Shipwrecks & Glass Beads: Indian Ocean World connectivity across the historic maritime cultural landscape

Jennifer L. O. Craig

Doctor of Philosophy

Department of Anthropology

McGill University
Montreal, Quebec

July 7, 2021

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Doctor of Philosophy

Table of Contents

DEDICATION

This dissertation is dedicated to my parents Linda and Donald Craig,

and to my husband TJ Maclay.

I dedicate my work to my ancestors

and their future in my daughters Aspen and Kaiya.

I am always grateful for the guidance of water.

Through the squalls and the flat calm I continue to listen and learn.

ACKOWLEDGMENTS

This project would not be possible without the support of the National Museum of the Philippines directors Jeremy Barns, Angel Baptiste and staff in the Archaeology Division Mary Jane Bolunia, Eusebio Dizon, staff in the Underwater Archaeology Division namely Clyde Jago-on and Bobby Orillaneda and from the Records Section Nida Curvas. During fieldwork I appreciated the research assistance by Emil Bersamira and Bobby Orillaneda. The fieldwork was supported by Social Science and Research Council of Canada MCRI, Society for Nautical Research, Brasenose College and Oxford University Meyerstein.

I sincerely appreciate my mentors Brendan Gillon and Gwyn Campbell, and my friend Clifford Pereira. I thank Andre Costopoulos for sticking it out with me to the end, editing the final draft of the thesis and directing me towards the Antiquity journal's more visual medium of the Project Galleries.

Thank you to the Australia Endeavour Award for professional development funds to train in museology at the Shipwreck Galleries of the Western Australia Maritime Museum (2012). Many thanks to the staff in the Department of Maritime Archaeology and Conservation for guiding me on clear communication of my intentions, work and results.

Salaam alaikum to the Maritime Oman team and for continued invitations since 2012 to stimulating formal and informal events on Arabian ship construction techniques. ขอบคุณมาก to the Thai Underwater Archaeology Department for the invitation to the Samut Sakhon shipwreck excavation.

Thank you Laure Dussubieux for analysis support in the Elemental Analysis Laboratory at the Chicago Field Museum with financial assistance by the National Science Foundation (BCS 1321731) and the Bruce and Barbara Trigger Award of the Anthropology Department McGill University; and statistical analysis and training supported by MITACS Research Training Award (2020).

I have so much gratitude for the opportunity to attend and participate in the archaeology conferences held by the Indo-Pacific Prehistoric Association (2014), and the Asia-Pacific Regional Conference on Underwater Cultural Heritage (2011 and 2014). The IOWC seminars, conferences and workshops were an invaluable kaleidoscope of ideas and methods for studying the IOW.

Writing and mapping of this thesis was supported by Social Science and Research Council of Canada MCRI (2014-2018) and McGill University Award of Excellence (2019-2021). I appreciate the minutiae support in creating the maps from the McGill Geographic Information Centre's staff: Paulo Arroyo, Carl Hughes, Lillian Fadin, Jeff Sauer, and Brandon Taylor.

During my doctorate my biggest hurtle was writing of this thesis and I am humbled by the patience of folks who worked with me: Charlotte Pham and Veronica Walker-Vadillo for help with the many drafts of the 2015 article (here Chapter 2), Nick Burningham for our IOWC conference paper on Arabian Sea peoples ship construction (Baggalas and Baghlas) and the drawing in Figure 2-2, writing tutorials with Stephen Kuntz, comments and suggestions provided by anonymous reviewers and editors of the Journal of Indo-Pacific Archaeology (Oli Pryce) and Antiquity (Liz Ryan and Claire Nesbitt) and the book chapter forthcoming edited by Heather Walden and Laure Dussubieux, and copy edits by Debby Waldman. I appreciate the professionalism and politeness of the anonymous reviewers of the Archaeological Research in Asia journal for comments to tease apart the three lines of thought in what became chapter 3 and portions of the linking passages.

I also would like to thank the McGill Anthropology librarian Nikki Thurmmon and the librarians William Bielaskie and Francisco Uribe in interlibrary loans for all their help with attaining access and copies of many references in the bibliography.

I am so grateful to water for your many, convoluted and fluid teachings.

ABSTRACT

This study presents the first chemical composition data on glass beads recovered from mid-second millennium CE of Philippines shipwrecks. The three shipwreck sites are relatively dated to 1460-1488 CE, 1488-1505 CE, and 1573-1620 CE and their cargo were stored in the National Museum of the Philippines. After morphological analysis of 1131 glass beads, 12 varieties of beads were identified. Of these, a representative sample of 87 glass beads were analyzed using laser ablation – inductively coupled plasma – mass spectrometry (LA–ICP–MS). LA-ICP-MS measures the specific amounts of elements, including traces, which combined together while the glass was molten. Three outcomes of these analyses indicated 11 varieties of beads: the glass recipe types, the colorants, and the measurements. The beads fall into standard or long categories. The colours are red, black, yellow, blue, orange, and white. The three types of glass recipes include two subgroups of high-alumina mineral soda glass, a later period lead potash glass, and a newly discovered and previously unidentified high magnesium high aluminum glass. I use Principal Component Analysis to compare glass manufacture sites with the shipwrecks' glass beads. A biplot comparing the lead potash glass and high magnesium high aluminum glass to the 14th century CE site in Fort Canning and 15th – 16th century beads from the Philippines indicates the shipwreck glass is similar to the later dated site. This data from the Philippines shipwreck sites, when contextualized within other glass evidence across the Indian Ocean World, allows a refinement of the chronology and distribution of mid-15th to mid-17th century glass in the region.

ABREGE

Cette étude présente les premières données de composition chimique sur des billes de verre récupérées dans des épaves de navires aux Philippines au milieu du deuxième millénaire de notre ère. Les trois sites de naufrages sont relativement datés de 1460-1488 CE, 1488-1505 CE et 1573-1620 CE et leur cargaison a été stockée au Musée national des Philippines. Après analyse morphologique de 1131 billes de verre, 12 variétés de billes ont été identifiées. Parmi celles-ci, un échantillon représentatif de 87 billes de verre a été analysé par ablation laser – plasma à couplage inductif – spectrométrie de masse (LA–ICP–MS). LA-ICP-MS mesure les quantités spécifiques d'éléments, y compris les traces, qui se sont combinés pendant la fusion du verre. Trois résultats de ces analyses ont indiqué 11 variétés de perles : les types de recettes de verre, les colorants et les mesures. Les perles entrent dans les catégories standard ou longues. Les couleurs sont rouge, noir, jaune, bleu, orange et blanc. Les trois types de recettes de verre comprennent deux sous-groupes de verre de soude minéral à haute teneur en alumine, un verre de potasse au plomb de la période ultérieure et un verre à haute teneur en magnésium et en aluminium nouvellement découvert et non identifié auparavant. J'utilise l'analyse en composantes principales pour comparer les sites de fabrication de verre avec les perles de verre des épaves. Un biplot comparant le verre de potasse au plomb et le verre à haute teneur en magnésium et en aluminium au site du XIVe siècle de Fort Canning et aux perles des Philippines du XVe au XVIe siècle indique que le verre de l'épave est similaire au site daté plus tard. Ces données des sites d'épaves des Philippines, lorsqu'elles sont contextualisées dans d'autres preuves de verre à travers le monde de l'océan Indien, permettent d'affiner la chronologie et la distribution du verre du milieu du XVe au milieu du XVIIe siècle dans la région.

CONTRIBUTION TO ORIGINAL KNOWLEDGE

My interest in the teachings of water with an archaeology tool-kit began when as a child I met a barracuda who informed me that my contribution in this lifetime would be from work underwater. I was always curious how we could tell the story of such a dynamic space/place. In what capacity I would work with water became clearer over time. Mixing together the water and my love of history and tangible objects, I sought university degrees in archaeology and history. I greatly expanded my repertoire with a MA in Maritime Archaeology and History from Bristol University. After, I immediately jetted off for the first time to cross the planet and arrived in Australia to help with supervising a fieldschool with Flinders' University under Mark Staniforth. I was well into the writing of this dissertation before I realized how instrumental Dr. Staniforth's training on the unification of water and land was in my thinking of maritime archaeology.

I entered McGill's PhD program intending to address the blank blue space at the center of the Indian Ocean world. My original question asked if the Philippines archipelago was a terminus for bead exchange or a transhipment point on to other locations. I wanted the bead artefacts to formulate the trade routes and dating of archaeological sites. I quickly identified that I needed to spell out the value of investigating artefacts from underwater contexts because terrestrial colleagues were unaware of the stories the water had to tell. I selected pre-Spanish Philippines because it was quickly obvious there was an enormous gap of knowledge between the ancient past (prior to year 1 CE) and the Spanish occupation from 1521 CE. I systematically identified the variety of glass beads available in the National Museum of the Philippines during fieldwork in 2014. Possibly the most adventurous year of my life!

During the adventurous year of 2014 I was living and working in three continents. I was writing, training and seeking funds in England (then a member of the European Union). I was research assisting in Turtle Island/North America at the Indian Ocean World Centre with my mentor Brendan Gillon. I was volunteering as a cultural attaché for environmental conservationists in Arabia. My fieldwork in the Philippines also occurred during this year, and possibly the most important and fun conferences I've ever attended: the Indo-Pacific Prehistoric Association in Siem Reap Cambodia and the UNESCO Asia-Pacific Regional Conference on Underwater Cultural Heritage in Hawaii, USA. These opportunities to fly across great expanses of water, and then land to work and live alongside so many coasts of the Indian Ocean, Atlantic Ocean and Pacific Ocean have most certainly shaped my ability to move in and out of macro, to micro, scale thoughts and analysis. As exciting as these viewpoints are and their potential to perpetually narrow and expand my thoughts, they also seemed to translate into confusion in my writing.

Learning of the many different writing styles and the importance of audience has preoccupied my time since defending my Research Proposal in 2015. This recognition of audience and context of the written word started to clarify how much of the data we have to work within anthropological archaeology is colonized, masculine, and heartless. This dissertation is the product of this learning and recognition. In developing the writing of this dissertation I tried other theoretical frameworks available within the discipline and quickly and with heart-break discovered the omission of water. Further, publications are changing with the global COVID-19 pandemic and revival of societal recognition of social injustices. Canons are being reconsidered. Perhaps the tide is changing.

If the tide is changing then may I ask if we could also change our expressions to more storytelling? I am enamoured by the recent Wenner Gren's Sapians podcast on *Black and Indigenous Storytelling as Counter-History* by Dian Million, Weshoyot Alvitre, Antoinette

Jackson, John Jennings, Ora Marek-Martinez and Cheryl White. These are my people!! I sit with previous anthropology department graduates such as Samuel Veissière whose thesis was written as a novel; and the editors of the journal of Antiquity who developed the Project Galleries, which gave me a space to bring ancestral cultural historical methodologies, as suggested by Charles Perreault (2019), to an observation window thousands of kilometers wide. And perhaps still the most uncomfortable and necessary impacts to sharing my vulnerabilities professionally are the feminist indigenous archaeologists Kisha Supernant, Jane Eva Baxter, Natasha Lyons, and Sonya Atalay who literally wrote the book on *Archaeologies of the Heart*. It is in these arenas that as an archaeologist and storyteller I expand on morphological and compositional raw data from small artefacts excavated from water and interpret the science into art.

CONTRIBUTION OF AUTHORS

This manuscript-based PhD thesis includes two single authored articles and one co-first author book chapter. However, I conducted all the research, data analysis, figure design, and writing in these chapters.

The published version of chapter 4 lists Laure Dussubieux as co-author. The article submitted presents my analysis and interpretation work. The concept of matching trace element analysis of soda alumina, lead potash and discovering a new glass recipe of high magnesium high aluminum were inspired by Dussubieux's work with laser-ablation iconoclastic plasma mass-spectrometry to identify the trace elements in glass chemistry and her continued role as a sounding board and statistical-trainer as I developed the theoretical, and then the interpretation of the glass elemental results. Dussubieux provided guidance and presented avenues for financial support from the laboratory stage of the project and edited the initial and revised drafts of the published book chapter.

The published version of chapter 2 and 5 are both single authored articles. The articles submitted present my work exclusively, with acknowledgements included in the published work and reproduced with more precision in the thesis section titled Acknowledgements. The thinking process that led to the production of the published version of chapter 2 comes from two avenues of work I was involved with at the time. First, I was one of three maritime archaeologists involved in the Indian Ocean World Centre's Major Collaborative Research Initiative project and found that I had to regularly explain to both terrestrial archaeologists and historians the value of data available within underwater archaeology sites. Second, I and two co-authors (Charlotte Pham and Veronica Walker-Vadillo) were invited to publish a chapter on Maritime Archaeology in the Oxford Handbook on Southeast Asian Archaeology. To create this chapter, I suggested we organize a session on Maritime Archaeology at the Indo Pacific Prehistoric Association and invite our colleagues from each country of Southeast Asia to present so we could reference work created by our colleagues. The thinking process that led to the production of the published version of chapter 5 comes from drafts of chapter 3 (rejected as a single author article to the journal *Archaeological Research in Asia*) and the thoughts on theory explained in the linking passages.

LIST OF TABLES AND FIGURES

CHAPTER 1

Introduction

1.1 Introduction

On beaches, glass beads packed in large ceramic jars are heaved up and loaded into an open-top boat. The hull of the boat sits between skids, waiting for the crew and local community to come together, and push the boat. When it is time, the boat and crew whoosh into the waters. The crew jump aboard the vessel, bouncing atop the cargo, and hollering out to one another to get to the post that best suits the balance of the boat. Each member of the crew grabs an oar or rope and in sync with their vessel, maneuvers over the waves, and through the shallow breakwaters. Confident in these maneuvers, the folks on the beach return to their various chores, while children splash about in the waves, waving, and shouting their bon voyages.

The beachside communities are likely located alongside estuaries where the sea meets the mouth of rivers. In the smaller centers, markets are created to trade spices and botanicals from up-river alongside the shipped-in glass beads, metal implements, and instruments. Some ceramics are sold in this market while other ceramics are re-filled to ship either up-river or out to sea.

Archaeologists, material scientists and ceramicists have worked together, revisiting collections of ceramics, to identify the various kinds of jar-use. In Southeast Asia, jars called Maenam Noi were shaped and fired near present-day Bangkok, and then reused to pack cargo over centuries within the region (Cort 2017; Sukkham 2014). The goods inside the jars seemingly changed to suit the demands of the markets to which they were being shipped. The goods of greatest interest, which came from the people in upriver hinterlands, were spices and botanicals. Meanwhile, downriver people along the coast exchanged the spices and botanicals for foreign goods like glass and metal, which they then traded with the folks upriver (e.g., Bacus 1999; Bronson 1980; Glover and Bellwood 2004; Junker 1999; etc.). The intermediaries who performed these down-the-line exchanges (Renfrew 1977) in the smaller centers in the past have largely remained faceless in both historical and archaeological accounts; in the records of Chinese, European and Arab travels, they are referred to, in passing, as barbarians, natives, and uncivilized (e.g. Pigafetta, Mao Kun, Chau ju kua, Ibn Battuta). The people at the ends of these exchange networks in the larger centers and polities, where things like currencies were formed and in operation, were identified by their language or religion and designated a geographic homeland. People such as Arab *sharrahs* or Hindu *chettairs*, in particular, are identified broadly as Gujarati (Reid 1988, 1993). All of them, however, whether identified or not, operated in a landscape ruled by the water.

When scholars first paid attention to the teachings of water and began to populate a water-scape, capitalization and globalization shaped the research. Fernand Braudel, a merchant-naval officer, consulted enormous archives and selected specific goods to follow in the ledgers of merchants. Braudel's work continues to pervade research methods and questions of maritime archaeologists and historians. Important works such as the *Indian Ocean* (Pearson 2003; Beaujard 2012) and *Southeast Asia in the Early Modern Era* (Reid 1993) have influenced decades of maritime-oriented scholars. This influence, which is the basis for the work being done by prominent scholars today, merged the regions of the Indian Ocean and Southeast Asia to form the Indian Ocean World (IOW). Scholars recognized that the people occupying the water spaces connected across distant places (e.g. Gwyn Campbell, Himanshu Prabha Ray, David Blundell, George Coedès).

Not everyone looked at the broader landscape. Some remained focused on their specialized region but published widely and participated in IOW dialogues (e.g. Pierre-Yves Manguin, Jun Kimura, Jeremy Green, Wijerathne Bohingamuwa), and continue to do so. More recently, scholars have entered the record of islands as hubs of activity for trade, provisions, and community (e.g. Edward Alpers, Burkhard Schnepel, Krish Seetah), while other scholars have turned to the inland waterways to trace the journeys of people canoeing (e.g. Edward Simpson, Miriam Stark). The conversation about the IOW has largely remained focused on capitalization, with globalization being redirected towards environmental agency. Capitalization has narrowed to focus on the goods and services available in places and along journeys that populate the water-scape.

The water-scape, if mapped and populated, consists of dots denoting the latitudinal and longitudinal locations where goods were produced, exchanged, buried, or even shipwrecked; while the lines over the water represent where goods were shipped. The dots represent a variety of locations both inland and coastal, while the lines remain largely over the open ocean. Only more recently have scholars argued to include local trade as part of the research (e.g. Nancy Beavan, Tep Sokha, Atthasit Sukkham). In either case the lines connecting places that are assigned to specific cultures and boat studies are merging. Specific groups of sailors are being identified based on details of ship construction technique recorded in historical iconography or epigraphy, and compared to ethnographic records of boat building (e.g. Tom Vosmer, Eric Staples, Nicholas Burningham, Pierre-Yves Manguin, Erbprem Vatcharangkul). However, the cargo within the boats is often overlooked in favor of details on the hull, except in Korea where there is equal emphasis on both (e.g. Minkoo Kim, Whan Suk Moon). The cargo research has largely remained focused on a few particular item-types, such as ceramic jars (e.g. Michel

Flecker, Roxanna Brown) but scholars are asking for more holistic cargo studies or at least alternative material culture foci (e.g. Brian Fahy, Carl Knapett, John Miksic). It is here that I find my work. I focus on glass cargo in three shipwreck case studies. The water-scape is populated with locations where glass material science from contemporary archaeological sites matches with my case studies. The archaeology analyses of these locations indicate activities of past peoples in settlements, burials or shipwrecks.

1.2 Context – Southeast Asia and Indian Ocean

This work is contextualized with the work of two other archaeological studies on beads in the IOW. Marilee Wood's work stems from her doctoral dissertation, *Interconnections: glass beads and trade in southern and eastern Africa and the Indian Ocean - 7th to 16th centuries AD*. Alison Carter's work stems from her doctoral dissertation research on *Trade, Exchange, and Sociopolitical Development in Iron Age (500 BC – AD 500) Mainland Southeast Asia: An Examination of Stone and Glass Beads from Cambodia and Thailand*. I borrow different aspects from both projects to investigate glass beads from shipwreck cargoes from 1460-1620 CE. I use the same two methods as Wood and Carter to analyze glass. I use morphological analysis to visualize the distribution of beads in the Philippines between 1460 and 1620 CE and produce the *terminus post quem* and *terminus ante quem* of a variety of glass bead types from my case studies; and I use elemental compositional analysis through laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS).

My elemental analysis was performed in the same location, using the same equipment, and performed by the same glass specialist, Laure Dussubieux, as Wood's and Carter's. For details on the LA-ICP-MS methods please turn to (see Appendix 1). I follow Wood and Carter for a baseline of information on glass in the geographical boundaries of my project (see chapter

3). My overarching geographical boundary is the Indian Ocean world (IOW), which extends from East Africa, the Middle East, South Asia, Southeast Asia, and East Asia. Wood's work is bounded within the Indian Ocean and Carter's work is bounded within Southeast Asia. By looking at shared elements in both these boundaries I merge and contextualize Southeast Asian and Indian Ocean glass data to refine the chronology and distribution of mid-15th to mid-17th century IOW glass.

