00	6.00	2.42	ND	0.83	499.0	7776.0	5.71	ND	4.70	1.65	1.2	0.56	9.30	26.72	9.30	ND	3.80	400.0	ND	14.17	69.0	29.0	ND	0.20
CAL-102B2	11.88	9.00	6.15	4.00	6.00	1.54	ND	1.37	350.0	7275.0	8.62	ND	3.80	1.20	1.2	0.40	9.38	8.03	6.66	ND	11.20	400.0	ND	11.24	44.0	29.0	ND	0.20
MEAN	10.60	9.00	6.55	4.00	6.00	1.98	ND	1.10	424.5	7525.5	7.17	ND	4.25	1.43	1.2	0.48	9.34	17.38	7.98	ND	7.50	400.0	ND	12.71	56.5	29.0	ND	0.20
STD	1.29	0.00	0.40	0.00	0.00	0.44	0.00	0.27	74.5	250.5	1.45	0.00	0.45	0.23	0.00	0.08	0.04	9.35	1.32	0.00	3.70	0.00	0.00	1.47	12.5	0.0	0.0	0.0
Ife Group 1. TABLE 1/a (pp. 272-285)																												
Blue/Green																												
ITA 27IF	1.64	10.88	6.82	3.60	5.36	1.35	<0.05	0.20	2496.0	280.0	1.20	11.96	2.60	0.95	8.5	0.95	1.33	295.15	1.66	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 27V	1.71	9.51	6.61	3.60	6.70	1.39	<0.05	0.20	2606.0	280.0	1.22	10.98	2.60	1.09	8.1	0.95	1.19	297.77	1.56	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 27Q	1.59	9.15	6.07	3.60	5.70	1.45	<0.05	0.20	2501.0	280.0	1.19	12.58	2.60	0.90	8.3	0.94	1.22	300.43	1.57	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 27R	1.71	9.96	6.60	3.60	4.71	1.54	<0.05	0.20	2656.0	280.0	1.19	12.01	2.60	0.94	8.2	1.00	1.19	305.90	1.65	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 863	3.09	11.08	6.98	3.60	3.57	0.20	<0.05	0.20	501.0	280.0	0.97	5.97	2.60	0.58	2.2	0.24	0.90	31.50	0.47	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 30B	1.51	11.68	7.05	3.60	7.28	0.31	<0.05	0.20	2921.0	280.0	0.89	2.79	2.60	0.47	4.6	1.61	1.10	110.70	1.24	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 100	1.50	9.98	5.85	3.60	6.41	0.29	<0.05	0.20	1990.0	280.0	1.22	3.92	2.60	0.45	8.4	0.45	0.64	166.10	1.16	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA 65	5.50	9.99	8.95	3.60	2.92	0.59	<0.05	0.20	280.0	280.0	1.85	4.56	2.60	0.59	4.0	1.14	6.80	1.89	0.89	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
MEAN	2.28	10.28	6.89	3.60	5.33	0.89	<0.05	0.20	1993.9	280.0	1.22	8.10	2.60	0.75	6.5	0.91	1.80	188.68	1.28	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
STD	1.31	0.80	0.88	0.00	1.43	0.55	0.00	0.00	958.39	0.00	0.27	3.89	0.00	0.23	2.36	0.39	1.90	120.24	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt Blue																										ND	26.60	0.80
ITA-30C	1.72	11.01	6.15	3.60	6.28	0.22	<0.05	0.20	1.5	280.0	1.66	4.05	2.60	0.63	6.2	0.46	0.67	145.77	0.69	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-271	1.27	11.25	6.70	3.60	6.00	0.25	<0.05	0.20	1.6	280.0	0.98	6.43	2.60	0.55	10.3	0.84	0.60	203.45	0.75	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ORU-207	1.26	10.16	ND	3.60	4.88	0.48	<0.05	0.20	1.8	280.0	2.51	4.58	2.60	0.52	1.1	0.58	9.90	276.25	1.27	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-30D	1.53	14.04	6.17	3.60	5.84	0.37	<0.05	0.20	2.3	280.0	1.32	9.90	2.60	0.94	8.2	0.72	0.42	282.14	1.28	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27A Culle	1.65	11.85	7.13	3.60	5.80	0.32	<0.05	0.20	2.0	280.0	2.65	7.33	2.60	0.82	8.0	0.65	0.71	145.50	0.94	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27B Culle	1.51	11.98	6.18	3.60	6.01	0.30	<0.05	0.20	3.8	280.0	2.57	12.24	2.60	0.85	7.6	0.31	0.48	52.44	1.10	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27E	1.50	11.98	6.10	3.60	5.78	0.28	<0.05	0.20	3.0	280.0	1.12	3.52	2.60	0.62	9.5	0.54	0.66	423.60	1.12	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27F	3.36	12.31	5.37	3.60	3.06	0.19	<0.05	0.20	4235.0	280.0	1.80	12.04	2.60	1.72	2.4	0.23	1.30	686.89	1.12	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27G	2.01	12.65	6.63	3.60	5.62	0.34	<0.05	0.20	3516.0	280.0	1.23	3.91	2.60	0.65	6.7	0.83	0.46	484.63	0.98	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27H	2.45	11.95	6.57	3.60	4.02	0.45	<0.05	0.20	5486.0	280.0	1.61	30.65	2.60	1.27	4.4	0.30	0.84	800.03	1.83	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-27K	1.43	9.94	5.88	3.60	5.34	0.21	<0.05	0.20	3023.0	280.0	0.76	4.24	2.60	0.70	14.8	0.57	0.44	291.45	0.72	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-1442	2.49	11.70	6.63	3.60	6.61	0.29	<0.05	0.20	5841.0	280.0	1.25	21.31	2.60	2.27	4.0	0.33	1.02	944.83	1.23	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ORU-33	3.20	11.48	6.06	3.60	3.16	0.43	<0.05	0.20	7471.0	280.0	0.87	13.66	2.60	0.24	5.1	0.66	0.88	1152.10	1.96	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-1030	3.12	12.35	6.51	3.60	2.21	0.22	<0.05	0.20	3977.0	280.0	0.64	4.71	2.60	0.55	2.2	0.19	0.71	526.79	1.30	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-30A	1.62	10.18	6.61	3.60	6.82	0.16	<0.05	0.20	2098.0	280.0	0.98	3.22	2.60	0.34	8.5	0.40	0.26	226.59	0.63	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-1386	1.83	11.13	1.62	3.60	5.50	0.41	<0.05	0.20	1711.0	280.0	0.81	5.45	2.60	0.42	3.3	1.16	0.94	243.74	1.43	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
ITA-91A Culle	1.43	11.20	6.69	3.60	6.07	0.24	<0.05	0.20	2403.0	280.0	1.26	3.67	2.60	0.43	8.4	0.57	2.39	267.09	1.07	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
MEAN	1.97	11.60	5.88	3.60	5.24	0.30	<0.05	0.20	2339.8	280.0	1.41	8.88	2.60	0.75	6.5	0.55	1.33	420.78	1.14	268.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
STD	0.68	0.98	1.58	0.00	1.29	0.09	0.00	0.00	2367.9	0.00	0.62	7.22	0.00	0.55	3.4	0.24	2.19	299.34	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)
Ife Group I TABLE 17a (pp.272-285) Continued														
Black														
IIA 2/C	1.80	9.17	6.32	3.60	4.21	4.85	<0.05	0.20	4778.0	280.0	1.33	17.10	2.60	1.25
IIA 2/D	1.74	10.46	6.33	3.60	4.16	4.71	<0.05	0.20	4802.0	280.0	1.30	17.42	2.60	1.58
IIA 2/H	1.82	10.56	6.25	3.60	4.19	5.09	<0.05	0.20	3235.0	280.0	1.42	22.23	2.60	1.65
IIA 89	2.09	8.56	6.12	3.60	4.08	4.91	<0.05	0.20	3589.0	280.0	1.52	23.17	2.60	2.08
MEAN	1.86	9.76	6.26	3.60	4.21	4.90	0.00	0.00	4101.0	280.0	1.39	19.98	2.60	1.64
STD	0.13	0.81	0.08	0.00	0.15	0.11	0.00	0.00	700.3	0.0	0.09	2.74	0.00	0.30
Green														
IIA 2/F	3.41	7.23	7.01	3.60	5.89	2.46	<0.05	0.20	730.0	210.0	1.14	9.58	2.60	0.72
Ife Class II. TABLE 20 (pp.291)														
Blue/Green (Tp)														
IIA 914	7.37	7.70	1.83	3.00	6.00	0.51	0.12	0.89	365.0	11361.0	0.39	10.40	2.29	1.01
IIA-885 Cruci	6.10	7.70	3.42	3.00	6.00	0.41	0.05	0.57	273.0	7894.0	0.54	10.26	2.29	0.78
IIA 1077 Cruc	5.80	7.70	6.21	3.00	6.00	1.08	0.06	0.39	379.0	4486.0	1.05	7.36	2.29	0.97
IIA 1421 Cruc	5.64	7.70	3.58	3.00	6.00	0.71	0.04	0.53	620.0	6418.0	0.63	11.66	2.29	0.84
MEAN	6.23	7.70	3.76	3.00	6.00	0.69	0.07	0.60	409.3	7539.8	0.65	9.92	2.29	0.90
STD	0.68	0.00	1.57	0.00	0.00	0.25	0.03	0.18	128.3	2515.5	0.24	1.58	0.00	0.09
Blue/Green (Tl)														
ORU-57A	14.07	7.70	2.41	3.00	6.00	1.09	0.05	1.46	396.0	13849.0	1.20	14.47	2.29	1.81
ORU-179B Fr	13.64	7.70	1.55	3.00	6.00	0.93	0.04	1.33	357.0	11991.0	0.91	11.31	2.29	1.05
ORU-206A	13.42	7.70	2.30	3.00	6.00	0.87	0.05	1.36	496.0	12948.0	0.75	11.75	2.29	1.19
MEAN	13.71	7.70	2.09	3.00	6.00	0.96	0.05	1.38	416.3	12929.3	0.95	12.51	2.29	1.35
STD	0.27	0.00	0.38	0.00	0.00	0.09	0.00	0.06	58.5	758.6	0.19	1.40	0.00	0.33
Blue/Green (Opaque)														
ORU-206B	10.82	7.70	3.26	3.00	6.00	1.31	0.08	0.54	1355.0	10277.0	1.15	11.78	2.29	0.99
ORU-179C Fr	9.20	7.70	3.79	3.00	6.00	1.35	0.10	1.27	925.0	9014.0	0.50	15.33	2.29	1.23
MEAN	10.01	7.70	3.53	3.00	6.00	1.33	0.09	0.91	1140.0	9645.5	0.83	13.56	2.29	1.11
STD	0.81	0.00	0.27	0.00	0.00	0.02	0.01	0.37	215.0	631.5	0.33	1.78	0.00	0.00
Igbo Ukwu Class I. TABLE 22a (pp.313).														