1.3 Research questions addressed in this dissertation

This research project examines glass beads from shipwreck cargoes and merges the results with terrestrial traditions in settlements and burials to constitute a maritime cultural landscape. By identifying the different varieties of glass bead types found at underwater sites across the Philippines and tracking their distribution I have been able to determine that there were three phases of trade: an earlier phase that broadly moved goods in an eastern direction focused on the triangular trade of the Indian Ocean and into the coastal exchange networks in Southeast Asia; a mid-phase when an explosion of activity occurred across the whole IOW and multiple locations produced glass that was shipped in every direction; and a later phase that broadly moved goods in a western direction and focused on the coastal exchange networks in Southeast Asia towards the Indian Ocean.

All three of my case studies are located in the Philippines. These data were supplemented with glass bead data from six sites in Southeast Asia and 15 sites in the Indian Ocean (see Linking Passage 3). Data from these sites allowed for a broader view of possible connectivities between sites in the Philippines and contemporary sites across the IOW. As there had not yet been a comprehensive examination of IOW trade networks using data from multiple Philippines archaeological sites, the first task involved addressing the question, ***Do shipwreck glass cargo indicate distinct patterns in the distribution of glass beads over time?***

To address this question, the glass beads from the archaeological sites Pandanan, Santa Cruz, and Royal Captain Shoal wreck 2 (RCSw2) were recorded with a focus on morphological characteristics, bead colour, and markings on the beads that were related to their production methods (see Appendix 2). This was supplemented with compositional analysis on a selection of the beads using LA-ICP-MS (see Appendix 3). Compositional analysis determined the glass recipe, as glass beads may look similar to one another but have been produced using different recipes from different workshops. These data were compared with known glass in IOW circulation (Dussubieux et al. 2008; Dussubieux et al. 2010).

The cargo context in which glass beads were found also was carefully noted in the museum records and updated with the literature to identify and determine if there were patterns of storage jars (or ceramics) within each of the three shipwrecks (see chapter 3). Although beads may have been incorporated into cargo in different ways on different ships, my research shows that mid-15th to early-16th century drawn soda alumina glass beads that originated from India were stored and shipped inside varieties of Thai Maenam Noi jars, while 16th century to mid-17th century wound lead potash glass beads from unknown sources were associated with Chinese ceramics.

Shipping in mid-15th to mid-17th century Southeast Asia is broadly categorized into mercantilism, tribute, or bootlegging, in which at least two of the ships that were eventually wrecked—the Pandanan and the Santa Cruz—likely participated. Mercantilism is the exchange of goods for currency, it is conducted by individuals who may or may not sail with their goods

(Beaujard 2019; Margariti 2007, 2008). Tribute shipments are emissary trade of materials, services or ceremony that act as “tokens of subservice but not direct rule of distant provinces” (Hall 2011; Miksic and Goh 2017: 42, 160; Renfrew & Bahn 2018: 217; Wade 2009, 2013). Bootlegging or freelance trade is a transaction between intermediaries who may travel with goods or operate in market places (Orillaneda 2016b; Renfrew & Bahn 2018: 223-224); and synonymous with “black market”. This derogatory term is not used in this dissertation but its pejorative presence is pervasive (Robinson 1983). The later shipwreck, the RCSw2, likely carried cargo from local merchants. My examination of glass beads has produced several surprising conclusions. My work confirms that there are differences in the glass beads found from the mid-15th through to the mid-17th century, a pattern that was identified but not quantified by earlier scholars (Carter 2016; Carter et al. 2016; Dussubieux and Gratuze 2013; Junker 2018).

The patterns observed in the glass beads were then used to address my second question: ***What refinements to the chronology and distribution of Indian Ocean World glass are possible if arbitrary boundaries are dissolved between Southeast Asia and Indian Ocean to form single maritime cultural landscape?*** As noted above, results from the analysis of glass beads show evidence of three phases of shifting patterns of glass bead cargo from 15th to 17th century Philippines shipwrecks. To begin with, during 1460-1487 CE, soda alumina (group 2) glass was traded eastward; previous studies in maritime archaeology and history indicate that these sites were likely connected by Gujarati sailor merchants across the whole IOW (Burningham 2019; Reid 1993).

Later, during 1488-1505 CE, glass trade across the IOW developed and expanded in new directions. Glass from India, including high-alumina soda (group 4) glass beads, seems to move from the west coast to the northeast, while lower quality wound lead-potash glass beads re-enter the maritime cultural landscape but with a different glass recipe (Carter & Dussubieux 2019). It is also in this period that we see increased numbers of glass beads across Southeast Asia both inland and underwater. I argue that contextualizing glass from shipwrecked cargo in a maritime cultural landscape indicates shifting patterns of people's connectivities across a water-scape that expanded the IOW.

1.4 Conclusion and dissertation outline

In this introductory chapter I have provided my research questions, a discussion of my theoretical orientation, a background to the premises my work builds from, and a review of my research questions and results. Linking Passage 1 explains the maritime cultural landscape within the specialism of maritime archaeology and the IOW as an emerging theoretical framework in the discipline of anthropological archaeology. Linking Passage 2 continues theoretical discussion of applying multilinear analysis of different types of cargo and details the provenience context of the glass beads in the three archaeological sites. Chapter 2 provides insight into what kind of information can be obtained from a shipwreck. It shows exemplars from other parts of the world where the interrogation of shipwreck data has proven useful. Chapter 3 provides details on the methodology and morphological characteristics of the 1131 glass beads collected in fieldwork during 2014, identifying 12 varieties of beads. The beads fall into standard or long categories. The colours are red, black, yellow, blue, orange, and white. Each bead photograph to scale is included in Appendix 4.

In Linking Passage 3, I suggest the theory discussed in earlier linking passages can be used towards tandem patterns of cargo. This passage provides the laboratory methodology and compositional analysis of LA-ICP-MS, which measures the specific amounts of elements, including traces that combined together while the glass was molten; and the additional details on the statistical techniques and methods used to differentiate the glass sources and artefacts.

In Chapter 4, I answer my first research question by contextualizing the archaeological sites I use as case studies in my project. I draw upon three resources to address the question of glass bead provenance in the Philippines from the compositional data of 87 representative glass beads: 1) published ceramic cargo patterns in all three shipwrecks, which were used to date each site; 2) observations of glass cargo patterns within the three shipwrecks used as case studies here; and 3) the chemical compositions of glass that were on board the shipwrecks. Chapter 4 combined the morphological and compositional analysis to indicate the shipwrecks had 11 varieties of beads, instead of the 12 varieties concluded from the morphological analysis alone. The identical black glass beads were two different recipes. The three types of glass recipes include two subgroups of high-alumina mineral soda glass, a later period lead potash glass, and a newly discovered and previously unidentified high magnesium high aluminum glass. I use Principal Component Analysis to compare glass manufacture sites with the shipwrecks' glass beads. A biplot comparing the lead potash glass and high magnesium high aluminum glass to the 14th century CE site in Fort Canning and 15th – 16th century beads from the Philippines indicates the shipwreck glass is similar to the later dated site. Combining evidence from glass and ceramics cargo, I compare chronological and distribution information. These comparisons are contextualized with contemporaneous regional affairs to re-create ancient exchanges.

Linking Passage 3 provides the comparison and contrast of data from the Philippines shipwreck sites with other glass evidence across the Indian Ocean World, specifically from six sites in Southeast Asia and fifteen sites in the Indian Ocean.

In Chapter 5, I answer my second research question by adding evidence to existing hypotheses in archaeological glass and merging regionalized studies on glass material in the Indian Ocean world. I unit contemporary glass evidence from archaeological sites both underwater and on land in the Indian Ocean World. This connectivity of glass refines the chronology and geographic distribution of mid-15th to mid-17th century glass, a distribution indicating that broad patterns of exchange occurred in specific directions, which shifted within short periods of time.

Linking Passage 1 – Theory: Discipline Context

> Archaeological sites connected to maritime activities are quite varied; shipwrecks and boat remains are the most commonly associated with maritime archaeology, but sites such as coastal settlements, lake and river dwellings, harbours, fish weirs, and shipyards are examples of the diverse nature of maritime sites. Maritime archaeology can thus be conducted in shallow waters or in deep waters, along the coast, on the foreshore, and in lakes or in rivers. Pham, Craig, Walker-Vadillo (2021, in-press)

Maritime archaeology studies have moved past unilinear, mono-directional trade patterns to complex network models of connectivity. This connectivity of archaeological remains on land and underwater is the theoretical framework known as maritime cultural landscape. Maritime archaeology today is concerned with "the study of material remains relating to human activities on the seas, interconnected waterways, adjacent locales and associated communities" (Adams, 2006: 1). The water connects places on land associated with each other to create a maritime cultural landscape (MCL).

This MCL can connect the artefacts from shipwreck cargoes with the features and artefacts from as far inland as hinterland settlements and burial grounds. Merging these archaeological sites into a shared landscape has potential for the study of emerging patterns of specific artefact production, exchange and use. This requires that we organize the archaeological data into geographic databases so we can visualize shifts in patterns in time and space.

We researchers working in the Indian Ocean World (IOW) do not adopt explanations for shifts in patterns from other regions. At the McGill Indian Ocean World Centre (IOWC), research is led by human-environment interactions, so naturally an ocean-centric model would suit maritime archaeology and the concept of maritime cultural landscapes. Although not all participants in the IOWC work from this concept, together we developed a geographic database to visualize shifts in patterns. The IOWC database organizes autonomous things, people, and the environment contextualized in an *Ocean* landscape, with a body of water at the center; thus it makes sense to include archaeological data from within the water that could contribute to the study of human-environment interaction. The most obvious data from within the water is archaeological shipwrecks.

Shipwreck sites are (often) in water, so to holistically consider the human-environment interaction such a site should include observations of aquatic micro and macro fauna migrations and water health. Underwater archaeology includes details on the site environment much like conventional terrestrial archaeology details site soils and sedimentology. Although the physical excavation of shipwrecks may differ from terrestrial archaeology, the artefacts and features are investigated in a similar manner. Perhaps a few similes would be of aid here: like the walls of houses, boat hull design informs us of architecture; like the house hardware, boat fastenings, wood species, and tools required for shipbuilding inform us of cultural construction techniques; like all the furniture and baubles within the home, boat cargo informs our theories and steers us away from biases in the interpretation. In shipwreck archaeological sites these autonomous things are interpreted from water perspectives that relate to their maritime cultural landscape (Westerdahl 1992; 2002), and draw connections between activities at sea and on land (Pearson 2013). Before continuing with the maritime cultural landscape of shifting patterns, we first need to know the extent of data available from shipwrecks.

CHAPTER 2

Value of Shipwreck Data

Craig, J. 2015. Value of Shipwreck Data in Databases, in *Journal of Indo-Pacific Archaeology* 36: 34-41.

2.1 Abstract

Shipwrecks are archaeological sites. This paper divulges details of the components of shipwreck sites in order to illuminate the value and extent of information possible. For the most part the Belitung Wreck is referenced throughout the text when available, otherwise other examples are incorporated to highlight the topic. Here is an introduction aimed at an audience unfamiliar with nautical archaeology terminology and methodology. Rather than suggest how to build a database for the purposes of data mining, this information will benefit projects, like McGill University's Indian Ocean World Center, intending to include shipwrecks as part of their dataset. Further, exemplars from other parts of the world where the analysis of shipwrecks has proven useful are included.

2.2 Introduction

Shipwrecks are valuable sources towards understanding our human past. Details of Southeast Asia shipwrecks are summarized in order to point out what information shipwreck sites can provide, with a specific focus on the Belitung Wreck as an example of how any one shipwreck can contribute to multiple narratives towards multiple disciplines. This paper ultimately points out the importance of integrating maritime archaeology information into the developing Indian Ocean World Center (IOWC) database project. Information cross-correlation could help to address major questions in various fields of research such as past shipping activities, worldly affairs and global climate. This paper does not provide a how-to guide on the integration of shipwreck data into databases nor does it discuss the potential of doing so through data mining. Instead, it provides insight into what kind of information can be obtained from a shipwreck. It shows exemplars from other parts of the world where the interrogation of shipwreck data has proven useful.

Shipwreck data is a valuable source for research on the history of a region and its connectivity with global networks. Southeast Asia is a geographical nexus within the Indo-Pacific Region between both the Indian Ocean and Pacific Ocean networks; it constitutes the social, cultural and environmental edges of the far eastern end of the Indian Ocean and the far western end of the Pacific Ocean, thus to discuss maritime archaeology of Southeast Asia is to investigate the inter and intra-connectivity of the Indo-Pacific Region.

The Indian Ocean World (IOW) is an ocean-centered concept that connects people and environment across the massive seascape of its namesake with networks expanding out across the globe. The connectivity of this space could be largely contributed to shipping activity thus it is important to explore the many facets of shipwreck archaeology and explain the value of shipwreck data in the IOWC database. The extent to which shipwrecks can add value to an ocean-oriented project is provided through examples on the Mediterranean World. This is not necessarily to say that the theoretical framework for the Mediterranean World should be adopted in the IOW but it is an example of the extent shipwrecks provide value to multidisciplinary databases.

2.3 Indian Ocean World Centre

The scope of the Indian Ocean World Center is the study of the Indian Ocean World between the early centuries BCE to modern times. The IOWC consists of nodes of focused research that contribute to wider questions of human-environment interaction. The geography of the research area is west to east from East Africa to eastern Southeast Asia, and north and south from China to Australia and/or the Red Sea to Madagascar. Its philosophy is established by the center's director Gwyn Campbell and aims to study the IOW from the region's autonomous things, people and environment; it is careful to not necessarily adopt the same explanations for shifts in the technology, infrastructure and socio-politics as they are understood in the Mediterranean and Atlantic, for example European slave ships in the Atlantic were purpose-built but this is not necessarily the case in the Indian Ocean and the labour, dockyards and ship dimensions should not be extrapolated from a different region's history to the IOW (Campbell 2015; 2014; 2013a; 2013b; 2013c; 2012).

The IOWC can be described as the epicenter for a Major Collaborative Research Initiative (MCRI) which entails over forty scholars and tens of students gathering information in their specialties on the natural and cultural interactions in IOW. The aim of the project is to investigate the rise and development of the world's first `global economy' from the early centuries B.C.E. to the present day. Its scope includes exchange of commodities and ideas and environment which may have helped to shape the exchange, such as cyclones, volcanic eruptions, monsoons, etc. The information is provided by a network of ten teams working in institutions across the globe on a range of topics, from the economy to the palaeo- and historic climate of the Indian Ocean or from Zheng He to the natural disasters in the Philippines and to the technical development of document analysis. The teams operate in an open door policy in which the work of one specialist can contribute to the gaps of someone else's work.

The significance of IOW research teams are the people and work generated within the MCRI network web. The project regularly organizes meetings, workshops and conferences in which scholars from very different specialties meet and share information within the teams and the broader network. Each team generates primary data on their specific node, the culmination is

Big Data. In order for the whole network to have access to this Big Data, a database is being developed as a key deliverable to the MCRI. This sharing and centralization of data moves away from the island-researcher notion of subjective building of tables for data organization; and instead promotes objective record keeping, which supports the agency analysis of things, people and places. The latter point allows data to speak for itself instead of through the lens of one scholar's research question. The database aims to organize the data so that patterns can emerge across multiple specialties.

The issue of how to integrate shipwrecks in databases is being tackled as a key deliverable within the MCRI based at the IOWC, McGill University. The MCRI/IOWC Database information will be useful for statistical and comparison information. The outcomes could be displayed in multiple formats depending on the researchers' interpretation: diagrams, tables, maps, etc. At present, the MCRI/IOWC Database is hospitable for entering single archaeology site location and time; this could expand to include individual entries on artefacts, ship construction and maintenance, and the natural environment of the shipwreck sites.

2.4 MCRI/IOWC Database

The concept and purpose of the MCRI/IOWC Database focuses on classification and cross-correlation of information; due to the amount of information being generated it is referred to in computer programming as Big Data. The Big Data is being organized through Bayesian Networks in a relational model database in order to enable queries that may shed some light on links and drivers of human-environment interaction. One of the main objectives of the project is to build the relational database in a manner that it is accessible to researchers for them to query, interpret, and integrate diagrams, tables, maps, and so on in their own work. The expectation of how it will work is as a cross-correlator between multidisciplinary data for interdisciplinary research questions. The current stage of the relational database is progressing due to a partnership with the McGill Geographic Center. Experts in Geographic Information Systems (GIS) software and webpage design are members of the MCRI and are developing the database output and a webpage for global data input.

At the current stage of development, the Big Data is composed of historical documents and modern-day anthropological interviews. The data generated by the various teams from these two disciplines in one database is advantageous because it invites queries entailing a longue durée framework over a large geographic area. The current development of the database is strong in supporting hypotheses from documentary sources and modern-day observations.

Up to now there is no perfect database system. The reason for this could be largely due to the lack of diversity in the subjects of the Big Data. Potentially, the IOWC database could be a good solution. The IOWC's MCRI is focused on an Indian Ocean landscape, with a body of water at the center; thus it is evident to include archaeological data from within the water that could contribute to hypotheses on the cause and effect of human-environment interaction. Other databases exist that include archaeology data and some of that data is from the water. Some databases also include archaeology from the IOW, but these are limited to terrestrial sites or only the geographic location and date of an underwater site. Although this paper does not aim to provide guidance on how to build a database, it is relevant here to mention other databases currently available as open sources, and explain what other maritime databases have done thus far to include shipwreck data. For example, the Maritime Buddhism database within the Electronic Cultural Atlas Initiative network includes data of ports and other coastal sites with Buddhist artefacts (Blundell and Zerneke 2014). Although the database seems to have had shipwreck data in the past (Brown 2004), this does not seem to be the current case (Yahja 2014).

Another database, the Shipwreck Asia database includes details of shipwreck site locations and dates (Kimura 2015), but it does not include the details of what artefacts and features are in the sites (Kimura 2010). **So if the MCRI/IOWC Database did include shipwreck sites, what kind of information would that bring to the project?**

Perhaps it is worth reviewing how valuable shipwreck data has been to Mediterranean regional history, another sea-oriented network study. The Mediterranean region's history has evolved beyond unilinear approaches, such as mono-directional trade patterns displayed on static maps, and instead towards network models of connectivity (Leidwanger et al. 2013; 2015). The team in the Oxford Roman Economy Project (OREP) are testing hypotheses set out fifteen years ago (Horden and Purcell 2000), with data drawn from the Mediterranean Sea. The rich data of the Mediterranean, from both land and sea archaeology excavations and within maritime and hinterland historical archives, is adapted to socio-spatial networks. The results indicate that certain periods of time correlate with changes in infrastructure, technology and resource extractions. For example, the graph of the mid-point date of 1,189 shipwrecks in A.J. Parker's catalogue (1992) displayed his proposal that a boom in the Roman economy occurred during fifth century BC to fifth century AD, and especially within the second century BC. Two decades after Parker's publication, the OREP published on their work which included Parker's data and five-hundred more shipwrecks graphed with the 'noise' of long date ranges removed (Wilson 2011). The results in Wilson's (2011) graphs show a different bell curve with the rise in economy in the first century AD and with a swift drop in the second century AD. In fact the drop in the number of shipwrecks is regarded as significant after the first century CE just when the major port of Portus was built and evidence of export increase in African Red Slip ware are confirmed in terrestrial excavations (Wilson 2011: 35). The accumulation of data on shipwrecks and its interpretation in graphs broadly point out the "diminishing returns are not yet set in and the accumulation of more data continues to be worthwhile" (Wilson 2011: 34). The OREP is also capable of pointing out gaps in the data and hypothesize reasons why these exist, for example shipwrecks may be available for study along the North African coast where few underwater excavations have taken place (Wilson 2011: 35-36). Another example expounds on the directional changes of trade to the east and north of Crete after the volcanic eruption of Thera in 1500BCE (Leidwanger et al. 2015). These examples from the OREP on Mediterranean Big Data test longue durée spatio-temporal hypotheses with maritime archaeology data. As mentioned, the hypotheses being tested by the OREP were proposed fifteen years ago by Peregrine Horden and Nicholas Purcell (2000), their work re-evaluated Braudel's (1972) concepts, which he tested only on the sixteenth century, to a much longer time period from Classical antiquity to the modern era.