Blue/Green														
IGB 13	11.44	4.99	0.70	6.00	2.80	0.76	ND	0.70	288.0	7362.0	0.67	8.63	1.13	0.89
IGB M4A	10.59	4.99	0.70	6.00	2.80	0.37	ND	0.70	303.0	18821.0	0.64	5.91	1.13	0.74
IGB M3A	10.41	4.99	0.70	6.00	2.80	0.40	ND	0.70	314.0	10673.0	0.75	7.19	1.13	0.61
IGB M4B	8.96	4.99	0.70	6.00	2.80	0.55	ND	0.70	258.0	8151.0	0.80	8.12	1.13	0.85
MEAN	10.35	4.99	0.70	6.00	2.80	0.52	ND	0.70	290.8	11251.8	0.72	7.46	1.13	0.77
STD	0.89	0.00	0.00	0.00	0.00	0.15	0.00	0.00	21.0	4538.0	0.06	1.03	0.00	0.11
Cobalt Blue														
IGB M3B	9.77	4.99	0.70	6.00	2.80	0.57	ND	0.70	2664.0	6943.0	0.79	7.04	1.13	0.31
IGB-M2B	11.83	4.99	0.70	6.00	2.80	0.42	ND	0.70	8510.0	900.0	0.51	5.38	1.13	0.50
IGB M2A	11.89	4.99	0.70	6.00	2.80	0.20	ND	0.70	8234.0	900.0	0.64	5.66	1.13	0.62
IGB H2	11.65	4.99	0.70	6.00	2.80	0.68	ND	0.70	8540.0	900.0	0.67	6.99	1.13	0.89
IGB H1B	11.22	4.99	0.70	6.00	2.80	0.79	ND	0.70	9609.0	900.0	0.83	6.78	1.13	0.78
IGB H1A	10.81	4.99	0.70	6.00	2.80	0.93	ND	0.70	6210.0	900.0	0.61	5.06	1.13	0.88
IGB H1C	10.30	4.99	0.70	6.00	2.80	0.86	ND	0.70	7541.0	900.0	0.69	7.71	1.13	0.76
IGB-G	11.45	4.99	0.70	6.00	2.80	0.90	ND	0.70	11440.0	900.0	0.84	7.13	1.13	0.63
IGB N2A	11.41	4.99	0.70	6.00	2.80	0.77	ND	0.70	11330.0	900.0	0.75	9.62	1.13	0.69

	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
Ife Group I TABLE 17a (pp.272-285) Continued														
Black														
IIA 2/C	7.3	1.80	1.17	405.68	4.40	450.0	28.20	130.0	95.00	1.18	300.0	ND	26.60	0.80
IIA 2/D	6.8	1.86	1.77	402.35	4.48	450.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
IIA 2/H	6.4	2.04	2.02	307.59	5.19	450.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
IIA 89	5.0	1.85	2.81	389.23	6.75	450.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
MEAN	6.4	1.89	1.94	376.21	5.21	0.0	22.05	130.0	95.00	1.18	300.0	ND	26.60	0.80
STD	0.9	0.09	0.59	40.09	0.94	0.0	3.55	0.0	0.00	0.00	0.0	0.0	0.00	0.00
Green														
IIA 2/F	10.3	2.38	1.63	33.77	1.97	450.0	20.00	130.0	95.00	1.18	300.0	ND	26.60	0.80
Ife Class II. TABLE 20 (pp.291)														
Blue/Green (Tp)														
IIA 914	11.0	1.47	2.61	7.21	1.75	450.0	28.20	130.0	55.00	3.26	133.0	ND	30.00	0.60
IIA-885 Cruci	11.0	0.21	2.26	15.18	1.57	450.0	17.60	130.0	55.00	2.51	61.0	ND	30.00	0.60
IIA 1077 Cruc	11.0	0.52	1.83	21.39	2.02	450.0	10.80	130.0	55.00	1.72	216.0	ND	30.00	0.60
IIA 1421 Cruc	11.0	0.46	2.57	56.03	2.00	450.0	11.90	130.0	55.00	2.38	69.0	ND	30.00	0.60
MEAN	11.0	0.67	2.32	24.95	1.84	450.0	17.13	130.0	55.00	2.47	119.8	ND	30.00	0.60
STD	0.00	0.48	0.31	18.63	0.19	0.0	6.90	0.0	0.00	0.55	62.2	0.0	0.00	0.00
Blue/Green (Tl)														
ORU-57A	11.00	0.39	4.03	11.44	3.87	450.0	67.00	130.0	55.00	3.19	103.0	ND	30.00	0.60
ORU-179B Fr	11.00	0.30	2.93	7.38	3.32	450.0	21.70	130.0	55.00	2.87	345.0	ND	30.00	0.60
ORU-206A	11.00	0.28	3.12	5.47	3.44	450.0	83.00	130.0	55.00	2.62	311.0	ND	30.00	0.60
MEAN	11.00	0.32	3.36	8.10	3.54	450.0	57.23	130.0	55.00	2.89	13.7	ND	2.09	0.60
STD	0.00	0.05	0.48	2.49	0.24	0.0	25.96	0.0	0.00	0.23	0.3	0.0	0.38	0.00
Blue/Green (Opaque)														
ORU-206B	11.00	1.07	3.66	57.86	4.11	450.0	35.10	130.0	55.00	4.22	652.0	ND	30.00	0.60
ORU-179C Fr	11.00	0.73	3.50	76.63	3.85	450.0	22.20	130.0	55.00	3.34	345.0	ND	30.00	0.60
MEAN	11.00	0.90	3.58	67.25	3.98	450	28.65	130.0	55.00	3.78	498.5	ND	30.00	0.60
STD	0.00	0.17	0.08	9.38	0.13	0.0	6.45	0.00	0.00	0.44	153.5	0.00	0.00	0.00
Igbo Ukwu Class I. TABLE 22a (pp.313).														
Blue/Green														
IGB 13	0.80	0.22	1.62	3.56	1.99	89.0	12.50	113.0	106.00	2.10	200.0	4.7	12.70	0.25
IGB M4A	0.80	0.17	2.75	36.93	1.52	122.0	22.90	6231.0	106.00	1.44	200.0	4.7	12.70	0.25
IGB M3A	0.80	0.17	1.32	19.14	1.59	110.0	18.80	5780.0	106.00	2.29	200.0	4.7	12.70	0.25
IGB M4B	0.80	0.25	2.80	364.20	1.96	125.0	17.40	6307.0	106.00	3.75	200.0	4.7	12.70	0.25
MEAN	0.80	0.20	2.12	105.96	1.77	111.5	17.90	4607.8	106.00	2.40	200.0	4.7	12.70	0.25
STD	0.00	0.03	0.66	149.56	0.21	14.2	3.72	2602.9	0.00	0.84	0.0	0.0	0.00	0.00
Cobalt Blue														
IGB M3B	0.80	0.22	1.55	198.06	1.96	138.0	9.50	3115.0	106.00	3.36	200.0	4.7	12.70	0.25
IGB-M2B	0.80	0.16	1.44	239.28	1.24	205.0	1.10	92.0	106.00	2.71	200.0	4.7	12.70	0.25
IGB M2A	0.80	0.19	1.55	258.43	0.53	241.0	15.60	134.0	106.00	3.27	200.0	4.7	12.70	0.25
IGB H2	0.80	0.18	1.45	490.89	1.51	285.0	2.50	1193.0	106.00	3.12	200.0	4.7	12.70	0.25
IGB H1B	0.80	0.25	1.68	641.84	2.04	246.0	0.80	245.0	106.00	5.15	200.0	4.7	12.70	0.25
IGB H1A	0.80	0.23	0.97	1097.90	1.90	228.0	1.70	829.0	106.00	3.80	200.0	4.7	12.70	0.25
IGB H1C	0.80	0.19	1.35	582.19	2.02	242.0	0.70	1366.0	106.00	3.41	200.0	4.7	12.70	0.25
IGB-G	0.80	0.24	1.83	770.57	2.00	327.0	1.10	370.0	106.00	4.63	200.0	4.7	12.70	0.25
IGB N2A	0.80	0.21	4.05	615.06	1.94	270.0	1.50	689.0	106.00	4.09	200.0	4.7	12.70	0.25

Igbo Ukwu Class I. TABLE 22a (pp.313) continued.