From the Mediterranean example above, we know a shipwreck database works (Wilson 2011: 33-59). When querying a database that includes shipwrecks, the results can provide graphs of higher or lower shipping activity based on the number and type of ships, they can indicate the supply and demand of cargo, the cause and effect of coastal infrastructure on urbanisation and/or politics, or even global climate changes and impacts on marine animal ecosystems.

The IOW has similar studies of the past social and cultural paradigms with interpretations influenced strongly by Braudel (1972), such as Michael Pearson's The Indian Ocean (2003) and in Southeast Asia Anthony Reid's Age of Commerce (Reid 1988; 1994). Major longue durée hypotheses were developed in these studies and continue to orient research questions within the Indo-Pacific Region, but neither of these volumes consider the archaeological evidence in equal measures to the historical evidence. As in the Mediterranean World, the Indian Ocean World has developed longue durée hypotheses (Pearson 2003; Reid 1988; 1994) based on activities largely centered on the seascape; further, like the Mediterranean, the IOW has a dataset of shipwrecks which provides plenty of information to test economy-oriented hypotheses over a longue durée. **So what kind of data do the shipwrecks in the IOW offer that can contribute to the MCRI/IOWC database?**

The MCRI/IOWC database is a centralized multidisciplinary database which has the capacity to integrate evidence of social, culture and environment data from both land and water; thereby developing a thoroughly holistic approach. The current working structure of the MCRI/IOWC database requires each entry to include three important details so it can cross-correlate time and space, and each entry must have a date and a geographic location narrowed to latitude and longitude. The historic sources are scoured for references to dates and locations of specific events in the past. Shipwreck sites have the same capacity to provide to the database data on the location and dates of artefacts, features and context. In order to appreciate the significance of what this data could have on IOW outputs, it is relevant to explain what data can be generated from shipwreck archaeological sites.

2.5 Shipwreck value for databases

Similar to a house or settlement, shipwrecks are remains of a place where humans conducted social, cultural and political acts with culturally-imbued objects. Entire seascapes can be created from the remains of shipwreck (Adams 2001). Christer Westerdahl (1992; 2002) proposes a very strong framework where both land and sea constitute the “-scape”, the maritime cultural landscape. How this differs from conventional landscape archaeology is all in the perspective: maritime cultural landscapes start from the perspective of the water and interprets materials from that angle. In the Braudelian interpretations mentioned above Michael Pearson’s

(2003) *The Indian Ocean* is a historian's exercise in interpreting the maritime cultural landscape of the Indian Ocean. Below I adopt a similar exercise to Pearson (2013) and share how a shipwreck could be used in the same way as a historical document to draw connection between activities at sea and on land. I do so with the primary example of the Belitung wreck, a 9th century shipwreck hypothesized to have origins in the Arabian Sea Region, and archaeologically excavated off the island of Belitung to the east of Sumatra, Indonesia. So, using this example, **what is the maritime cultural landscape of the Belitung wreck? How could this example of underwater archaeology in Southeast Asia contribute to a Social/Natural Science and Humanities database on the Indian Ocean?**

2.5.1 Hull Design

The design of ship's hull with the intention of transporting economic goods is constructed for two purposes: 1) integrity of the ship, and 2) maximum cargo (Steffy 1994:8-10). The integrity of the design had to transport objects and people while withstanding potentially violent marine environments, depending what area the ship moved over was a major contributing factor to how a ship was built. For example, if a ship was to move over sheltered waters and short distances then the hull could be shaped to a maximum capacity design – that of a rectangular parallelepiped or cuboid, as is the case with barges; therefore the rectangular center of a ship is its profit area and the rest of the area to the ends and sides is overhead (Steffy 1994: 10). Whereas in order to operate in (stormy) open waters the ship had to entail some elements of design such as curved sides and pointed bow that may not have suited the cost-benefit ratio but did get the transport mechanism, the ship, safely from one location to another (Steffy 1994: 10). An example of seafaring capacities is the Jewel of Muscat, a reconstruction of the Belitung Wreck. In order to calculate the correct dimensions for the reconstruction the archaeological site plan and archaeologist were consulted along with information derived from contemporary archaeological ship's timbers, the bow of the ship was not intact and exact dimensions were calculated based on available information of the interior structure (Belfioretti & Vosmer 2010: 116; Burningham 2011; Vosmer, et al. 2011).

Hull shape is important in seafaring/sailing capacities and cargo transportation. In a database the data on the hull of the ship can note the technology of shipbuilding and highlight information on wood species, tools required for shipbuilding, and ship maintenance in shipyards (Adams 2001). Anthropology specialists in ship construction, often ethnographers but some iconographers, are working in a positivist manner on gathering more specific data so that we move away from boat-type categorization and instead towards agency of ship components (Maarleveld 1995; McGrail 2001; 2004). This is especially important in terms of fastenings (McCarthy 2005; McGrail 2004).

2.5.2 Fastenings

Fastenings are the small thing that connects or fastens two different parts of a ship (i.e. one plank to another). They are cultural constructs and highly indicative of where and by whom a ship was built. Consequently, fastenings can narrow survey areas for past locations of shipbuilding and maintenance. In a database if the detail of a fastening is included then there is strong potential for correlation of ship construction technique to cultural group and therefore location of shipbuilding.

The Belitung Wreck is of a fastening tradition in which the planks of the ships were sewn together with plant fiber twine (Nicholas Burningham, pers. comm., February 2015; Flecker 2000; Jackson 2012; Eric Staples, pers. comm., February 2015). Although the initial publication state the vessel was stitched (Flecker 2000), the drawings of the wreck's fastenings were indeed sewn (Flecker 2000: 207, Figure 14). Sewn plank construction fastens a plank to another plank with continuous, connected stitches in a crossover X style (see Figure 2-1). Sewn ships are identified as a tradition based on ethnographic and iconographic evidence in the Middle East and western India (Agius 2002; 2008; Blue and Staples 2015; Vosmer 1992). Sewn planks are of the Arabian Sea Region, a regionally identifiable ship construction technique, and are separate from that of stitched planks which are of the Southeast Asia Region (Mangiun 2013; see Figures 2-1 and 2-2). Stitched planks are a tradition ascribed to Southeast Asian manufacture based on archaeological evidence of twine in shipwrecks. Stitching fastens a plank to another plank by individual stitches with one discrete vertical line rather than continuous sewing (see Figure 2-2).

Figure 2-1: Picture of shipwreck planks sewn together.

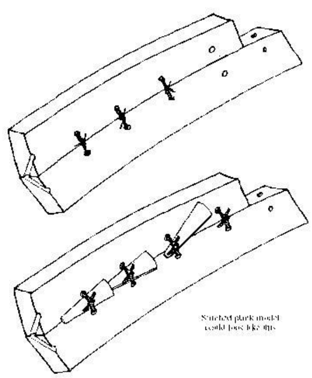


Figure 2-2: Drawing of ship planks stitched together (courtesy of N. Burningham).

The Belitung Wreck was fastened by sewing and does not include any nails; however, nails are another defining fastening for ship construction technique. Chinese boatbuilding tradition includes bulkheads and metal nail fasteners, whereas Southeast Asian boat-building tradition includes fasteners of wooden treenails or dowels. South-China-Sea Tradition hybrids are a combination ascribed to ships' fastenings and building sequences that combine both Chinese and Southeast Asian traditions (Flecker 2007; Manguin 1984). Here is it useful to bring in multiple other shipwreck examples from the Southeast Asia Region to highlight the discussion on South-China-Sea Tradition hybrids. South-China-Sea Tradition shipwrecks can include evidence on a sliding scale between the two traditions of Chinese and Southeast Asian (Manguin 1984), for example, the hull of the Ko Khram and Phu Quoc II shipwrecks have dowels, metal nails and bulkheads so these are hybrid but more towards the Chinese end of the sliding scale; whereas the Longquan and Nanyang wrecks both have treenails so these are examples of hybrid vessels resembling the Southeast Asian tradition of the sliding scale (Brown 2009; Flecker 2007; Kimura 2010; Kimura 2015; McGrail 2001; Orillaneda 2008; Orillaneda & Ronquillo 2011).

2.5.3 Wood Species and Dating

A shipwreck is not just a pile of timbers but indeed they are timbers. Wood species contribute to seascape/landscape studies with identifying logging areas, shipbuilding centers and possible trade patterns in timber. Aside from the knowledge to be gained of the past, wood species identification can narrow survey locations for archaeologists of shipbuilding activities and contribute to conservationists' research in landscape management practices.

In the Belitung Wreck the major elements of construction such as the keelson, planks and futtocks are identified as multiple species of woods largely sourced from Africa. Recalling that Arabian Sea peoples tradition is to sew a ship's timbers together, the twine which held the ship together was originally identified as hemp from the Caucasus and expected to have been an import to the Middle East long before the 9th century date of this shipwreck (Flecker 2008: 386). Later, specialist-analysis identified the twine as hibiscus (a plant found in Southeast Asia but not in East Africa or the Middle East); the wadding between the fastening-twine and the wooden planks is Melaleuca a plant sourced from Indonesia (Nicolas Burningham pers. comm. in Flecker 2008: 386). So, although the main component of the vessel, the planks, are associated with African trees and were cut and shaped according to Arabian Sea Region ship construction traditions the vessel may have undergone major maintenance in Indonesia when the chalking was partially replaced and tightened with Indonesian plant fibers (Flecker 2008:386; Vosmer et al. 2011).

2.5.4 Tools Required for Shipbuilding and Ship Maintenance

Dockyards in specific geographic areas can be associated with shipwrecks based on the tools required for shipbuilding and ship maintenance that are found on-board the shipwreck, these are present due to adjustments or general repairs of the ship made while sailing.

Where ship building/maintenance occurred can be inferred from fastening types and timber species. For example, the Belitung Wreck, originally an Arabian Sea peoples' construction and found off the coast of Indonesia, showed signs of maintenance work in Indonesia (Flecker 2008). From these observations maritime archaeologists deduced the possible explanation that the ship had originally arrived from the Arabian Sea area, sailed to China (based on one type of cargo) and wrecked off Indonesia. Prior to the wrecking, while it sailed in Southeast Asia the ship went through normal maintenance over the course of a long voyage and required some local maintenance on the hull in order to continue.

If we could gather all the data about all the ships' hulls that had repairs it may give us hints about who could conduct repairs and where in the Southeast Asia Region. It also shows the importance of certain locations strategically located on maritime routes, where ships from all nations would stop to refit or careen. In a database this information from shipwrecks would contribute to locate these important international centres for ship maintenance and trade goods exchange.

2.5.5 Cargo

Cargos, like ships' hulls, have a story that starts with production, travel and ends with use and deposition. Studies of cargo in Southeast Asia is largely centered on ceramics (Van Tilburg et al. 2014: Session 8; Brown 2004; 2009), whereas other artefact studies are rare but growing (i.e. Craig in-prep, Fahy 2015, Orillaneda in-prep). Ceramics from shipwrecks have contributed to ceramics dating and market shift hypotheses. Ceramic cargo on the Belitung shipwreck are used to support the hypothesis that the sailors conducted a unilinear west to east and return direction sail which started from the Arabian Sea Region to China, where they picked up ceramic cargo, and left to return to their home-port but stopped into conveniently located Indonesia (in-terms of geography and hospitable ports for gathering supplies), where they later wrecked (Flecker 2008). This hypothesis is based largely on the ceramic cargo, ship's hull and the location of the shipwreck. **If the rest of the Belitung cargo were considered as closely as the ceramic cargo would the hypothesis remain the same or would a different, and perhaps larger, network of connectivity come to light?** Metal coins, for example, are now being considered along with contemporary historic documents on the monetary system of China, Japan and Korea. Angela Schottenhammer (2015) points out the evidence of bronze coins from the Belitung, Intan and Cirebon shipwrecks align with comments on money in documents from the

Imperial courts of China, Japan and Korea. **Why would a 9th century ship bring back to the Arabian Sea money from China, Japan or Korea?** A further example is the Santa Cruz, a 15th century shipwreck off the coast of the Philippines being reconsidered by Bobby Orillaneda. Orillaneda initially developed hypotheses of the ship's trade route with the ceramics cargo in his masters (Orillaneda, pers. comm., November 2010), for his doctorate he is returning to the wreck and investigating the site as a whole with multiple different types of cargo which is testing the original hypothesis of the trade route, not only in its direction but the entire validity of mono-directional trade route hypotheses. This type of work requires in-depth analyses of multiple artifacts to be conducted and the results of the entire assemblage analyzed as a whole; however, few studies are available on cargo aside from ceramics. In the case of the Santa Cruz there are two other studies which can contribute to Orillaneda's study, that of Brian Fahy's work on metals and organics and the author's own work on stone and glass beads. The separate cargo studies are already showing different patterns of exchange then when the trade route hypothesis was based solely on ceramics.

If in a database we could have the detailed inventory of cargo composition as separate entries of different types of cargo we could trace the journey of particular objects through time and space and develop new hypotheses on patterns of the distribution of artefacts.

2.6 Environment of Shipwreck Site

Archaeology can contribute to environment studies; it can reconstruct climate and past environments therefore connecting causation between human-environment interactions. Shipwreck site formation processes can extrapolate data on marine life, water currents, air currents, seasonality of weather and animal migrations, sedimentology of the seabed, bathymetry, salinization, temperature, coastal erosion-stabilization, etc. (see the example of the

Liberty shipwreck in Ridwan this volume). On the one hand, this information can contribute to the macro scale of climatology studies. For example, the water temperature and sedimentology are datasets useful to geological oceanography and ultimately research in global warming. On the other hand, shipwreck deposits can contribute to microscale analysis. In archaeological studies of shipwreck sites the shipworm is the main macro-organism investigated to explain micro-organism migrations and changes. Wood borers inside shipwreck timbers, such as the teredo navalis, can indicate the salinity, temperature, and pollution of surrounding waters (Garrison 2004; Palma & Santhakumaran 2015). This information can contribute to local knowledge on marine resource health, oceanography, and marine biology which in turn informs climatologists of shifts in micro-organism migrations either vertically in the water column or horizontally across oceans, an example of which is eutrophication (Chislock et al. 2013) the nutrient saturation of water in which phytoplankton cannot live causing multiple knock-on effects such as warming of the oceans and ecosystem alterations (National Research Council 2005a; 2005b; Marker 2007). The possibilities and reliability of qualitative and quantitative studies on natural factors in shipwreck sites is often focused on studies of water currents and scouring (digging-out), such is the case off East Africa (Breen et al. 2001; Breen & Lane 2004; Quinn et al. 2007).

In a database, it would be interesting to have detailed entries on shipwreck site environments. That information could be extracted from site excavation reports to regroup data about the different types of environment and contribute to information directly on micro-organisms and ultimately climate variations.

2.7 Conclusion

This paper illustrated the breadth and depth of information that can be gathered from shipwreck sites. Databases that include details of shipwreck sites will include information not available in other databases. If shipwrecks are included in the IOWC database, the information can feed into what the larger database is aiming at: global economy and climatology studies. Shipwrecks provide information of shipbuilding traditions, the types of artefacts available on site and how cargo and environment studies can contribute to trade route hypotheses. Specialists in maritime archaeology can investigate shipwreck sites to provide data that can contribute to the sciences and humanities. This paper builds towards future work on how to integrate shipwreck data into the IOWC Database. Shipwrecks in Southeast Asia have illustrated the amount and diversity of information. This is contextualized within a wider ongoing database project at McGill University's Indian Ocean World Centre.

From the example of Parker's shipwreck database in the Oxford Roman Economy Project we have concrete evidence that the inclusion of shipwrecks in a multidisciplinary project can indicate major impacts and shifts in the Mediterranean Sea (Wilson 2011). In the Indian Ocean World most known shipwrecks are in the Southeast Asia Region, starting with shipwreck input from this region and expanding it across the Indian Ocean World to East Africa could contribute to studies on major migrations and ecosystem fluctuations, the output of which can help us to better understand human environment interaction.

The culmination of all this information on the Belitung Wreck points out shipwrecks are not just piles of timber and the value of shipwreck data in a database. The ship's hull was discussed in terms of its sewn fastenings that indicate the ship construction technique originated from the Arabian Sea Region. A unilinear methodology was originally applied to the cargo's ceramics which were used to explain the directionality of the ship as from the western Indian Ocean and its main destination having been China before it was on its return journey. When later organic species analysis was conducted on the twine of the sewing and the wadding between the twine and planks a secondary hypothesis was proposed that the Belitung Wreck had stopped for hull repairs in Indonesia, where it later wrecked. Maritime archaeologists can and are returning to shipwreck sites to re-evaluate the site as a whole, including multiple artefacts in their analyses instead of a focus on one type of artefact to explain trade routes; this developing multilinear analysis of cargo has opened shipwreck sites to new developments in Big Data database outputs on network connectivity. Although not developed in this paper, there are many other aspects of a shipwreck that would be interesting if set into a database, such as decorations which hint at symbols and rituals and folklore, or weapons which may indicate allies, etc.

References

ADAMS, J. (2001). Ships and boats as archaeological source material. World Archaeology 32 (3):292-310. doi: 10.1080/00438240120048644.

AGIUS, D. A. (2002). In the Wake of the Dhow: The Arabian Gulf and Oman. Garnet-Ithaca Press.

AGIUS, D. A. (2008). Classic Ships of Islam: From Mesopotamia to the Indian Ocean. Brill.

BLUE, L. K. & STAPLES, E. (2015, Feb February 14 to 16). Sewn-plank Boat Workshop, GU Tech, Muscat, Oman.

BLUNDELL, D., & ZERNEKE, J. (2014). Electronic Cultural Atlas Initiative: Early Austronesian Historian Voyaging in Monsoon Asia: Heritage and Knowledge for Museum Displays Utilizing Text, Archaeology, Digital Interactive Components, and GIS Approaches. International Journal of Humanities and Arts Computing (8):237-252.

BRAUDEL, F. (1972). The Mediterranean and the Mediterranean world in the age of Philip II. Collins.

BREEN, C., W. FORSYTHE, P. LANE, T. MCERLEAN, R. MCCONKEY, A. L. OMAR, R. QUINN, and B. WILLIAMS. (2001). Ulster and the Indian Ocean? Recent maritime archaeological research on the East African coast. Antiquity 75 (290):797-798. doi:10.1017/S0003598X00089304.

BREEN, C., & LANE, P. (2004). Archaeological approaches to East Africa’s changing seascapes. World Archaeology 35 (3):469-489. doi: 10.1080/0043824042000185838.

BROWN, R. (2009). Ming Gap and Shipwreck Ceramics in Southeast Asia: Towards a Chronology of Thai Trade Ware. Siam Society.

BROWN, R. M. (2004). History of shipwreck excavation in Southeast Asia. In J. Ward, Z. Kotitsa, & A. D'Angelo (Eds) The Belitung wreck: Sunken treasures from Tang China (pp. 40-55). Seabed Explorations.

CAMPBELL, G. (2012, Nov. 12). Keynote Opening Speech. In G. Campbell (Chair), The Dimensions of the Indian Ocean World Past [Panel presentation] Sources and Opportunities for interdisciplinary work in Indian Ocean World History, 9th -19th Centuries, Western Australia Museum, Fremantle, Australia.

CAMPBELL, G. (2013a, Nov. 8). Africa in the Indian Ocean world in the first millennium CE [Conference session]. Proto-globalisation in the Indian Ocean world, University of Oxford, Oxford, UK.

CAMPBELL, G. (2013b, Nov. 22). The Historical Debate over the Origins of the Malagasy [Conference session]. East Africa and Early Trans-Indian Ocean World Interchange, McGill University, Montreal, Canada.

CAMPBELL, G. (2013c, Sept. 9). Keynote Speech. In G. Campbell (Chair), The Indian Ocean World [Panel presentation] The European Impact on the Indian Ocean World, McGill University, Montreal, Canada.