	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
Cobalt Blue																												
IGB N1A	11.63	4.99	0.70	6.00	2.80	0.61	ND	0.70	8831.0	900.0	0.74	7.39	1.13	0.77	0.80	0.26	2.85	377.14	1.61	221.0	0.70	102.0	106.00	4.40	200.0	4.7	12.70	0.25
IGB N3B	10.97	4.99	0.70	6.00	2.80	0.88	ND	0.70	8380.0	900.0	0.73	5.45	1.13	1.06	0.80	0.24	<2.61	938.86	1.71	239.0	2.30	848.0	106.00	2.02	200.0	4.7	12.70	0.25
IGB N1B	11.28	4.99	0.70	6.00	2.80	0.66	ND	0.70	6541.0	2026.0	0.63	8.43	1.13	0.52	0.80	0.21	3.20	858.53	1.67	214.0	4.40	1109.0	106.00	3.40	200.0	4.7	12.70	0.25
IGB N2B	10.43	4.99	0.70	6.00	2.80	1.23	ND	0.70	10602.0	1360.0	1.34	8.58	1.13	0.62	0.80	0.27	3.39	1388.90	2.22	248.0	2.20	177.0	106.00	3.23	200.0	4.7	12.70	0.25
IGB N3D	11.00	4.99	0.70	6.00	2.80	0.75	ND	0.70	10522.0	900.0	0.79	6.26	1.13	0.97	0.80	0.25	2.38	490.26	1.89	354.0	0.60	152.0	106.00	3.25	200.0	4.7	12.70	0.25
IGB N3E	10.59	4.99	0.70	6.00	2.80	1.13	ND	0.70	10109.0	900.0	1.16	10.12	1.13	1.03	0.80	0.31	2.35	829.88	2.66	363.0	2.90	284.0	106.00	3.64	200.0	4.7	12.70	0.25
MEAN	11.08	4.99	0.70	6.00	2.80	0.76	ND	0.70	8624.2	1408.6	0.78	7.17	1.13	0.74	0.80	0.23	2.00	651.85	1.79	254.7	3.17	713.7	106.00	3.57	200.0	4.7	12.70	0.25
STD	2.74	1.21	0.17	1.45	0.68	0.30	0.00	0.17	3475.22	1487.57	0.32	2.69	0.36	0.30	0.26	0.08	1.14	370.03	0.72	97.9	3.9	756.6	34.2	1.35	64.44	1.51	4.09	0.08
Green																												
IGB KW1B	10.62	4.99	0.70	6.00	2.80	0.31	ND	0.70	5139.0	2998.0	0.61	6.12	1.13	0.62	0.80	0.17	1.72	21.71	1.23	194.0	4.50	1833.0	106.00	3.04	200.0	4.7	12.70	0.25
IGB K1A	10.94	4.99	0.70	6.00	2.80	0.35	ND	0.70	4087.0	4925.0	0.60	7.35	1.13	0.59	0.80	0.16	1.73	31.31	1.36	152.0	11.80	2647.0	106.00	2.54	200.0	4.7	12.70	0.25
IGB K2A	10.95	4.99	0.70	6.00	2.80	0.45	ND	0.70	3354.0	5096.0	0.60	4.95	1.13	0.79	0.80	0.16	1.73	27.55	1.38	155.0	9.50	3422.0	106.00	2.61	200.0	4.7	12.70	0.25
IGB K2B	10.97	4.99	0.70	6.00	2.80	0.38	ND	0.70	3344.0	3814.0	0.56	6.99	1.13	0.55	0.80	0.17	1.76	26.38	1.39	138.0	10.20	2882.0	106.00	2.66	200.0	4.7	12.70	0.25
IGB P2	11.54	4.99	0.70	6.00	2.80	0.70	ND	0.70	3336.0	8354.0	0.74	9.18	1.13	0.74	0.80	0.33	3.50	5.90	2.11	223.0	14.90	4370.0	106.00	3.36	200.0	4.7	12.70	0.25
MEAN	11.00	4.99	0.70	6.00	2.80	0.44	ND	0.70	3852.0	5037.4	0.62	6.92	1.13	0.66	0.80	0.20	2.09	22.57	1.49	172.4	10.18	3030.8	106.00	11.00	200.0	4.7	12.70	0.25
STD	0.30	0.00	0.00	0.00	0.00	0.14	0.00	0.00	704.8	1826.0	0.06	1.40	1.13	0.09	0.80	0.07	0.71	8.88	0.31	31.4	3.39	842.7	106.00	0.30	200.0	4.7	12.70	0.25
Yellow																												
IGB-L2A	11.13	4.99	0.70	6.00	2.80	0.29	ND	0.70	8522.0	900.0	0.64	6.44	1.13	0.65	0.80	1.04	3.11	5.79	1.41	252.0	4.80	9941.0	106.00	3.00	200.0	4.7	12.70	0.25
IGB L1A	12.43	4.99	0.70	6.00	2.80	0.49	ND	0.70	8261.0	900.0	3.48	7.36	1.13	0.48	0.80	0.20	2.76	5.28	1.41	173.0	21.90	4936.0	106.00	3.27	200.0	4.7	12.70	0.25
IGB L3C	10.23	4.99	0.70	6.00	2.80	0.39	ND	0.70	8080.0	900.0	1.26	7.35	1.13	0.86	0.80	0.50	12.82	14.05	1.95	278.0	12.20	19777.0	106.00	4.17	200.0	4.7	12.70	0.25
IGB L4B	11.02	4.99	0.70	6.00	2.80	0.36	ND	0.70	7900.0	900.0	0.78	11.37	1.13	0.80	0.80	0.23	9.24	7.60	1.69	241.0	7.20	11461.0	106.00	3.22	200.0	4.7	12.70	0.25
IGB L2B	10.68	4.99	0.70	6.00	2.80	0.33	ND	0.70	5589.0	900.0	0.88	8.33	1.13	0.77	0.80	0.35	7.48	8.12	1.54	203.0	8.80	11357.0	106.00	3.23	200.0	4.7	12.70	0.25
IGB L3B	10.05	4.99	0.70	6.00	2.80	0.43	ND	0.70	9399.0	900.0	0.94	6.74	1.13	0.84	0.80	0.25	8.30	7.84	1.97	226.0	9.30	15601.0	106.00	3.49	200.0	4.7	12.70	0.25
IGB-L1B	12.03	4.99	0.70	6.00	2.80	0.61	ND	0.70	11423.0	900.0	2.17	9.41	1.13	0.99	0.80	0.28	3.04	2.53	1.72	203.0	3.50	7721.0	106.00	6.55	200.0	4.7	12.70	0.25
IGB L3A	11.97	4.99	0.70	6.00	2.80	0.60	ND	0.70	6527.0	900.0	0.90	8.73	1.13	0.92	0.80	0.57	5.45	6.04	2.75	245.0	1.80	14755.0	106.00	2.61	200.0	4.7	12.70	0.25
IGB L2C	10.56	4.99	0.70	6.00	2.80	0.37	ND	0.70	7616.0	900.0	1.45	4.96	1.13	0.62	0.80	0.19	4.95	4.30	1.53	167.0	10.80	17782.0	106.00	3.03	200.0	4.7	12.70	0.25
IGB-J2A	10.49	4.99	0.70	6.00	2.80	0.38	ND	0.70	6835.0	900.0	0.63	6.34	1.13	0.71	0.80	0.20	1.52	5.60	1.27	195.0	10.90	14067.0	106.00	2.89	200.0	4.7	12.70	0.25
IGB-J2B	10.36	4.99	0.70	6.00	2.80	0.36	ND	0.70	7823.0	900.0	0.64	6.64	1.13	0.73	0.80	0.19	1.44	5.06	1.28	209.0	25.20	18638.0	106.00	3.17	200.0	4.7	12.70	0.25
IGB-J2C	11.38	4.99	0.70	6.00	2.80	0.75	ND	0.70	4523.0	900.0	1.02	8.73	1.13	0.82	0.80	0.39	2.86	8.53	2.01	364.0	1.60	6861.0	106.00	4.22	200.0	4.7	12.70	0.25
MEAN	11.03	4.99	0.70	6.00	2.80	0.45	ND	0.70	7708.2	900.0	1.23	7.70	1.13	0.77	0.80	0.37	5.25	6.73	1.71	229.7	9.83	12741.4	106.00	3.57	200.0	4.7	12.70	0.25
STD	0.75	0.00	0.00	0.00	0.00	0.13	0.00	0.00	1698.5	0.00	0.80	1.64	0.00	0.13	0.00	0.24	3.38	2.77	0.40	51.2	7.04	4616.7	0.00	1.01	0.00	0.00	0.00	0.00
Igbo Ukwu Class II. TABLE 22b (pp.319).																												