CAMPBELL, G. (2014, Oct. 23). Keynote Opening Speech. In G. Campbell (Chair), The Indian Ocean World [Panel presentation] Trade in Animals and Animal Products in the Indian Ocean World from early times to c.1900, McGill University, Montreal, Canada.

CAMPBELL, G. (2015, April 23). Welcome Address. In G. Campbell (Chair), The Indian Ocean World [Panel presentation] Currencies of Commerce in the Greater Indian Ocean World, McGill University, Montreal, Canada.

CHISLOCK, M. F., DOSTER, E., ZITOMER, R. A. & WILSON, A. E. (2013). Eutrophication: Causes, Consequences, and Controls in Aquatic Ecosystems. Nature Education Knowledge 4 (4):10.

CONWAY-JONES,H.(2006).PurtonBargeGraveyard. http://www.gloucesterdocks.me.uk/canal/graveyard.htm.

FLECKER, M. (2000). A 9th-century Arab or Indian shipwreck in Indonesian waters. International Journal of Nautical Archaeology 29 (2), 199-217. doi: 10.1111/j.1095-9270.2000.tb01452.x.

FLECKER, M. (2008). A 9th-century Arab or Indian shipwreck in Indonesian Waters: Addendum. International Journal of Nautical Archaeology 37(2), 384-386. doi: 10.1111/j.1095-9270.2008.00193.x.

GODDIO, F. (2007). Topography and Excavation of Heracleion-Thonis and East Canopus (1996-2006): Underwater Archaeology in the Canopic region in Egypt. Oxford Centre for Maritime Archaeology.

JACKSON, R. (2012). Photo Logs: Construction. http://www.jewelofmuscat.tv/image/tid/9.

MAARLEVELD, T. J. (1995). Type or technique. Some thoughts on boat and ship finds as indicative of cultural traditions. International Journal of Nautical Archaeology 24(1), 3-7. doi: 10.1111/j.1095-9270.1995.tb00706.x.

MANGUIN, P-Y. (2013, Nov 21). Early Shipbuilding and trans- Indian Ocean Voyages. [Conference session]. East Africa and Early Trans- Indian Ocean World Interchange, McGill University, Montreal, Canada,

MCCARTHY, M. (2005). Ships' fastenings from sewn boat to steamship. Texas A&M University Press

MCGRAIL, S. (2001). Boats of the world: from the Stone Age to medieval times. Oxford University Press.

MCGRAIL, S. (2004). Boats of the world: from the Stone Age to medieval times. Oxford University Press.

MUCKELROY, K. (1978). Maritime archaeology. Cambridge University Press.

PALMA, P. & L.N. SANTHAKUMARAN. (2014). Shipwrecks and Global 'Worming'. Archaeopress.

PARKER, A. J. (1992). Ancient shipwrecks of the Mediterranean & the Roman provinces. Tempus Reparatum.

PATIENCE, K. (2006). Shipwrecks and Salvage on the East African Coast. Dar Akhbar Al Khaleej.

PEARSON, M. N. (2003). The Indian Ocean. London; New York: Routledge.

ROBINSON, D. (2013). Heracleion in context: The maritime economy of the Egyptian Late Period. Queen's College, University of Oxford, March 15th-17th.

SCHOTTENHAMMER, A. (2015, April 23). Bronze Coins and Silver Ingots: The Major Currencies across the East Asian Mediterranean [conference presentation on comparison of 10th century shipwreck archaeological coins and historic documents in China, Japan and Korea]. Currencies of Commerce in the Greater Indian Ocean World, McGill University, Montreal, Canada.

VAN TILBURG, H., TRIPATI, S., WALKER-VADILLO, V., FAHY, F., KIMURA, J. (2014). Proceedings of the 2014 Asia-Pacific Regional Conference on Underwater Cultural Heritage. Vol 1: Sessions 1-7; Vol 2: Sessions 8-15. Electrical Pencil: Honolulu, Hawaii.

WILSON, A. (2011). Developments in Mediterranean shipping and maritime trade from the Hellenistic period to AD 1000. In D. Robinson & A. Wilson (Eds.) Maritime Archaeology and Ancient Trade in the Mediterranean, (pp. 33-59). Oxford Centre for Maritime Archaeology.

YAHJA, A. (2014). Shipwreck Exploration: A Prospect with Robotics and GIS. [ECAI Atlas of Maritime Buddhism. Buddhist Culture and Technology: New Strategies for Study]. Maritime

Buddhism Workshop held in conjunction with the United Nations Day of Vesak Celebrations. http://ecaidata.org/organization/about/ecai-maritime-buddhism-project

Linking Passage 2 – Theory: Shipwrecks Context by multilinear analysis of cargo

The emerging multilinear analysis of cargo indicates patterns in materials of shipwreck cargo demonstrate shifting patterns in shipping. Shipping can be investigated through multiple disciplines to record and illustrate connectivity across maritime cultural landscapes. To pursue shifting patterns of archaeological and anthropological recordings within bodies of water is the specialism of maritime archaeology and to unite this data with terrestrial remains is the theory of maritime cultural landscape, but similar theories are employed in other disciplines. In the study of history, connectivity is created either from data gathered from maritime documents stored in marine archives that indicate sailing directions and timings (e.g. Himanshu Prabha Ray 2011), or from empiric archives that recorded tribute shipments in and out of a country (e.g. Geoff Wade 2005), or from merging historical mercantilist archives and shipwreck archaeological evidence (e.g., Angela Schottenhammer 2015, Roxani Margariti 2015). Further, in the study of anthropological archaeology, terrestrial archaeologists identify connectivity relationships by refining chronological variations from diachronic changes and contemporaneous differences; this methodology connected megalithic construction with water infrastructure in Maski central India (Bauer & Johansen 2021), and connected early Indo-Pacific bead manufactures and networks of exchange in the western Indian Ocean (Suvrathan 2021:137). This investigation into the materiality of beads "through the context of the finds" (Ray 2021: 99) is an emerging discussion in anthropological archaeology. Suvrathan (2021: 137) proposed that this methodology "brought out something of the gradations of value in the patterning of the beads at the three sites." In this case the contexts included the process of manufacture, the surrounds of the craftsmen within elite polities (Abraham 2016), and the colour of the glass used to make the beads. We're left with questions which, had the context included glass chemistry, might have further contextualized the three archaeological sites.

As Suvrathan did in her study, I too consider three archaeological sites, but in this study the sites are shipwrecks. In the previous chapter the Belitung shipwreck exemplified how any one shipwreck can contribute to multiple narratives. It is important to know the details of ship construction because it informs us of who sailed the ship and what environment it operated in. Where the ship's hull was built and who performed the building are indicated by fastener material and method (McCarthy 2012), thus identifying the people who built the hull and its geographic origin. The hull shapes are built for their particular use and suit their working environment. The stylistic and morphologic analysis of ceramics can date a site. The results can be compared in tandem with other cargo, such as metals and glass, as multilinear analysis to demonstrate shifting patterns in shipping.

LP 2.1 Shipwreck Archaeological Sites

LP2.1.1 Pandanan site

The Pandanan site was a barge with a hull that is shallow and box-like, based on the one-fourth of wreckage available, the boat was 25 to 30 meters long and 6 to 8 meters wide (Dizon 1996b). This construction would allow for one layer of cargo to sail within sheltered waters. The Pandanan was located alongside an inner harbour island, within a sheltered harbour at the southern tip of Palawan Island (Dizon 1996b 1:13). Its flat-bottom of scarf-jointed planks with frames and bulkheads had holes to allow the water to pass through; Dizon (1996a: 70) purported that this is an identifying feature of Vietnamese-built boats.

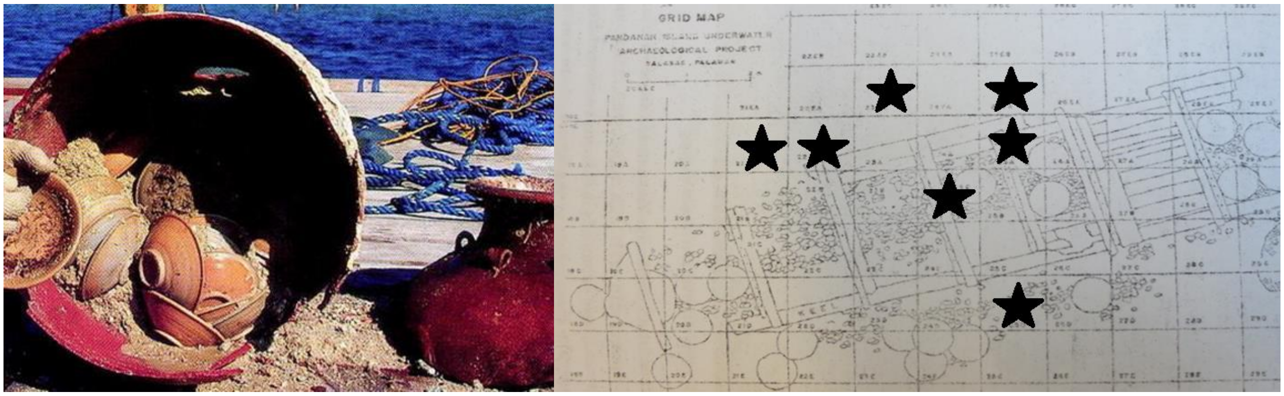


Figure LP2-1: Pandanan site. Left - Maenam Noi jars collected from the Pandanan shipwreck (Gilbert Fournier in Orillaneda 2016b). Right – Site plan of Pandanan. Stars mark where glass was excavated from the shipwreck (Dizon 1996b).

The Pandanan cargo included a Chinese Yong-Le (1465-1487CE) copper coin which marked the terminus ante quem at 1487 CE (Dizon 1996b; Orillaneda 2000). Analyzed cargo includes morphological and stylistic analysis of the late 15th century Chinese and Vietnamese ceramics (see Section 4.4.1). While the rest of the cargo entailed stone implements, metals (e.g. iron caldrons, bronze gongs, firearms, bronze cannons) and glass and carnelian beads (Brown n.d.; Cayron 2006:29; Dizon 1996a: 66; Orillaneda 2000, 2016a). A morphological analysis on 200 samples of the glass beads provisionally identified them as Indo-Pacific style specific to manufacture at Sungai Mas, Borneo, which was in production from 5th c. to 14th c. (Cayron 2006). The association of these glass beads with the aforementioned ceramics has only recently been explored in tandem, the results lead to multilinear connections in Thailand’s Ayutthaya Empire during the Ming Ban (see Section 4.6; Craig & Dussubieux 2021).

LP 2.1.2 Santa Cruz site

The Santa Cruz was an open-ocean sailing vessel because the hull had a deep V-shape, based on eighty percent of the hull preserved under the waterline the boat was 25 m long and 5.8 m wide, with three masts and a compartmented hold, decked with a castle (Goddio, Fabre, 2014:8,10). This construction would allow for cargo packed in tiers, to sail large distances across rolling waves of open-ocean. The Santa Cruz was located along the open-ocean side of the small island Zambales near the coast of the Philippines archipelago largest island Luzon (Orillaneda 2012). Its flush laid/edge-joined doweled wood planks (Orillaneda 2016a) were secondarily joined by iron nails to the frame of transverse bulkheads, which functioned as the compartmented hold, were made of wood species common to the Philippines: Vitex, Verbenaceae, Mimusops, Sapotaceae, Afzelia, Caesalpiniaceae and Teakwood (Goddio et al 2014: 8,10; Orillaneda 2008, 2012, 2016a, 2016b). These wood materials are not found in China but the iron nails and transverse bulkheads were regular Chinese shipbuilding methods for this period. The Santa Cruz is suspected to have been built by Chinese diaspora in the Philippines (Goddio et al. 2014: 8, 10; Manguin 2001: 15) or Thailand (Flecker 2005; Orillaneda 2016b).

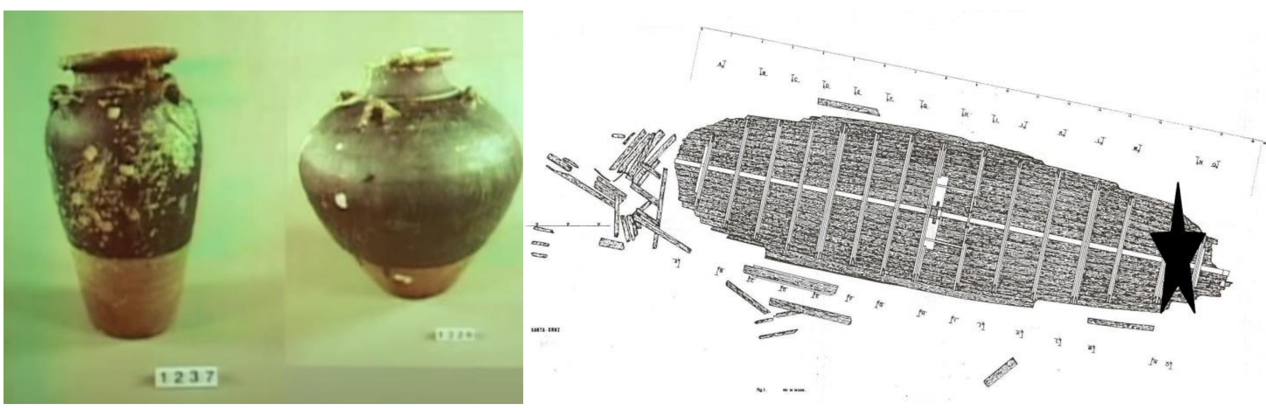


Figure LP2-2: Santa Cruz site. Left - Sawankhalok jars collected from Santa Cruz shipwreck (Orillaneda 2011, 2012). Right – Site plan of Santa Cruz. Star marks where glass was excavated from the shipwreck (Orillaneda 2013).

The site date range were derived from Chinese, Burmese, Thai and Vietnamese porcelain and stoneware jars of the late 15th century (see Section 4.4.2; Dizon 2003). Alongside these ceramics were a variety of other materials: tin, copper and iron ingots from the Malaya Peninsula or eastern Sumatra, cast iron bowls, ship-used cooking iron cauldron and plate, net weights and weighing scales, bronze gongs, brass and copper spiral bracelets, bronze cannons, metal box, bronze crown, and three corroded Chinese coins (Fahy 2014; Goddio 2002; Orillaneda 2016b).

Other cargo include green glass bracelets (Orillaneda 2016b:52), organic implements of wood and stone, and glass and carnelian beads (Orillaneda 2008, 2016a). No further research was conducted on the glass beads until now. The study conducted here in association with the aforementioned ceramics has only recently been explored in tandem. Like the Pandanan shipwreck, the results lead to multilinear connections in Thailand’s Ayutthaya Empire during the Ming Ban but the Chinese association of glass beads and ceramics points to possible bootlegging (see Section 4.6; Craig & Dussubieux 2021).

LP 2.1.3 Royal Captain Shoal wreck 2 site

The RCSw2 was likely a small coasting vessel (Goddio 1988: 128) with open-ocean sailing capacity because of its location on an atoll, a dead-reef. Although no timbers remain to conclusively analyze the hull, the location of the cargo concentrated in a concretion on the side of an atoll is informative (Alba 1988-9:3; Goddio 1988:35; Orillaneda 2014:424, 2016b: 24). Atolls are located in open-ocean environment and would require a ship capable of sailing such waters to reach it. The concretion formed due to the metal gongs loaded in the cargo. This is caused by metal to saltwater osmosis which creates a hard shell, like coral, around metal objects that stabilizes the location of the archaeological deposit (e.g., Scafuri 2017).

Figure LP2-3: Royal Captain Shoal wreck 2 site. Left – Blue and White Wanli jars collected from the RCSw2 site (Orillaneda 2017). Right – site location on edge of atoll, site plan illegible (Alba 1988; Jubelin, Lizé, Pfeffier 1985).

The site date range is derived from late 16th to early 17th centuries blue and white wares (See Section 4.4.3; Brown 2009: 167; Goddio 1988). Alongside the ceramics were a variety of other materials: bronze gongs, bronze box, bronze Song coin (early or middle 13th c.), bronze padlock, iron ingots, copper bracelets, ivory or bone counter (necklace?), a ring, and glass beads (Goddio 1988; Jubelin, Lizé, Pfeffier 1985). The 200 metal gongs underwent seriation analysis which inferred Suzhou copper foundries in China (Goddio 1988: 121). A morphological analysis on 200 samples of the glass beads provisionally identifies them as Chinese (Curvas 1985; Goddio 1988; Francis 1992, 2002: 78, 80, 82, 170). The association of these glass beads with the aforementioned ceramics has only recently been explored in tandem, the results lead to multilinear connections in the upswing of Chinese products flooding the market post the Ming Ban (see Section 4.6; Craig & Dussubieux 2021).

Maritime archaeologists now know much about how certain dimensions of a shipwreck can be identified to merge with terrestrial traditions in settlements and burials to constitute a maritime cultural landscape. Along these lines, in the Philippines Jun Cayron (2011, 2015) proposed a methodology that compared morphological traits of glass beads from Palawan Island's terrestrial and underwater archaeological sites, to test Francis' hypothesis that Indo-Pacific and Chinese glass beads never overlapped in their presence in the Philippines. Cayron concluded an opposition that the two bead types indeed overlapped.

In the next chapter I borrow Cayron's methodology to gather morphological data on glass bead archaeologically excavated from both underwater and terrestrial sites. I begin with describing the foundations of bead research in the Philippines. I then describe the specific methods I borrow from others to gather new data on glass beads from the three shipwreck case studies. I provide details on the analytical methods and the samples I analyzed, breaking them down into categories of colours: red, black, blue, yellow, white, and orange. This new data is then compared to the bead research in the Philippines to establish each glass colour terminus ante quem and terminus post quem. To geographically contextualize the results I conduct a literature review of the archaeological sites in the Philippines with references to glass beads. These steps to display the geographic distribution of glass bead morphological traits is a basis for grasping the Philippines glass maritime cultural landscape and informed me that further analysis is required to refine context of connectivity for this nation within the IOW.

CHAPTER 3

Morphological analysis

This chapter details and contextualizes the morphological data from the shipwreck case studies. Twelve varieties of monochrome glass beads are identified when compared with the known Bead Types in the Philippines. The archaeological sites associated with glass beads in the Philippines are also mapped to show the distribution of contemporary sites across the archipelago.

3.1 Background: Foundations of Bead Types in the Philippines

The foundation of bead analysis in the Philippines is the Bead Type Reference Collection Code, which classifies beads recovered from terrestrial archaeological sites across the Philippines. Archaeological sites in the Philippines are largely dated based on ceramic seriation, with some sites radiocarbon dated such as Butuan (Bolunia 2013; Lacsina 2015). As early as 1967 CE Fox (1967) recognized the frequency of beads in Philippines archaeological sites and invited Rey Santiago to collect representative samples of each different bead (Fox and Santiago 1985). Santiago made index cards with punch holes to write the site name and used string to attach each different type of bead and collectively titled them Bead Type Reference Collection. Santiago also formulated a method to characterize the beads into a typology (Santiago 2003) and chronologically organized them by cultural horizon (Santiago 1970, pers comm. 2011; henceforth Santiago's plates). The cultural horizons were created by Fox's supervisor Henry Otley Beyer (1947).

These efforts proved invaluable to Peter Francis Jr when, in the 1980s, he visited the National Museum of the Philippines in his search for Asian bead typologies and was introduced to Santiago's work. It is unclear whether Francis saw the index cards of Santiago's Bead Type

Reference Collection. Although, Francis most certainly saw Santiago's plates and assigned the plate letter and number to Francis' (1989) catalogue descriptions (henceforth Francis' catalogue). However there is some confusion about how Francis' catalogue referenced Santiago's plates. Santiago's plates are chronologically organized by cultural horizon using letters. Each plate then has a variety of beads arbitrarily numbered. So to use Santiago's plates one would reference the Bead Type Reference Collection Code, which for example could be 1-NE or Bead Type No. 1-Early Neolithic (Santiago 2003:3, 6). However, Francis' catalogue did not record the cultural horizon and instead noted the plate letter and bead number. In sum, Francis's notations are B2, or Late Neolithic Bead Type No. 2.

Date (Beyer 1947) **Revised Date (Francis 2002)**	**Cultural Horizon** **(Beyer 1947)**	**National Bead Typology of the Philippines** **Santiago (2003)**
200 to 1200 CE revised 1 to 1150 CE	Developed Metal Age	**Plate D**: Developed Metal Age beads
1200 to 1450 CE revised 1150 to 1450 CE	Early and Middle Phases of the Age of Trade and Contact with the East	**Plate F**: beads of the Age of Trade and Contact with the East, Middle Phase
1450 to 1600 CE	Late Phase of the Age of Trade and Contact with the East	**Plate J**: Glass and Bone Beads of the age of Contacts and Trade with the East, Late Phase

Table 3.1 Dates assigned to bead cultural horizons (Beyer 1947; Francis 2002; Santiago 2003).

Several decades after Francis was in the Philippines he revisited his earlier work and again discussed the Philippines beads in his seminal publication *Asia's Maritime Bead Trade: 3000BC to present*. In an appendix devoted exclusively to the National Bead Typology of the Philippines (Francis 2002: 223-238) the cultural horizons of Santiago's (1970) earlier work were revised. Thus some beads, particularly red glass Indo-Pacific beads, showed up in the Philippines archaeological record earlier but were also proposed to have left earlier when Francis revised the dates (see Table 3.1). Francis' (2002) conclusions proved problematic because the archaeological sites in my study include beads he considered no longer present in the Philippines. Before going further with this last point I would like to discuss the details on how and what I recorded of the glass beads in my study.

3.2 Methods and Materials: new data from shipwrecks

I conducted a morphological analysis of the glass beads from the shipwrecks of the Pandanan (1460-1487 CE), Santa Cruz (1488 - 1505 CE) and the RCSw2 (1573-1620 CE) to produce *terminus post quem* and *terminus ante quem*. My morphological analysis borrows terminology, methods, and descriptive layout from others. To explain the shape or form of the beads, I borrowed the hybrid glossary of terms from W.G.N. Van der Sleen's *A Handbook on Beads* (1956: 32, 34, 37, 44, 46), which built on Horace Beck's *Bead Nomenclature* (1928). The way I lay out this section and my descriptive terminology is borrowed from Marilee Wood (cf 2011).

3.2.1 Analytical Methods

All of the beads I examined are made from glass. First I laid them on the examining table. Then I sorted them according to how they were manufactured, end treatment and physical characteristics—e.g., diaphaneity, color, form, size (diameter and length)—and bore size. Diaphaneity is either translucent ("light passes through entire bead") or opaque ("no light seen through edge of bead") (Wood 2011: 70 table 3). Color, based on observation, is red, yellow, black, turquoise, orange, or white. The bead forms are either tube or barrel used interchangeably, oblate, cylinder or convex bicone (Beck 1928; van der Sleen 1956). Size is in millimeters, measured with calipers. The bore is the perforation through the glass that must be included in order to identify the glass as a bead, which allows the glass to be strung. The diameter is measured perpendicular to the bore. The length of the bead is measured parallel to the bore.

The size of a bead needs further explanation. Wood (2011: 70 tables 1 and 2) offers a calculable method to size beads that I adopt here. In her tables 1 and 2 on “bead size (diameter) categories” and “bead length ratios” respectively I can compare the measurements I took and resolve bead size (see table below).

Diameter	Length ratio designation formula	What size this means for the beads in my case studies
minute ≤2.5 mm small >2.5 – 3.5 mm medium >3.5 – 4.5 mm large >4.5 – 5.5 mm very large >5.5 mm	disc length = <1/5 diameter short length = >1/5 and <4/5 diameter standard length = >4/5 and <1 1/5 diameter long length = >1 1/5 and <2 diameter very long length = >2 diameter	L: 4.5-15; D:3-7 = Large to very large + long length to very long length L:1-4; D:3-6 = minute to medium + standard length

Table 3-2: Summary table of bead diameter and length for Pandanan IP RED glass beads. In measured length (L), diameter (D) and comparison to Wood’s (2011) tables 1 and 2 for categorized descriptors RedStandard (rs) and RedLong (rl).

All of the glass beads found in the Philippines during the Age of Contacts and Trade with the East (1450 to 1600 CE) are characterized by one of two methods: drawing or winding. The vast majority were made initially with the drawing technique and later the winding technique. Indo-Pacific drawn beads were made by using tools, specifically the *chetak* and *lada*, to pull glass from a mass into the tubes, after which the glass was chopped into beads (Abraham 2016; Kanungo 2000; Kock & Sode 1994; Francis 1989). With the naked eye one can see bubbles aligned parallel to the perforation. The wound beads were probably made by melting glass in a furnace and winding the molten glass around a mandrel and chopped into beads (Lankton, Dussubieux and Rehen 2008). Wound bead surfaces have swirl marks from the winding process, and with the naked eye one can see bubbles perpendicular to the perforation. The ends of wound beads do not require additional treatment (Wood 2011).

An alphanumeric system to catalogue beads was developed by Kenneth Kidd and Martha Kidd (1970) and later augmented by Karlis Karklins (1985), and is used by many bead researchers. In Philippines pre-European-trade assemblages so few bead types were present that the system is not particularly useful. It may, however, be useful to know the class designations that are applicable to the shipwreck assemblages presented here:

Ia: undecorated simple drawn tube-shaped beads

IIa: undecorated simple drawn non-tubular beads

WIa: undecorated simple wound cylindrical beads

WIb: undecorated simple wound round beads

Wld1: undecorated simple wound donut beads

3.2.2 Samples Analyzed

The tables below are grouped by the colour of the glass beads analyzed (red, black, turquoise, and yellow) and by the number ("n") of beads available from the shipwrecks (Pandanan, Santa Cruz, and RCSw2). During fieldwork at the National Museum of the Philippines in 2014, I recorded the form (barrel, oblate) of each type (Indo-Pacific = IP) or manufacture style (Wound = W). The average and the standard deviation of the bead measurements are recorded. To give us a sense of the variation in sizes I also included the maximum and minimum recorded measurements. Where broken bead measurements are included is the black wound glass beads of the RCSw2 because the available portions of the beads could be measured lengthwise. In one case, turquoise glass beads, the artifacts were not available in the collection at the National Museum of the Philippines, so I included Goddio et al. (1987) measurements from the Goddio et al. excavation publication.

3.2.2.1 Red glass beads

A variety of shapes and sizes of Indo-Pacific red glass beads shows up well into the archaeological record of the mid-15th century, but drops from the record by the Hongzhi period (1488-1505 CE). The colour red in glass beads reappears in later 16th century sites (i.e., RCSw2 1573-1620 CE) when the beads are no longer drawn opaque but wound transparent. The size of the later red glass beads remains the same average length with larger diameters and twice the bore size.

Pandanan IP RED barrel long "n" =111

	L	D	B
AVE	9.0	4.9	2.2
STDEV	2.2	0.7	0.4
MAX	15	7	3
MIN	4.5	3	1.5

Pandanan IP RED oblate short "n"=205

	L	D	B
AVE	2.3	3.5	1.5
STDEV	0.5	0.5	0.4
MAX	4	6	2
MIN	1	3	1

RCSw2 W RED "n"=26

	L	D	B
AVE	2.2	4.3	2.8
STDEV	0.4	0.5	0.2
MAX	4	5	3
MIN	1.5	3.5	2

Table 3-3: Summary table of red glass beads available from the shipwrecks. I measured length (L), diameter (D) and bore (B) size. I calculated each size average (AVE), standard deviation (STDEV), maximum (MAX) and minimum (MIN).

3.2.2.2 Black glass beads

Indo-Pacific black glass oblate beads start to appear in the mid-15th century and continue in the shipping record for another 50 or so years until they disappear sometime between 1505 and 1573 CE. Their sizes alter slightly, with their length decreasing, their diameter increasing and the bore holes stabilizing mostly to one size. There is a notable difference in number with many more in the earlier cargo of the Pandanan than in the later shipwreck, and no drawn but only wound dark glass beads in the RCSw2.

Pandanan IP BLACK all "n" = 338

	L	D	B
AVE	2.7	3.2	1.6
STDEV	0.6	0.5	0.4
MAX	4	5	3
MIN	1	3	1

Santa Cruz IP BLACK all "n" = 36

	L	D	B
AVE	2.5	3.9	1.9
STDEV	0.5	0.5	0.1
MAX	4	6	2
MIN	1.5	3	1.2

RCSw2 W dark "n" = 1 whole / 4 broken

	L	D	B
MAX	3	5	3
MIN	1.5	-	-

Table 3-4: Summary table of black glass beads available from the shipwrecks. I measured length (L), diameter (D) and bore (B) size. I calculated each size average (AVE), standard deviation (STDEV), maximum (MAX) and minimum (MIN).

3.2.2.3 Blue glass beads

All of the blue glass beads are wound and they change over time. Between 1488 and 1505 CE, smaller, narrower beads with thick winds and large peaks were recorded in three shipwrecks of the Southeast Asia Region: Santa Cruz, Lena Shoal and the Brunei. In the Santa Cruz the beads were five to seven mm in diameter and six to seven mm long. On the Lena Shoal ("n" = 132 whole / 32 broken), the beads were six millimetres in diameter and four millimetres long (Goddio, et al. 2002: 251). We see a similar pattern in the literature with the shipwreck of the Brunei's blue glass beads, described with four windings and comparable to the shipwreck of the RCSw2's beads (Huet 2001: 135 translated from French). The later blue glass beads from the shipwreck of the RCSw2 were bigger and squatter and comprised of thin and numerous winds with no peaks. Diameter ranged from nearly five millimetres to over eight millimetres (D. 4.8-8.2 mm). Length ranged from two and a half millimetres to just over five millimetres (L. 2.5-5.2 mm).

Santa Cruz W blue "n" = 54

	L	D	B
AVE	4.7	5.3	2.7
STDEV	1.0	0.5	0.4
MAX	7.0	7.0	3.5
MIN	3.0	4.0	2.0

RCSw2 W blue
Two different sizes (Goddio et al 1987)

« n » 38	L	D	B
AVE	5.2	8.2	3.8

« n » 40	L	D	B
AVE	2.4	4.8	2.1

Table 3-5: Summary table of blue glass beads available from the shipwrecks. I measured length (L), diameter (D) and bore (B) size. I calculated each size average (AVE), standard deviation (STDEV), maximum (MAX) and minimum (MIN).

3.2.2.4 Yellow glass beads

Wound yellow glass beads show up towards the end of the 15^{th} century and continue into the 17^{th} century. They are initially opaque and of a wonky, biconical shape with different-sized bores. By the 17th century, the yellow glass beads have a more standardized set of measurements all around, and the glass is no longer a greasy smooth surface but bubbly and translucent.

Santa Cruz W opaque "n" = 41

	L	D	B
AVE	4.1	5.7	1.9
STDEV	0.4	0.6	0.4
MAX	5.0	7.0	3.0
MIN	3.0	4.0	1.0

RCSw2 W translucent "n" = 7

	L	D	B
AVE	2.2	4.7	2.8
STDEV	0.5	0.4	0.1
MAX	3	5	3
MIN	2	4	2.5

Table 3-6: Summary table of yellow glass beads available from the shipwrecks. I measured length (L), diameter (D) and bore (B) size. I calculated each size average (AVE), standard deviation (STDEV), maximum (MAX) and minimum (MIN).

The shipwreck of the RCSw2 had the only recorded white or orange glass beads. The white surface was noted as bubbly and opaque.

RCSw2 W translucent "n" = 4

	L	D	B
MAX	3	5	3
MIN	1.5	4	2.5

Table 3-7: Summary table of white glass beads available from the shipwrecks. I measured maximum (MAX) and minimum (MIN) of length (L), diameter (D) and bore (B) size.

None of the orange glass beads were whole, so measurements are not included here. The translucent orange glass bead was a sliver at 2mm thick and its surface very porous. The opaque orange glass were clearly wound and 3mm thick.

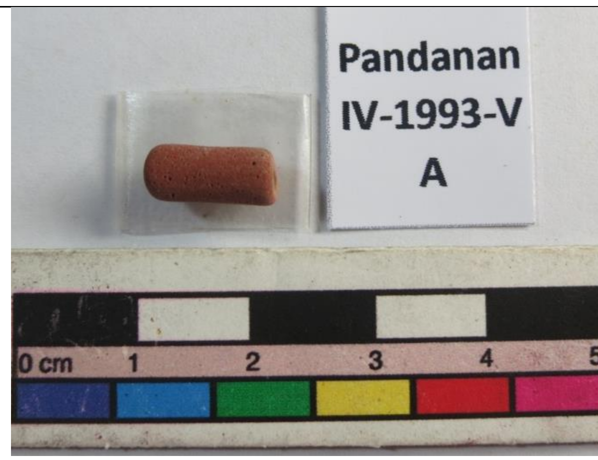
This concludes the morphological analysis I conducted on the glass beads from the shipwrecks.

3.3 Morphological Comparison and Bead Chronology: terminus ante quem and terminus post quem

Borrowing Cayron's (2011, 2015) methodology to compare the underwater and terrestrial beads of Palawan island, I expand the comparison of bead types across the Philippines archipelago. I compared the beads from the case studies of underwater archaeology sites to the terrestrial archaeology record available in Santiago's plates and Francis' catalogue. This produced the *terminus post quem* and *terminus ante quem* for each bead type recorded on the shipwrecks. In Figure 3-1, I compare the new data about the morphological traits of the beads from the shipwrecks with the images and descriptions that most closely resemble the bead color and form from Santiago's plates and bead material, and the diaphaneity and dimensions from Francis's catalogue.

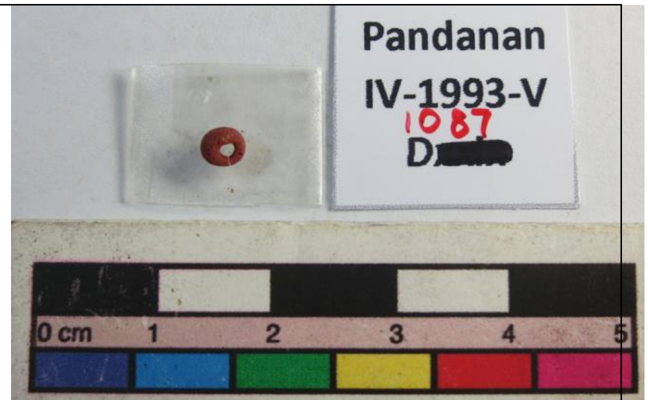
<table>
<tr><th colspan="2">Pandanan</th></tr>
<tr><td>Santiago 1970 + Francis 1989</td><td>Shipwreck beads/new data</td></tr>
<tr><td>


D-40. Brownish opaque red Indo-Pacific tube, barely reheated D. 4.44, L. 6.78. Morong, Tres Reyes, Butong.

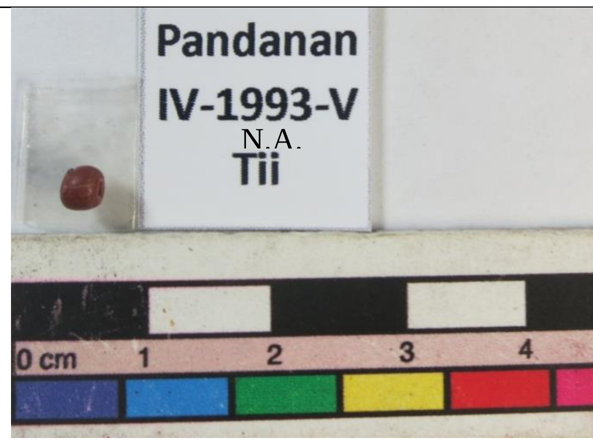

D-39 Indo-Pacific tube dull red and cut at an angle D. 6.83, L. 9.52.
Calatagan, Tres Reyes, Butong.
</td><td>


Drawn opaque red barrel/tube, bubbly
Length is between 7.5 to 10.5
Diameter is between 4 and 6
Bore is between 1.5 and 3 but identically sized on both ends and there is an oblong hole
End treatment is cut at an angle and reheated
Ia
(L.10.5, D.5.5, B.3)
</td></tr>
</table>

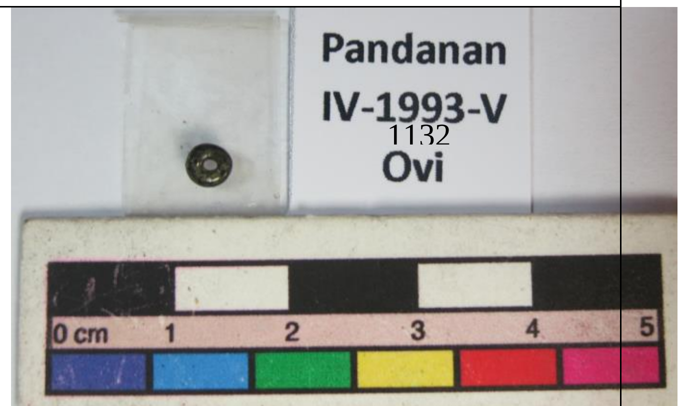
<table>
<tr>
<td>


F-33 Opaque Indo-Pacific red short cylinder, cut at an angle and barely reheated D. 2.54, L. 2.54.
Bolinao, Gubat.
</td>
<td>


Drawn opaque red barrel/oblate dull
Length is between 2 and 4
Diameter is between 4 and 6
Bore is between 1.5 and 2 but identically sized on both ends and round hole
Cut at an angle and reheated
Ia
(L.3, D.4, B.2)
</td>
</tr>
<tr>
<td colspan="2">**Pandanan**</td>
</tr>
<tr>
<td>Santiago 1970 + Francis 1989</td>
<td>Shipwreck beads/new data</td>
</tr>
<tr>
<td>

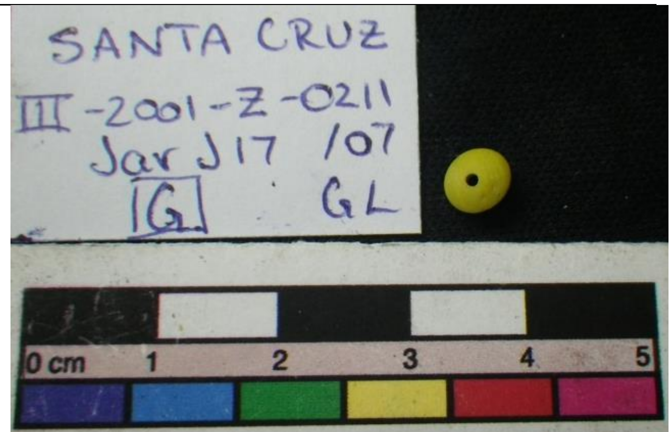

D-42 Opaque red Indo-Pacific cut at an angle and heavily reheated L. 4.19, D.5.08.
Manunggal, Tadyaw, Calatagan, Pagayona, Misabis, Butong, Santa Ana.
</td>
<td>


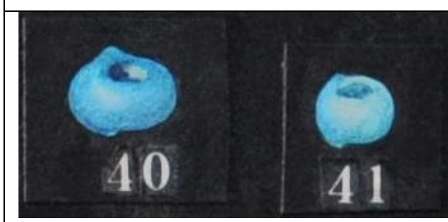
Drawn opaque oblate/barrel
Length is between 2 and 4
Diameter is between 3 and 5
Bore is between 1.5 and 2 but identically sized on both ends and there is an oblong hole
Cut at an angle and heavily reheated
Ia
(L.3, D.3.5, B.2)
</td>
</tr>
</table>