Blue/Green																												
IGB O	6.74	3.20	2.11	4.60	3.20	0.60	ND	0.50	233.0	7140.0	0.72	9.58	1.62	0.77	1.80	1.69	2.35	4.30	2.02	207.0	23.70	238.0	104.00	3.24	452.0	4.5	20.27	0.38
IGB M5C	7.93	3.20	4.42	4.60	3.20	0.71	ND	0.50	270.0	7943.0	0.70	10.67	1.62	1.00	8.50	1.02	2.11	5.43	2.41	153.0	17.10	187.0	104.00	2.44	452.0	4.5	20.27	0.38
MEAN	7.31	3.20	3.27	4.60	3.20	0.66	ND	0.50	251.5	7541.5	0.71	10.13	1.62	0.89	5.15	1.36	2.23	4.87	2.22	180.0	20.40	212.5	104.00	2.84	452.0	4.5	20.27	0.38
STD	0.60	0.00	1.15	0.00	0.00	0.05	0.00	0.00	18.5	401.5	0.01	0.54	0.00	0.11	3.35	0.33	0.12	0.56	0.19	27.0	3.30	25.5	0.00	0.40	0.0	0.0	0.00	0.00
Cobalt Blue	7.54	3.20	4.00	4.60	3.20	1.12	ND	0.50	4398.0	7451.0	1.94	9.94	1.62	1.12	4.30	1.41	6.50	504.81	2.90	202.0	24.20	223.0	104.00	1.78	452.0	4.5	20.27	0.38
IGB R																												
Green																												
IGB-P1	8.96	3.20	3.93	4.60	3.20	1.75	ND	0.50	376.0	8807.0	0.80	20.76	1.62	1.10	30.30	1.14	4.82	7.34	3.40	214.0	24.50	207.0	104.00	3.10	452.0	4.5	20.27	0.38
Greenish Yellow																												
IGB-T3A	6.07	3.20	5.86	4.60	3.20	4.91	ND	0.50	254.0	3390.0	1.40	9.41	1.62	1.05	2.80	0.49	2.22	12.75	2.07	72.0	24.60	149.0	104.00	2.06	452.0	4.5	20.27	0.38
IGB T3B	5.36	3.20	5.62	4.60	3.20	5.14	ND	0.50	643.0	3462.0	1.45	10.67	1.62	1.00	4.00	0.53	1.82	16.22	2.47	99.0	11.00	135.0	104.00	2.47	452.0	4.5	20.27	0.38
IGB T3C	5.41	3.20	6.31	4.60	3.20	4.48	ND	0.50	304.0	2772.0	1.32	5.79	1.62	1.08	2.50	0.42	1.81	11.04	2.04	77.0	8.60	119.0	104.00	2.42	452.0	4.5	20.27	0.38
MEAN	5.61	3.20	5.93	4.60	3.20	4.85	ND	0.50	400.3	3208.0	1.39	8.62	1.62	1.04	3.10	0.48	1.95	13.34	2.19	82.7	14.73	134.3	104.00	2.32	452.0	4.5	20.27	0.38
STD	0.32	0.00	0.29	0.00	0.00	0.28	0.00	0.00	172.8	309.7	0.05	2.07	0.00	0.03	0.65	0.05	0.19	2.16	0.20	11.7	7.05	12.3	0.00	0.18	0.0	0.0	0.00	0.00

	Na2O	CaO%	Al2O3%	MgO	K2O	Fe2O	PbO%	Cl%	MnO (ppm)	Cu (ppm)	U (ppm)	La (ppm)	Sm (ppm)	Yb (ppm)	Cs (ppm)	Ta (ppm)	Th (ppm)	Co (ppm)	Sc (ppm)	Ba (ppm)	Sb (ppm)	Sn (ppm)	Cr (ppm)	Hf (ppm)	Zn (ppm)	Ag (ppm)	Ce (ppm)	Eu (ppm)
Igbo Ukwu Class II. TABLE 22b (pp.319).																												
"Indian" red																												
IGB-X	4.99	3.20	6.23	4.60	3.20	2.49	ND	0.50	562.0	3012.0	1.42	6.41	1.62	0.74	4.60	1.00	1.48	39.90	1.84	93.0	9.10	161.0	104.00	1.38	452.0	4.5	20.27	0.38
IGB-U3	7.65	3.20	5.44	4.60	3.20	2.03	ND	0.50	408.0	11588.0	1.44	8.93	1.62	1.01	2.40	0.72	2.27	9.32	6.85	155.0	22.00	167.0	104.00	2.43	452.0	4.5	20.27	0.38
IGB-U1	8.54	3.20	4.45	4.60	3.20	1.98	ND	0.50	415.0	12564.0	0.98	120.34	1.62	1.07	4.60	0.81	2.48	9.45	5.85	212.0	38.30	300.0	104.00	3.12	452.0	4.5	20.27	0.38
IGB-U2	8.58	3.20	4.62	4.60	3.20	1.95	ND	0.50	414.0	12494.0	0.97	13.46	1.62	1.13	5.00	0.82	2.58	9.68	5.92	227.0	36.50	322.0	104.00	3.03	452.0	4.5	20.27	0.38
MEAN	7.44	3.20	5.19	4.60	3.20	2.11	ND	0.50	449.8	9914.5	1.20	37.29	1.62	0.99	4.15	0.84	2.20	17.09	5.12	171.8	26.48	237.5	104.00	2.49	452.0	4.5	20.27	0.38
STD	1.46	0.00	0.71	0.00	0.00	0.22	0.00	0.00	64.9	4003.7	0.23	48.02	0.00	0.15	1.02	0.10	0.43	13.17	1.93	52.8	11.86	73.9	0.00	0.69	0.0	0.0	0.00	0.00
Igbo Ukwu Class III. TABLE 22c (PP. 319).																												