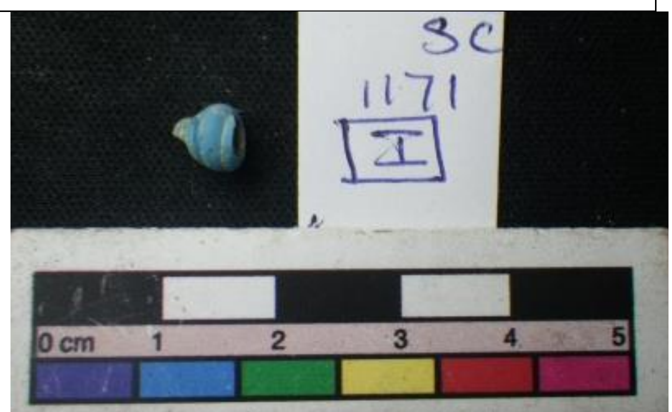
Pandanan	
Santiago 1970 + Francis 1989	Shipwreck beads/new data
 J-7 Black glass suboblate. It is very difficult to tell if this specimen was wound or drawn D. 5, L. 3.5. Calatagan, Misabis, Gubat.	 Drawn opaque lenticular/oblate Length is between 2 and 4 Diameter is between 3 and 5 Bore is between 1 and 2 but identically sized on both ends and there is either an oblong or round hole Cut at an angle and heavily reheated Ia (L.2, D.4, B.2)

Santa Cruz	
Santiago 1970 + Francis 1989	Shipwreck beads/new data
 J-7 Black glass suboblate. It is very difficult to tell if this specimen was wound or drawn D. 5, L. 3.5. Calatagan, Misabis, Gubat.	 Drawn opaque black barrel Length is between 2 and 3 Diameter is between 3.5 and 4 Bore is 2 mm identically sized on both ends and there is either an oblong or round hole on each end Cut at an angle and reheated Ia (L.2.5, D.4, B.2)

<table>
<tr>
<td>

F-2 small wound yellow glass oblate.
D. 5.08, L. 4.19.
Santa Ana.</td>
<td>

Wound opaque yellow convex bicone
Length between 3 and 4
Diameter is between 5 and 7
Bore is 0.5 to 2 at 0.5 difference in size with a round hole on each end
Wld1
(L.4, D.6, B.1.5)</td>
</tr>
<tr>
<td colspan="2">Santa Cruz</td>
</tr>
<tr>
<td>Santiago 1970 + Francis 1989</td>
<td>Shipwreck beads/new data</td>
</tr>
<tr>
<td>

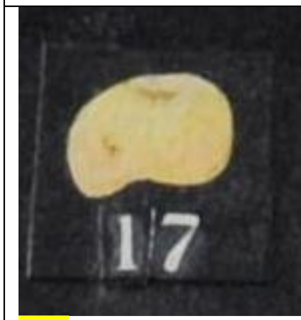
F40, F41
No descriptions available in Francis 1989</td>
<td>

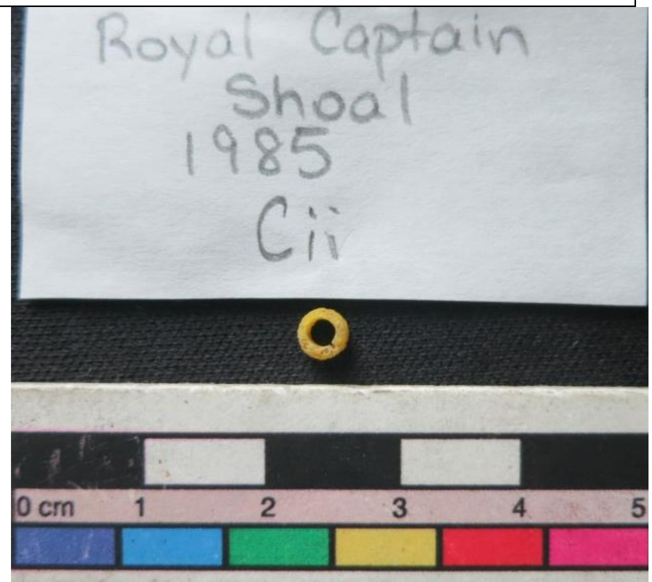
Wound opaque turquoise
Obvious multiple layers with peaks at one or both ends
Length is 6 to 7
Diameter is between 5 and 7
Bore is between 2 and 3.5 with an identically sized round hole at each end
Wlb
(L. 6, D. 5, B. 2)</td>
</tr>
</table>

<table>
<tr><th colspan="2">Royal Captain Shoal wreck 2</th></tr>
<tr><td>Santiago 1970 + Francis 1989</td><td>Shipwreck beads/new data</td></tr>
<tr><td>
J-3 Small opaque orange wound suboblate of poor glass. Found on the right wrist of buried individual KT-1196, D. 5.08, L. 3.17. Calatagan.</td><td>

Wound opaque orange
Very obvious multiple layers of glass
Broken
(L. 3)


Sliver of bubbly transparent orange glass</td></tr>
</table>

<table>
<tr><th colspan="2">Royal Captain Shoal wreck 2</th></tr>
<tr><td>Santiago 1970 + Francis 1989</td><td>Shipwreck beads/new data</td></tr>
<tr><td>

F-17 Opaque yellow glass, highly pitted. It is very difficult to tell if this bead is wound or drawn L. 2.54, D. 3.30.
Bolinao, Misabis, Santa Ana, Bahughan [Bayughan].</td><td>

Wound opaque yellow annular
Very bubbly.
Length between 1.5 and 3
Diameter 4 or 5
Bore has a lot of variation in size but range is only 2.5 to 3 with identically sized round holes at both ends
Wlb
(L. 2.5, D. 4, B. 2.75)</td></tr>
<tr><td>

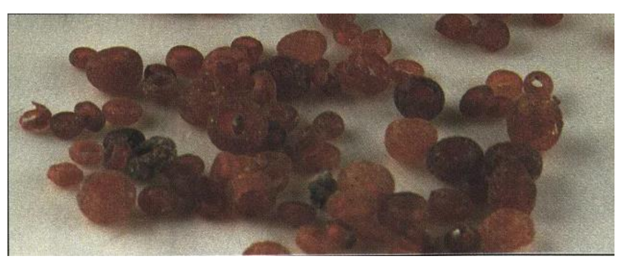
F-48 [possibly made with] Manganese, black, small wound ring or annular
D. 4, L. 2.
Calatagan, Misabis.</td><td>

Wound transparent dark annular
Length between 1.5 and 3mm
Diameter only possible with complete bead at 5
Bore only possible with complete bead at 3
Wlb
(L. 2,2,3,1.5, D. broken or 5, B. broken or 3)</td></tr>
</table>

<table>
<tr><th colspan="2">Royal Captain Shoal wreck 2</th></tr>
<tr><td>Santiago 1970 + Francis 1989</td><td>Shipwreck beads/new data</td></tr>
<tr><td>


F-18 Transparent copper red coil bead.
D. 2.3, L. 2.15.
Misabis, Bolinao.
</td><td>


Wound opaque translucent red
segmented
Only one example of this segmented
bead in assemblage.
(L.4, D.4, B. 2.5)


Wound translucent ruby red. Separated into two groups based on darker red colour and size
A. Lighter: Length is between 2 and 3 . Diameter is between 3.5 and 5
B. Darker: Length is between 1.75 and 2. Diameter is 3.5
Bore is 2.5 to 3 with an identically sized round hole at each end
Wlb
(L. 2, D. 5, B.2.5)

Goddio et al. 1987: Photo 4. Group 725. [translated from French] Wound spherical translucent red glass beads. Two groups
</td></tr>
</table>

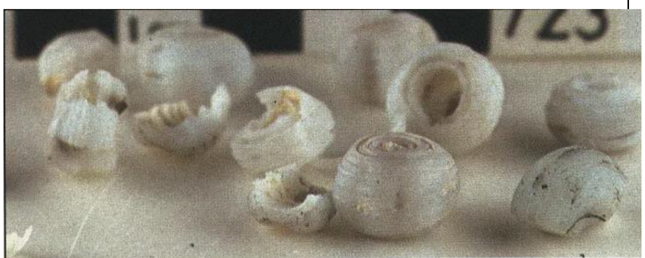
<table>
<tr><td></td><td>A. Average diameter is 6.6mm
B. Average diameter is 4mm</td></tr>
<tr><td colspan="2">Royal Captain Shoal wreck 2</td></tr>
<tr><td>Santiago 1970 + Francis 1989</td><td>Shipwreck beads/new data</td></tr>
<tr><td>

J-23 Clear translucent suboblate of bubbly glass. The apertures are large (2.5-2.3mm), [possibly from] Peking. D. 9, L. 5.
Calatagan.

J-17 White wound oblate, well made, the winding is obvious. D. 9, L. 7.5.
Calatagan.

</td><td>

Wound opaque white annular
Very bubbly
Length is between 1.5 and 3
Diameter is between 4 and 5
Bore no variation in size, which is 3 with identically sized round holes at each end
Wlb
(L. 3 , D.5 , B.3)



Goddio et al. 1987: 75 Photo 2. Group 723. [translated from French] Wound opaque white cylindrical glass beads. This type consists of five whole beads and five broken beads. Very bubbly. The whole beads measured average D.10.5.

</td></tr>
</table>

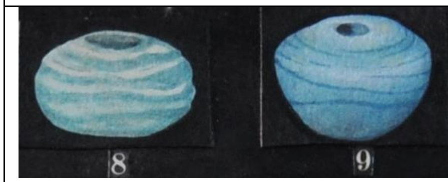
<table>
<tr><th colspan="2">Royal Captain Shoal wreck 2</th></tr>
<tr><td>Santiago 1970 + Francis 1989</td><td>Shipwreck beads/new data</td></tr>
<tr><td>
H8, H9
No descriptions available in Francis 1989
Not available for my fieldwork.</td><td>
Goddio et al. 1987: Photo 3. Group 724. [translated from French] Wound spherical turquoiseglass beads with circular bore. Split into two groups based on their size: 38 beads average L. 5.2,D.8.2, B.3.8;
40 beads average L. 2.4,D.4.8, B.2.1. Two of these beads were connected so we hypothesize they were made in the same location.</td></tr>
</table>

Figure 3-1 Morphological comparison: new data, Santiago's plates, Francis's catalogue. Right column includes new data I gathered. The left column includes images from Santiago's plates and descriptions from Francis's catalogue. All measurements are in millimetres.

In Figure 3-1, I compared the previous recordings of Philippines beads with the morphological traits of glass beads I recorded during fieldwork in 2014 at the National Museum of the Philippines (see above for methods). The previously recorded bead morphological traits were available in two parts: painted images in Santiago's plates and descriptions and dimensions in Francis's catalogue. Figure 3-1 is the outcome of the morphological comparison of new data, Santiago's plates, and Francis's catalogue. In Figure 3-1 the right column includes new data I gathered. In the left column are images from Santiago's plates and descriptions from Francis's catalogue. Above the descriptions are images of the beads from Santiago's plates. The first red glass bead is noted as either D-40 or D-39, these notations reference Santiago's plate D: Developed Metal Age (200 to 1200 CE) bead number 40 or 39. Otherwise, in both columns, the numbers refer to measurements in millimetres. Similar to tables 2 to 5 above, the millimetre measurements in Figure 3-1 are length (L), diameter (D) and bore (B) size. For each different variety of bead type I included the breadth of sizes I measured between their minimum and maximum lengths, diameters, and bores. In the right column, after the measurements, end treatments are described. And class designations are assigned (i.e. Ia is an undecorated simple drawn tube-shaped bead). In the right column the brackets are the measurements for the specific bead pictured with the ruler, site name and accession number. Finally in the left column locations Gubat, Misabis, Calatagan, Bolinao, Bahughan, Santa Ana, Tadyaw, Pagayona, Butong, Tres Reyes and Morong (Francis 1989) were the sites listed in Francis's catalogue. The locations are archaeological sites where Santiago gathered his data when he joined Fox to survey archaeological beads across the Philippines (Fox & Santiago 1985).

By comparing side by side these data on measurements and images it is possible to narrow which of the Francis/Santiago beads match with the shipwreck beads. From the results in this section I updated the bead chronology in the Philippines by producing *terminus post quem* and *terminus ante quem,* or *the span of time* glass beads were present in the Philippines for each variation of the Indo-Pacific and Chinese bead types recorded from the shipwrecks (Table 3-8). The data I compared to reach an update (see Table 3-8 below) on the Philippines bead timeline drew on previously established bead dates in the Philippines (see Section 3.1, Table 3.1) and compared them to the site dates of the shipwrecks in this study (see Section 4.3, Table 4.1). In either the previous data or in the site dates for this project, the terminus post/ante quem dates for glass beads in the Philippines are not absolute dates. These relative dates for glass beads in the Philippines are a limitation in this study. Having said that, it could be argued the Pandanan terminus ante quem (1487 CE) based on the absolute date of the Yong-Le coin (1465-1487 AD), solidly adds evidence of Indo Pacific drawn opaque red glass beads in the Philippines beyond Francis' (2002) hypothesis.

Glass bead types in the Philippines	Updated terminus post/ante quem	Data compared to reach update
Indo Pacific drawn opaque red	1 to 1487 CE	Plate D [D 40 + D39+ D42] + Plate F [F33] + Pandanan (1460-1487 CE)
Indo Pacific drawn opaque oblate black	1460 to 1573 CE	Plate J [J7] + Pandanan (1460-1487 CE) + Santa Cruz (1488-1505 CE) –RCSw2 (1573 to 1620CE)
Wound opaque yellow convex bicone	1300 to 1505 CE	Plate F [F2] + Santa Cruz (1488-1505 CE)
Wound opaque yellow annular, wound transparent dark annular and wound or segmented translucent ruby red	1300 to 1620 CE	Plate F [F17 + F48 + F18] + RCSw2 (1573-1620CE)
Wound opaque orange	1450 to 1620 CE	Plate J [J3] + RCSw2 (1573-1620CE)
Wound opaque white	1450 to 1620 CE	Plate J [J23 + J17] + RCSw2 (1573-1620CE)

Table 3-8 terminus post quem and terminus ante quem for each bead type recorded on the shipwrecks.

According to the updated bead chronology presented above, Chinese beads entered the archipelago in the early 14th century and were exchanged alongside the pre-existing Indo-Pacific beads. So the Chinese bead entry into the Philippines is a century later from Cayron's (2011) observation that Chinese glass beads entered the Philippines during the 13th century and over the next century, by 1400 CE, they replaced Indo-Pacific beads. Followed by an interim period or phasing-in when wound opaque yellow and translucent dark or red glass beads were common. This interim period lasted from 1300 to the mid-1400s. The period when Chinese and Indo-Pacific beads were exchanged differs depending on the bead color. For example, drawn red opaque glass beads were around for the longest time, nearly 1500 years, although that was 500 years less than what Cayron found in his Palawan observations (2011: 205-207).

Cayron (2011) observes mid-15th century Indo-Pacific beads were replaced by Chinese beads. I expand on this observation with specific bead type varieties. In the updated bead chronology (table 3-8) we see a variety of manufacturing styles in the record, including drawn opaque black glass beads, and wound opaque orange and wound opaque white glass beads. By comparing the data on measurements and images from the shipwrecks, I updated the bead type chronology and proposed the chronological range for each variation.

Next, like Cayron's methodology, which compared Palawan underwater with terrestrial glass described in the literature, I review glass artifacts present in historic period Philippine archaeology sites.

3.4 Literature Review of Philippines Archaeology Sites

In the Philippines the relative dating of archaeological sites based on ceramic seriation is common practice. Aside from ceramics very few artifact images and descriptions exist. The pre-1960s ceramic classificatory historical period highly influenced the chronology and description of (esp.) pre-colonial archaeology (Beyer 1947; Dizon 1994; Evangelista 1969), and later extended to underwater archaeology (Dizon and Ronquillo 2010; Green 1987; Lopez 1967; Ronquillo 1998). For example, the shipwrecks of the Pandanan, Santa Cruz and the RCSw2 are dated based on ceramic seriations of the cargo (Dizon 1996; Goddio 1988; Orillaneda 2012, 2016) spanning the period between 1460 and 1620 CE.

For the period 1460 and 1620 CE the overview of Philippines archaeology literature disclosed that most sites had glass beads and two archaeological sites had glass bead manufacture residues: Intramuros and Tanjay (Dalupan in Bacus 1999; Junker 1999, 2018). Some discrepancies to consider include that Intramuros and Santa Ana are adjacent to one another (Bacus 1996, 2004) and Tanjay was first excavated during Francis's visit to the Philippines (Junker 1990, 1993) with many excavations and publications to follow (Junker 1994, 1998, 1999, 2018). Significantly, during the period 1460 and 1620 CE Intramuros and Tanjay are the only known archaeological sites in Southeast Asia where glass was likely manufactured. In the period immediately preceding this time, glass beads were manufactured in Oc Eo of Vietnam and Sungai Mas of Borneo during 6th century CE to 13th century CE (Ramli et al. 2012) and in Fort Canning of Singapore during the 10th to 14th centuries (Miksic 2013).

Site Name	Recorded bead	Site type	Date	reference
North				
Botel	Arm-rings of translucent blue glass, and sixteen small yellow and blue glass beads Nine glass rings (two of them broken), nine strands of small glass beads 225 yellow beads; three blue glass beads, two of them large; one small green bead; and 71 small brown beads	Jar burials	Late 14th to early 16th c.	Beauclair 1970
Batanes Itbayat Uyogan Bayughan (Bahughan)	Red glass beads, likely 12th century Indo-Pacific; Blue glass beads with winding striation from China Glass beads regularly associated with earthenware -	Settlement Jar burials	15th c. Iron Age to historic material?	Mijares et al 2003: 29-31 Scheans and Laetsch 1981:33 ?
Central-Visayas				
Site Name	**Recorded bead**	**Site type**	**Date**	**reference**
Kiangan	Yellow glass bead CAR-2012-WI-10418 representative of 10 other similar beads	Jar burials	15th c.	Francis 1992: 6-7 in Yakal 2017
Porac (Gubat)	-		Early/late 14th through early 16th c.	Evangelista 1969
Intramuros Santa Ana	Possibly glass bead manufacture	Settlement	mid-15th to mid-16th c. 960-1279AD	Bacus 1999: 74 Fox 1967
Batangas (Butong)	-		14th to early 16th c.	Fox 1967
Calatagan	Beads… between the tombs	Burial - graves	15th to 16th c.	Oloc Janse 1944: 38-41 Barretto-Tesoro 2008: 81
Marinduque Island and Banton Island (Tres Reyes)	-		14th and 15th c.	Evangelista in Fox 1967
Palawan (Pagayona)	-	Jar burials	Developed Metal Age (200BC. to	Kress 1978

			200 CE)	
Victorias	Hundreds of multi-colored glass beads	Jar burials	14th to 15th c.	Tenazas 1973
Cebu	Locally made valuables such as glass beads, and glass and shell bracelets found exclusively in the elite area	Burial and habitation	14th to mid-15th c.	Bacus 1996 :79
Tanjay	Glass beads associated with the elite residences Several small glass beads, square in cross-section and medium blue in color Several glass beads including yellowish-orange barrel-shaped bead with a hexagonal profile and a pale yellow cylindrical bead with a circular profile Glass beads	Settlement local glass bead manufacture	11th to 15th-16th c. Santiago phase 1100-1400 CE 12th-14th c. Osmena Phase (1400-1600 CE)	Bacus 1996 :79 Junker 1993: 164
Bacong	Only one (glass) bead	Settlement	15th to 16th c.	Bacus 1996
South-east				
Site Name	**Recorded bead**	**Site type**	**Date**	**reference**
Surigao	cornerless hexagonal blue drawn beads		1650 to 1730 CE	Dizon 1994: 205 Karklins 1974, 1985
Butuan	Glass beads	Settlement – Balanghay boat deposit	dates of 320, 990 and 1250 CE but recalibrated	Cayron 2011:196-197 Lacinsa 2015
Jolo	Glass beads	One of several craft specialized within residences		Spoehr's 1973: 79-102 in Junker 1993: 170

Table 3-9 historic period archaeological sites in the Philippines dated between 1460 to 1620 CE, including specific comments on beads where available. The table lists locations starting from the geographic north end of the archipelago and flows to the furthest south site.

Table 3-8 lists Philippines historical archaeology sites dated between 1460 to 1620 CE. This left out a few locations recorded in Francis's catalogue because without more information these placenames are available in multiple locations: Misabis, Tadyaw and Morong. Locations from the literature do not all include beads in the descriptions; for example Santa Ana, Batangas, Bolinao and Porac. Possibly, these latter locations' beads were looted. Figure 3-2 plots the locations listed in table 3-8 showing that beads are present across the archipelago.

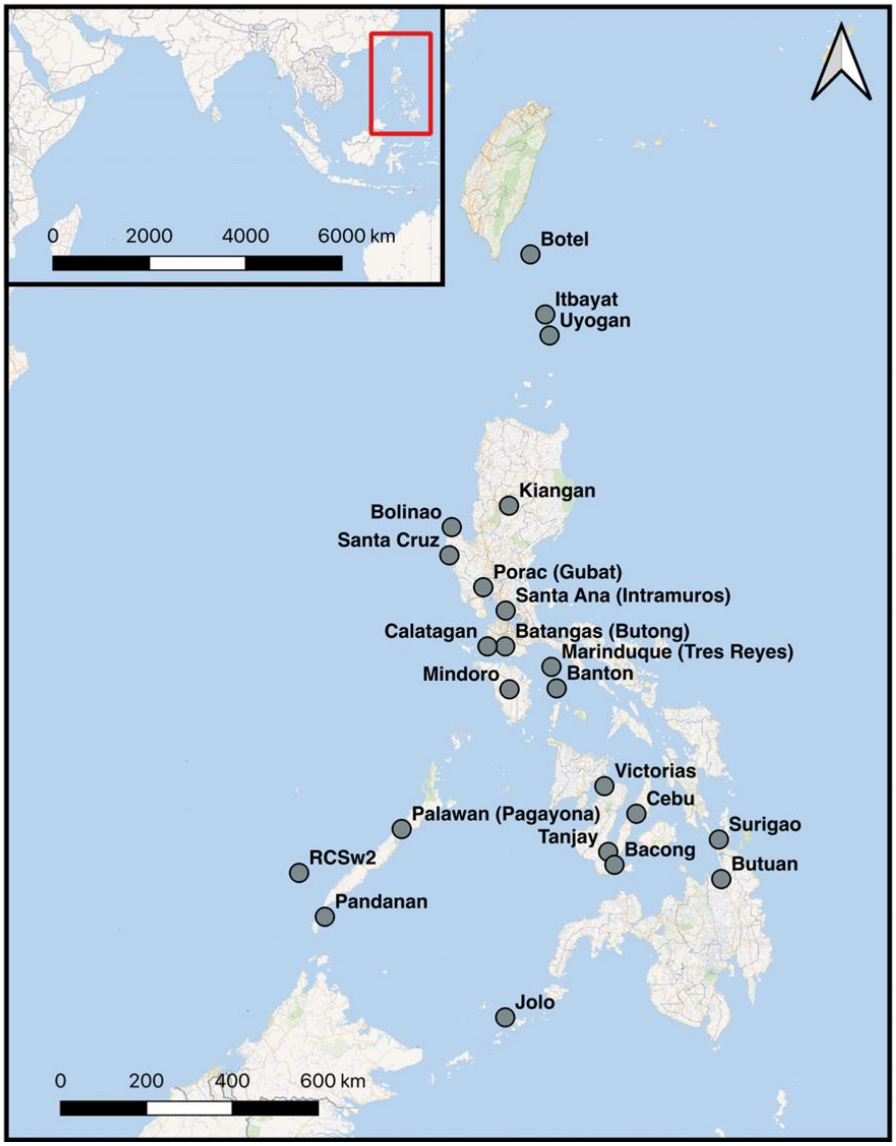


Figure 3-2 Map of Philippines archaeological sites cited by Francis's catalogue and/or referenced to glass beads in the literature.

In the Philippines the drawn glass beads were replaced by wound beads that ranged in size from four to six mm. By the 17th century there were bigger wound beads (Francis 2002:82). **Could this be related to glass craftsmanship in the Philippines?** As mentioned earlier, there is the evidence of glass workshops in Intramuros and Tanjay (Dalupan in Bacus 1999; Junker 1999, 2018), although it is unclear if the glass was imported in the form of raw glass or already shaped into beads or vessels. Like in other areas of Southeast Asia where imported raw glass may have been used to make beads in Thailand during the 4th to 2nd century BC (Bellina and Mahawitthayalai 2017; Dussubieux and Bellina 2017) and in Myanmar between the 4th and 1st c. BC and perhaps later (Dussubieux et al. 2020). It is also still unclear to what extent glass may have been recycled in the region (Carter 2016), as has been suggested in later periods that glass beads recovered from graves were melted to make new beads (Miksic 2013; Miksic and Goh 2017). Returning to the Philippines, Laura Junker (1999) describes the glass crafts workers of Tanjay as living among other craftsmen in elite residences (i.e., metallurgical). This echoes Shinu Anna Abraham's (2016) observations of glass craft workers in south Asia. **Is it possible that for millennia, the tradition was maintained of highly skilled craftsmen living and working in the quarters of elite residences?** The answer to this question can only come from more archaeological evidence.

Linking Passage 3: Towards Tandem Patterns of Cargo

The artefact that has been investigated to the greatest depth and breadth in the archaeological record is ceramic. Seriation of ceramics, particularly in maritime archaeology, have indicated connectivity across the maritime cultural landscape and, in the IOW, the probability of "small-scale seafaring communities travelling across the seas, rather than by elite merchant groups at the behest of States or Empires" (Chandra & Ray 2013; Ray 2016). Ceramic kiln traditions on land, often deep into hinterlands, can be connected with ceramics stored in shipwreck cargo (e.g. Roxanne Brown, John Guy, Attahasit Sukkham). Such studies shed important details on the upstream-downstream flow of goods, or how such dendritic activities shaped political economies of Southeast Asian polities in Cambodia (e.g., Nancy Beavan, Alison Carter, Miriam Stark, Sohka Tep) and the Philippines (e.g. Mary-Jane Bolunia, Grace Barretto-Tesoro, Laura Junker, Ligaya Lacsina). Yet, as pointed out earlier (chapter 2), ceramics are not the only artefacts from shipwreck sites. Boat studies in maritime archaeology have done much to elucidate the people who built and potentially sailed ancient ships (Pham et al *in press*). For each of the three case studies here the artefacts and features of both ceramics and hulls are analyzed and contextualized. Now I add glass studies.

To make glass, three main components are required: a flux, a stabilizer and a melter. Each of these components allows for glass to be melted, shaped, colored, and hardened. Production of glass can be defined as where someone collects the components to make raw glass; the raw glass can be melted and combined with other components. Glass workshops are archaeologically visible through the presence of crucibles to heat and melt the glass, and tubers and wasters of the melted glass (Bellina & Mahawitthayalai 2017; Kanungo 2016).

Laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) can measure the elemental components in glass. The laser makes a small hole, indistinguishable with the naked eye, where it removes the glass to measure the mass-to-charge ratio of ions or elemental analysis. This is conducted eleven to fifteen times on each and every color of the glass object (Gratuze 2013a, 2013b, 2016; Gratuze & Dussubieux 2000; see Appendix 1). Through compositional analysis it is possible to identify the aforementioned three main components of glass, which together can be used to determine the location of production or a workshop.

The baseline identifier for Indo-Pacific beads is still being refined but we generally can point to five groups of soda alumina glass (Dussubieux, et al. 2010; Dussubieux, et al. 2008; Wood & Dussubieux 2020). Mineral soda alumina group 1 which consists of low uranium and high barium comes from Giribawa in Sri Lanka. Mineral soda alumina group 2 contains high uranium, low barium, and low cesium. It is suspected to from Chaul in West India. Mineral soda alumina group 3 consists of high uranium, low barium, and high cesium comes from Khao Sam Khao in Thailand. Mineral soda alumina group 4 contains high barium and high cesium and is from an unknown location suspected to be in Southeast Asia. Finally mineral soda alumina group 6 contains low uranium, high cesium, and high zirconium from an unknown location.

The combined study of morphological and elemental LA-ICP-MS analysis of glass beads has connected seafaring in the Indian Ocean triangular trade (Wood 2015, 2016, 2017), and has the potential to do the same in Southeast Asia (Carter, et al. 2016). This potential is what I explore in the next chapter, where I recreate ancient exchanges with tandem patterns of evidence from shipwreck hulls and cargo ceramics and glass.

CHAPTER 4

Tandem patterns of cargo in 15th – 17th century Philippines shipwrecks

Craig, J. & Dussubieux, L. 2021, In press. Shifting patterns of glass bead cargo of 15th – 17th century Philippines shipwrecks, in *Elemental Facility Projects at the Chicago Field Museum* (H. Walder and L. Dussubieux, Eds.). Leuven University Press. 8.

4.1 Abstract

A total of 87 glass beads, included as cargo in three 15th-17th century AD shipwrecks from the National Museum of the Philippines collections, were analyzed using laser ablation – inductively coupled plasma – mass spectrometry (LA–ICP–MS). Several glass types were identified, including three subtypes of high-alumina mineral soda glass and lead potash glass. The final glass type represents a newly discovered and previously unidentified type of high magnesium high aluminum glass. This study represents the first glass data from the mid-second millennium AD of collections excavated from underwater. The subtype results are statistically verified by Principal Component Analysis to show the known locations of bead manufacture with beads excavated from the shipwrecks. The lead potash glass and unidentified glass are compared to the 14th century AD site in Fort Canning and 15th – 16th century beads from the Philippines in a biplot. Furthermore, the average composition of chosen elements point out the different colorants compositions.

4.2 Introduction

Beads archaeologically excavated from Philippines islands are recognized as foreign products, but where they came from is still not clear. The main possibilities are that glass in Southeast Asia was produced within the region or from the wider Indian Ocean world including locations such as India and China (Francis 2002; Junker 2018). Datasets for glass manufacture do exist for India (Dussubieux 2016; Dussubieux et al. 2010, 2012; Dussubieux and Kanungo

2013; Dussubieux and Gratuze 2013) and China (Henderson et al. 2018). Recognizing the Philippines are an archipelago with over 7000 islands, boats were certainly the means of transportation; this study investigates what we know of glass bead shipment, using compositional analysis as a method of comparing glass recipes. With reference groups of possible production centers available for comparison, representative samples of glass cargo were selected from three shipwrecks excavated along the coast of the Philippines: Pandanan, Santa Cruz and Royal Captain Shoal wreck 2. All three shipwrecks are named after nearby geographic place names.

In Southeast Asia, it is more common to use ceramic seriation than compositional analyses to characterize a shipwreck cargo; ultimately the chronological and distribution information from ceramics recreates ancient exchanges. The 15th to early 16th century AD Chinese junk known as the Brunei shipwreck is an exception; glass cargo patterns are considered in tandem with ceramics, amongst other cargo, to better understand shipment (L'Hour 2001a, 2001b). This is an example of employing more holistic perspectives to cargo; by analyzing and comparing artefacts, ancient exchanges are enriched and customized (see Carter et al. Chapter 1 this volume). This paper presents the results of compositional analysis of 85 glass beads that were excavated, in some cases, within ceramic jars from three Philippines shipwrecks (Table 1). We return to this association of glass and ceramic jars in our discussion later.

In this chapter we draw upon three resources to address our question of glass bead provenance in the Philippines: 1) published ceramic cargo patterns in all three shipwrecks, which were used to date each site; 2) observations of glass cargo patterns within the three shipwrecks used as case studies here; and 3) the chemical compositions of glass that were on board the shipwrecks. Combining evidence from ceramics and glass cargo, we compare chronological and distribution information. These comparisons are contextualized with contemporaneous regional affairs to recreate ancient exchanges.

4.3 Three shipwreck archaeological sites

An excavation was conducted in 1996 at the northeastern section of Pandanan Island, southern Palawan (Dizon1996b) on a shipwreck with a Chinese-Vietnamese hybrid hull (Dizon 1996b: 11; Orillaneda 2016a: 85, 2016b:43). The site date range was derived from late 15th century Chinese and Vietnamese ceramics and a Chinese Yong-Le (1465-1487 AD) copper coin (Dizon 1996b; Orillaneda 2000). Other cargo on board entailed stone implements, metals (e.g. iron caldrons, bronze gongs, firearms, bronze cannons) and glass and carnelian beads (Brown 2004; Cayron 2006:29; Dizon 1996a: 66; Orillaneda 2000, 2016a). For this study, representative samples of 28 black and 13 red glass beads were analyzed with LA-ICP-MS.

In 2003 an excavation off Santa Cruz Island, close to Zambales of Luzon (Orillaneda 2003), was conducted on a shipwreck hull identified as a hybrid South China Sea Shipbuilding Tradition (Goddio, et al. 2014: 8, 10; Orillaneda 2003; Orillaneda 2012, 2016a, 2016b). The shipbuilding technique is seemingly Chinese but the materials are from archipelago Southeast Asia (Orillaneda 2016a). Pointedly, scholars surmise the ship was built by Chinese diaspora in the Philippines (Goddio, et al. 2014: 8, 10; Manguin 2001:15) or Thailand (Flecker 2005; Orillaneda 2016b). The site date range was derived from Chinese, Burmese, Thai and Vietnamese porcelain and stoneware jars of the late 15th century (Dizon 2003). Alongside these ceramics were a variety of other materials: tin, copper and iron ingots from the Malaya Peninsula or eastern Sumatra, cast iron bowls, ship-used cooking iron cauldron and plate, net weights and weighing scales, bronze gongs, brass and copper spiral bracelets, bronze cannons, metal box, bronze crown, three corroded Chinese coins (Fahy 2014; Goddio, et al. 2002; Orillaneda 2016b), green glass bracelets (Orillaneda 2016b:52), organic implements of wood and stone, and glass and carnelian beads (Orillaneda 2001; Orillaneda 2016a). For this study, representative samples of 4 blue, 10 yellow, and 12 black glass beads were analyzed with LA-ICP-MS.

In 1985 an excavation took place on a shipwreck approximately 100km west of Palawan Island on the atoll reef named after the later British frigate *Royal Captain*. The timber remains were deteriorated and dispersed (Goddio 1988: 35; Orillaneda 2012: 424) though the cargo spread and location indicate it may have been a small local coasting vessel (Goddio 1988: 128). The site date range was derived from late 16th to early 17th century's blue and white wares (Brown 2009: 167; Goddio 1988). Alongside the ceramics were a variety of other materials: bronze gongs, a bronze box, bronze Song coin (early or middle 13th c.), bronze padlock, iron ingots, copper bracelets, ivory or bone counter (necklace?), a ring, and glass beads (Goddio 1988; Jubelin, et al. 1985). For this study, representative samples of 9 red, 1 orange, 1 dark purple-grey, 3 yellow, and 4 white glass beads were analyzed with LA-ICP-MS.

Site/Shipwreck	**Pandanan**	**Santa Cruz**	**RCSw2**
approximate age	1460-1487 CE	1488-1505 CE	1573-1620 CE
possible cultural affiliation	Vietnamese-Chinese	South China Sea Tradition	Indigenous Pilipino, Small coasting vessel
Glass bead samples for LA-ICP-MS	28 black 13 red	4 blue 10 yellow 12 black	9 red 1 orange 1 dark purple-grey 3 yellow 4 white
TOTAL beads analyzed	41	26	18

Table 4-1 Summary Table of site contexts and glass artefacts analyzed in this study.

4.4 Cargo Ceramic Seriation

In Southeast Asia by the first half of the 15th century, a major power shift moved to the Ayutthaya Kingdom (now Thailand). Oversight of important kilns such as Si Satchanalai, Sukhothai, Mae Namnoi/Bang Rachan came under Ayutthaya monopoly (Sukkham 2018). The new directives under the Ayutthaya forces brought about a change in the ceramics trade that matched, and for a short time superseded, exports of Chinese (Jingdezhen and Longquan ceramics, for example), Vietnamese (Chu Dau and Go Sahn ceramics, for example) and Burmese (now Myanmar; Twante ceramics, for example) ceramics (Brown 2009; Sukkham 2018). These ceramics supplied the market in shipments to several destinations in the region (Sukkham 2018). Shipments of such ceramics and the goods they stored occurred, according to nautical archaeologists, on many varieties of ships some of which were ocean-going hybrid vessels (Flecker 2007; Green 2011). The hybridity of the vessels was in relation to the building materials from Southeast Asia but the craftsmanship of Chinese (Manguin 1984). This scenario of hybrid ship and mixed ceramic cargoes we noted earlier in our shipwreck case studies of the Pandanan and the Santa Cruz (Orillaneda 2016a, 2016b). These correlations of ship construction technique and ceramic cargo help maritime archaeologists to narrow shifting patterns in shipping (i.e. Green, at al. 1987; Maarleveld 1995; Orillaneda 2011) largely by means of ceramic seriation as the method to observe changes in cargo and date the shipwreck.

Seriation draws on archaeological materials from different stratigraphic proveniences to note changes of form over time thus producing chronology of manufacture (Orton & Hughes 2013). For each site’s date range in our case studies, we summarize the relevant ceramic seriation. If more than one type of ceramic is available in the shipwrecks cargo, the dates of manufacture are compared to one another to seek overlap and narrow *terminus post quem* (earliest possible date) and *terminus ante quem* (latest possible date).

4.4.1. Pandanan ceramics

Pandanan cargo dated between 1460-1487 AD is largely Cham wares (Brown 2009; Dizon 1996b; Orillaneda 2012), with some Thai Maenam Noi 1 and 2 storage jars (Cort 2017) as well as some Sukhothai plates, and a small number of Minyao ceramics (Tan 1998/9).

In the Pandanan cargo ceramists have narrowed the date (1436-64 AD) of particular forms and designs of the Minyao wares from Jingdezhen kilns in eastern China (Brown 2009; Ketel 2011; Orillaneda 2016a:85, 2016b:43). Cham wares are a type of blue and white ceramic produced during the 13th to 17th century. In 1460 AD exports started from the Go Sanh kilns in east central Vietnam (Brown 1988, 2009; Miksic 2009). Comparing the Minyao Chinese, blue and white Cham with the Go Sanh Cham wares it is possible to establish the *terminus post quem* at 1460 AD.

The Thai wares establish the terminus ante quem at 1487 CE. Two different Thai wares were accounted for in the cargo: 1) Maenam Noi jars, and 2) Sukhothai plates. The jars were created as shipment containers for the Ayutthaya Kingdom (Cort 2017:273) in Maenam Noi kilns by the surrounding communities in the Ban Ko Noi area between 1360 to 1767 AD (Grave & Maccheroni 2009). Another term for these storage jars is the same as the kilns they were made in – the Bang Rachan, which are “exclusively earthenware and stoneware and found on ships [in the South China Sea] dating from the 15th through 18th centuries” (Sukkham 2015: 324). The Pandanan is currently the only shipwreck to have carried the earlier variety of the jar at the beginning of their presence on shipwrecks (Brown 2009:185; Cort 2017:282). Next, the Sukhothai fish plates, from further north of Ayutthaya and of an earlier kingdom, were produced between 1450 and 1487AD (Brown 2009:72), which narrows the *terminus ante quem* date of the Pandanan to 1487 AD.

4.4.2 Santa Cruz ceramics

The Santa Cruz shipwreck is dated between 1488-1505 AD. Santa Cruz cargo is largely Chinese ceramics and some Burmese, Vietnamese, and Thai wares. Since excavation, this shipwreck has always been assigned a date to the late 15th century (Dizon 2003). Stylistic and morphologic analysis of all the ceramics in comparison to collections on nearly every continent have dated the available forms and motifs to the Hongzhi period of 1488-1505 AD (Orillaneda 2012).

In the Santa Cruz the Chinese ceramics were mostly celadon from Longquan but also included other ceramics from eastern China kilns n Jingdezhen and Guangdong (Orillaneda 2001; Orillaneda 2012, 2016b), which were in production from the 13th to 19th centuries. The Burmese earthenware figurines are from the Twante kilns in production during the 15th century (Brown 2008). The Vietnamese wares are blue and white from Chu Dau kilns produced during 13th to 17th century (Orillaneda 2003; Orillaneda 2016b). The Thai wares were from Si Satchanalai kilns (1351-1558 AD) and mid-15th century Maenam Noi kilns (Brown 2009; Cort 2017; Orillaneda 2003; Orillaneda 2016b).