Blue/Green																												
IGB M5A	10.43	9.00	3.18	ND	3.00	0.90	ND	1.30	626.0	10886.0	0.96	9.96	1.88	1.26	2.50	0.56	2.93	38.92	3.53	261.0	23.00	263.0	51.00	3.00	460.0	12.0	26.00	0.60
IGB M5B	12.25	9.00	2.13	ND	3.00	1.23	ND	1.30	353.0	15499.0	1.14	10.44	1.88	1.66	2.60	0.97	3.49	11.18	4.44	233.0	23.40	180.0	51.00	3.24	460.0	12.0	26.00	0.60
MEAN	11.34	9.00	2.66	ND	3.00	1.07	ND	1.30	489.5	13192.5	1.05	10.20	1.88	1.46	2.55	0.77	3.21	25.05	3.99	247.0	23.20	221.5	51.00	3.12	460.0	12.0	26.00	0.60
STD	0.91	0.00	0.52	0.00	0.00	0.17	0.00	0.00	136.5	2306.5	0.09	0.24	0.00	0.20	0.05	0.20	0.28	13.87	0.45	14.0	0.20	41.5	0.00	0.12	0.0	0.0	0.00	0.00
Green																												
IGB-Z2	10.68	9.00	1.57	ND	3.00	0.93	ND	1.30	1045.0	11020.0	0.91	10.39	1.88	1.19	9.20	0.54	7.00	32.74	3.04	166.0	27.90	142.0	51.00	2.93	460.0	12.0	26.00	0.60
	9.12	0.00	2.01	0.00	0.00	0.86	0.00	0.00	530.0	10580.8	0.83	8.25	1.50	1.15	3.38	0.61	3.38	24.35	3.09	184.2	19.54	141.3	40.80	2.48	368.0	9.6	20.80	0.48
Igbo Ukwu Class IV. TABLE 23 (pp.327).																												
Colourless																												
IGB-V1	2.81	13.94	6.64	2.00	3.20	0.30	ND	0.16	638.0	233.0	0.97	4.47	1.22	0.95	2.50	4.62	1.19	3.64	0.93	108.0	1.20	110.0	27.00	1.22	75.0	2.0	16.83	0.27
IGB-V2	3.49	15.29	7.84	2.00	3.20	0.27	ND	0.16	447.0	233.0	0.76	4.29	1.22	0.79	2.60	2.25	1.19	3.94	0.81	176.0	1.20	110.0	27.00	1.04	75.0	2.0	16.83	0.27
IGB-V3	3.71	15.43	7.29	2.00	3.20	0.24	ND	0.16	578.0	233.0	0.72	3.52	1.22	0.74	2.80	0.36	1.26	19.49	0.91	185.0	1.20	110.0	27.00	0.66	75.0	2.0	16.83	0.27
MEAN	3.34	14.89	7.26	2.00	3.20	0.27	ND	0.16	554.3	233.0	0.82	4.09	1.22	0.83	2.63	2.41	1.21	9.02	0.88	156.3	1.20	110.0	27.00	0.97	75.0	2.0	16.83	0.27
STD	0.38	0.67	0.49	0.00	0.00	0.02	0.00	0.00	79.8	0.0	0.11	0.41	0.00	0.09	0.12	1.74	0.03	7.40	0.05	34.4	0.00	0.00	0.00	0.23	0.0	0.0	0.00	0.0
Green																												
IGB-S2	2.53	14.87	7.37	2.00	3.20	2.48	ND	0.16	492.0	233.0	2.49	9.37	1.22	1.28	8.70	2.09	3.80	6.31	2.06	150.0	1.20	110.0	27.00	1.72	75.0	2.0	16.83	0.27
IGB-S3	2.67	11.83	7.07	2.00	3.20	2.60	ND	0.16	481.0	233.0	2.53	7.73	1.22	1.25	8.90	2.04	3.92	6.21	2.07	166.0	1.20	110.0	27.00	1.99	75.0	2.0	16.83	0.27
MEAN	2.60	13.35	7.22	2.00	3.20	2.54	ND	0.16	486.5	233.0	2.51	8.55	1.22	1.27	8.80	2.07	3.86	6.26	2.07	158.0	1.20	110.0	27.00	1.86	75.0	2.0	16.83	0.27
STD	0.07	1.52	0.15	0.00	0.00	0.06	0.00	0.00	5.5	0.0	0.02	0.82	0.00	0.02	0.10	0.02	0.06	0.05	0.00	8.0	0.00	0.00	0.00	0.14	0.0	0.0	0.00	0.00
Cobalt Blue																												
IGN-N3C	2.28	10.43	6.56	2.00	3.20	0.66	ND	0.16	7928.0	233.0	1.58	18.64	1.22	0.94	12.80	1.64	1.71	1104.80	2.99	617.0	1.20	110.0	27.00	1.83	75.0	2.0	16.83	0.27