4.4.3 Royal Captain Shoal wreck 2 ceramics

The RCSw2 had exclusively Chinese Zhangzhou kiln ceramics (Liu 2016) dated from motifs and styles to the Wanli Dynasty (1573–1620 AD) (Goddio 1988:115). In this case the ceramic identification and seriation dated the RCSw2 site to centuries earlier than the nearby British shipwreck *Royal Captain* (Curvas 1985; Alba 1988; FEFNA 1999).

4.5 Results: LA-ICP-MS analysis of glass beads

Through LA-ICP-MS analysis, we identified three main compositional groups, which can be clearly distinguished from one another by observing the varying levels of potash (K_2O) and magnesia (MgO) (see Figure 4-1). One group with higher levels of K_2O also contained high concentration of lead (Pb), and was identified as a lead-potash (Pb-K) glass. The second cluster represents a glass with rather low K_2O and MgO that also has high soda (Na_2O) and high alumina (Al_2O_3) concentrations. It was identified as a mineral soda-high alumina (m-Na-Al) glass. The final cluster also has high Al_2O_3 concentrations and similar concentrations of K_2O as the m-Na-Al glass, but has exceptionally high MgO concentrations. These beads represent a newly identified glass type.

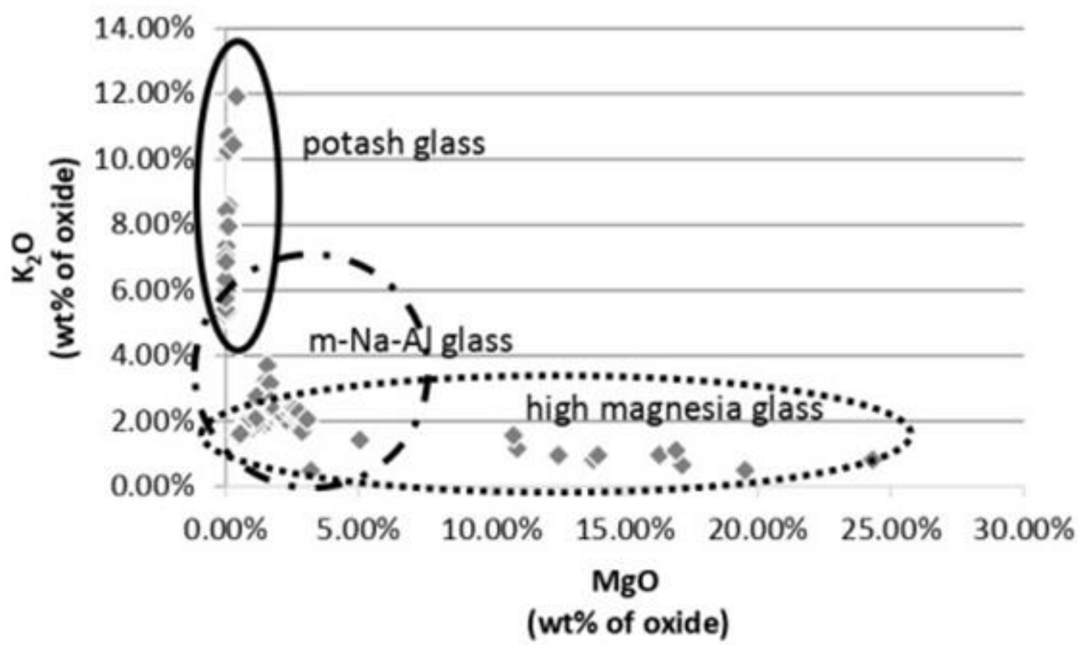


Figure 4-1 The beads analyzed in this study plotted by MgO and K2O, showing three main compositional groups. The dotted ellipsis on the bottom represents the Pandanan, the dash-dot circle in the corner represents the Santa Cruz, and the solid-line ellipsis at the top represents the RCSw2.

In Table 4-2 we summarize our LA-ICP-MS results of each shipwreck's different glass bead recipes organized by color. We present the average reduced compositions of the major glass compositions here to delineate groups. Some key trace elements were included because they can be colorants or other important markers. Using the reduced compositions, calculated taking into account only constituents brought by the silica-rich ingredient and the flux, avoids any diluting effects due to the addition of colorants.

	N	*SiO2	*Na2O	*MgO	*Al2O3	*P2O3	*K2O	*CaO	*Fe2O3	Li	Rb	Sr	Zr	Cs	Ba	U
Pandanan																
red soda alumina group 2	13	59.6	17.9	1.2	9.1	0.1	2.1	4.5	2.9	22±5	51±10	237±23	170+/-19	0.7±0.1	344±41	196±147
black new type	11	64.6	1.8	14.7	11	0.1	1.0	2.0	4.6	15±8	6±2	165±86	213±52	0.1±0	16±8	171±77
black soda alumina group 2	17	59.7	19.9	2.2	7.4	0.2	2.2	4.3	3.8	14±4	50±16	210±46	182±39	0.7±0.2	395±76	235±62
Santa Cruz																
black soda alumina group 2	12	60.3	20.3	1.7	7.7	0.2	2.6	3.2	3.7	22±21	59±9	201±40	170±31	1±0.2	448±71	284±47
blue lead potash	4	69.3	1.8	0.3	0.7	0.0	19.2	7.9	0.8	4.5±1.7	6±1	22±15	4±3	0.2±0.1	19±11	0.2±0.1
yellow soda alumina group 4	10	70	17.5	1.1	5.8	0.2	0.2	2.2	2	41.8±9.1	9±4	59±7	657±1058	5.4±2.2	519±101	58±18
RCSw2																
yellow lead potash	3	82.1	0.5	0.6	0.7	0.0	15.7	0.4	0.4	10±8	25±10	66±107	13±17	0.3±0.5	36±47	0.3±0.5
red lead potash	9	81.5	0.7	0.1	0.9	0.0	15.3	1.2	0.4	6±6	29±10	6±8	22±60	0.1±0.1	32±70	0.3±0.2
white lead potash	4	73.8±	0.9	0.1	0.9	0.0	16.7	7.3	0.3	10±3	8±1	9±1	2±1	0.2±0.1	7±2	0±1
dark purple-grey lead potash	1	82.3	0.3	0.2	1.3	0.0	13.5	1.8	0.5	4	33	15	7	0.2	19	0.3
orange lead potash	1	59.3	0.7	0.8	3.6	0.2	22.2	6.9	6.1	10	51	73	153	1	132	3

Table 4-2 Glass beads and elemental glass compositions for shipwrecks Pandanan, Santa Cruz and Royal Captain Shoal wreck 2 (RCSw2). N is the amount of glass beads per group/color (table1). Average reduced compositions include an * and are measured by weight percent (wt%). Trace elements are measured in parts per million (ppm) and include their average and standard deviation.

4.5.1 Lead-potash glass

Twenty-six beads, 4 of them from the Santa Cruz and 22 from the Royal Captain Shoal wreck 2, all coiled beads, were identified as lead-potash (Pb-K) glass, containing between 13.5 and 22 weight per cent (wt%) of K_2O and between 46 to 60 wt% of lead oxide. Soda concentrations are generally low, as are MgO concentrations, suggesting the use of a rather pure

K_2O source, possibly saltpeter (Dussubieux, et al. 2020). With alumina concentrations mostly below 1 % (at one exception), the silica source seems to have been rather pure. Lime (CaO) concentrations vary in a wide range (0.1 to 5 %). The highest lime concentrations are found in white and opaque turquoise blue beads. The presence of higher CaO concentrations in the opaque beads suggests the possible use of calcium fluoride (CaF_2) as a white opacifier (Henderson, et al. 1989; Borell 2010: 149). As fluorine was not measured in our samples, it is impossible to confirm this hypothesis with our data. The opaque blue beads are distinguished from the white beads by the addition of copper (0.9 wt%), producing a turquoise blue color when present as Cu^{2+}. One orange opaque coiled bead contains higher CaO concentrations and also higher MgO, phosphorus oxide (P_2O_5), copper, and iron concentrations. The glass was probably coloured with cuprite (Brill & Cahill 1988), and with iron added to the glass to facilitate the opaque orange colour (Ahmed, et al. 1977; Dussubieux, et al. 2008; Carter, et al. 2016). The higher concentrations of CaO, MgO, and P_2O_5 in the orange opaque glass might be explained by the intentional introduction of fuel ash to the glass melt, to create a reducing environment to more easily obtain cuprite (Schibille & Freestone 2013).

Lead-potash glass recipes appear to have begun around the 6th century in China and was initially used to produce glass vessels (Fuxi 2009: 28). This glass recipe was used into the Ming Dynasty (1368–1644 CE) (Brill, et al. 1991; Gratuze 2001: 10). Lead-potash glass was manufactured over a very long period but two trace elements: Rb and Li can be used to distinguish glass manufactured around the 14th century CE or later. Beads with a lead-potash composition found at Fort Canning, Singapore and dating from the 14th century CE (Borell 2010; Dussubieux & Gratuze 2010) have lower rubidium but higher lithium concentrations. Lead potash beads from the Philippines, excavated by Karl Hutterer at Tanjay from a burial that was dated to the late 15th to early 16th century based on associated porcelain ceramics (Laura Junker, personal communication), have higher rubidium and lower lithium concentrations. The lead-potash glass beads from the shipwrecks match closer the higher Rb – lower Li compositions found in the Philippines which aligns with the dating of the shipwrecks (both date to the end of the 15th century or later) (see Figure 4-2). Beads with similar compositions were found in jar burials found in the Cardamom Mountains of Cambodia, dating from the 15th to the 17th century CE (Carter, et al. 2016). The earlier mentioned shipwreck of the Brunei, located 22 nautical miles off the Sultanate of Brunei includes cargo of two glass artefacts of Pb-K composition (Gratuze 2001), although the absence of data for Li precludes from a more precise group attribution.

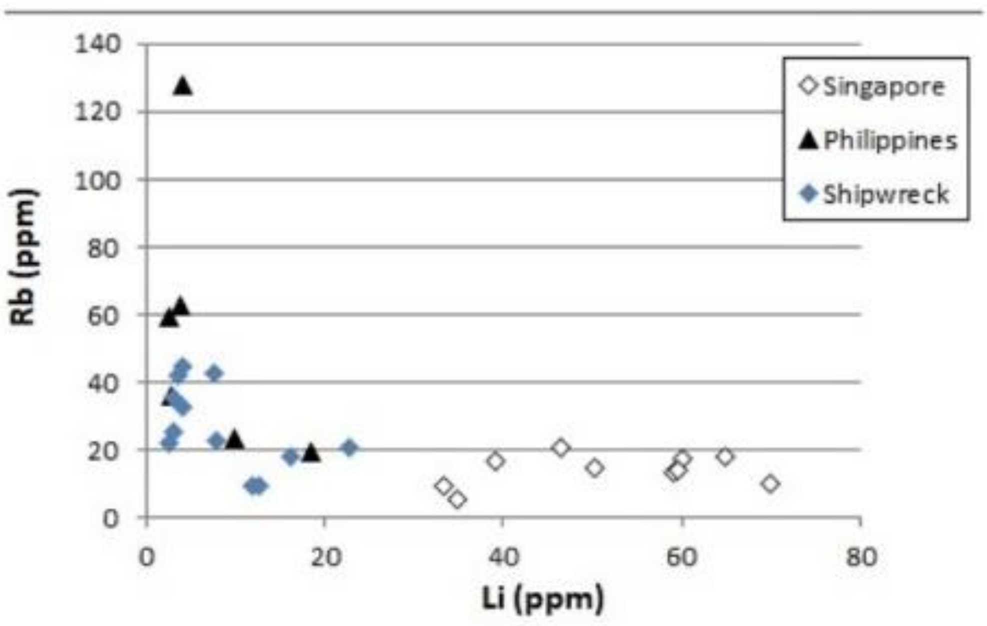


Figure 4-2 A biplot of Rb and Li for lead-potash glass showing the difference between the earlier (14th century) Fort Canning beads and the later (15th – 16th century) beads from the (RCSw2) shipwreck beads and the Philippines (adapted from Carter et al 2016: 405 figure 3).

4.5.2 High-alumina mineral soda glass beads

Fifty-one drawn or wound beads from the two earlier shipwrecks Pandanan (c. 1450–1487) and Santa Cruz (c. 1488–1505) have a soda-rich composition with Al_2O_3 concentrations, between 5 to 9 wt%, and relatively low MgO concentrations (generally lower than 1.5 % although there is a number of exceptions). These were classified as belonging to the mineral soda – high alumina or m-Na-Al category. This glass, manufactured from a natural mix of an immature granite sand and soda rich efflorescence, was produced in South Asia (see Appendix for more details). Five different sub-groups were identified based on the concentrations of the following constituents: MgO, CaO, Sr, Zr, Cs, Ba and U (Dussubieux, et al. 2008; Dussubieux, et al. 2010; Dussubieux & Wood 2020). Additional sub-groups identified at the Medieval site of Indor (Rajasthan) were recently recognized by Trivedi and Dussubieux (this volume; forthcoming).

To determine what m-Na-Al sub-groups the shipwreck beads belong to principal component analysis (PCA) was performed, following the method described by Dussubieux et al. (2010) and using the constituents listed above. The PCA compared the beads from the shipwrecks with a dataset available from the literature (Figure 4-3) and show that all the beads (22) from the Pandanan belong to the m-Na-Al group 2 glass whereas the Santa Cruz beads split between the m-Na-Al group 2 (12 beads) and the m-Na-Al group 4 (10 beads).

The m-Na-Al group 2 glass is characterized in general by higher concentrations of U and lower levels of Cs, Ba and Zr when compared to the m-Na-Al groups 1, 3, 4 and 6 glass. The minimum uranium concentration measured in the shipwreck beads is quite high (close to 200 ppm) and correspond to the maximum value measured in the glass beads from Chaul that serve as our reference for the m-Na-Al group 2 glass. Trivedi and Dussubieux (in this volume;

forthcoming) identified at the site of Indor, Rajasthan (14th century CE and onward) glass samples with higher U concentrations (> 200 ppm) suggesting that such a glass was also available in India, although more work is needed to understand its exact composition, place of production, distribution and chronology. For now, we will still consider that the m-Na-Al shipwreck material with high U is part of the m-Na-Al group 2 glass but a common origin with the beads from Chaul is quite unlikely. The Pandanan red beads have a level of Fe_3O_2 (2.89 wt%) and CuO less than 1% (0.36 wt%) in line with the concentrations found in the m-Na-Al group 2 red glass. Black beads can be colored by the presence of manganese or iron. Both the Pandanan and Santa Cruz black m-Na-Al group 2 beads have low levels of MnO (0.12 wt%) but rather high Fe_2O_3 level (ranging from 1.7 to 5.3 wt%). Dark glass contains an average of 2.2 % of iron (as Fe_2O_3) in the m-Na-Al group 2 beads from Chaul (Dussubieux, et al. 2008). In Southeast Asia, m-Na-Al group 2 glass material was identified in 15th to 16th century Cambodia (Carter, et al. 2016) and 15th century Sumatra (Dussubieux 2009).

The m-Na-Al group 4 glass is characterized by low strontium and high cesium (Cs) concentrations. The high levels of Pb and tin (Sn) in the yellow Santa Cruz beads were probably due to the use of a lead stannate (Pb_2SnO_4) a yellow opacifier. The m-Na-Al group 4 also occurs at 15th to16th century sites in Sumatra, in north-eastern India and Bangladesh (Dussubieux, et al. 2008), and at a 17th to 19th century site in Kenya (Dussubieux, et al. 2008, 2010). Other specimens of yellow glass m-Na–Al group 4 are the 404P glass bead from the Brunei shipwreck (Gratuze 2001) and in both the Okei and the Phnom Khnang Peung sites of the Cardamom Mountains (Carter et al. 2016).The m-Na-Al glass from the Brunei shipwreck seems to belong to this sub-group as indicated by the really low Sr concentrations (<100 ppm) and moderate U concentrations (~50 ppm). It is currently unclear where this subtype was manufactured.

Kanungo (2004) posits a north India provenance. Indeed, its high Cs concentrations are similar to the m-Na–Al group 3 glass thought to originate in north India (Dussubieux & Gratuze 2013).

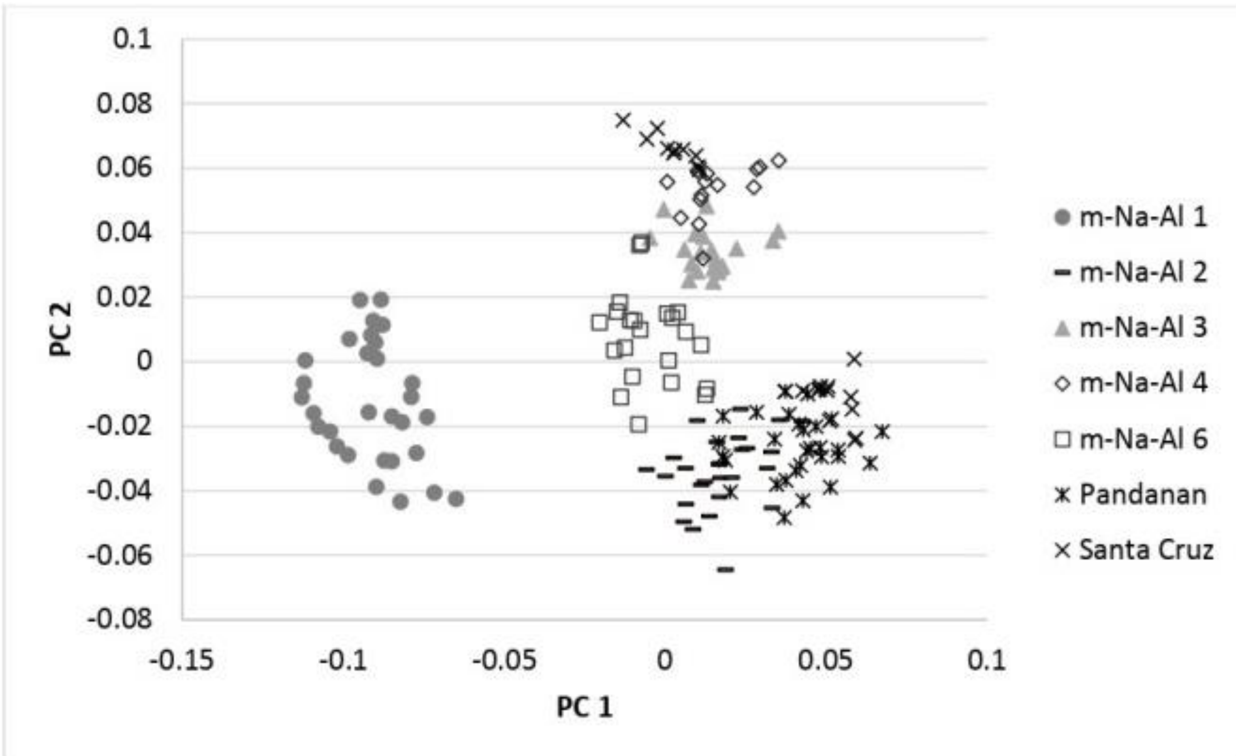


Figure 4-3 PC1 and PC2 calculated for the m-Na-Al glass beads from the Pandanan and the Santa Cruz and the m-Na-Al 1 (unpublished), 2 (Dussubieux et al. 2008), 3 (Dussubieux and Kanungo, 2013), 4 (Dussubieux, 2009) and 6 (Dussubieux and Wood 2020) glass groups.

4.5.3 Newly identified high magnesia-alumina glass

Eleven drawn beads have an unusual composition with low soda, potash and lime (< 3.4 wt%) high MgO (ranging from 5.0 to 24.3 wt%) and high Al_2O_3 (ranging from 7.2 to 13.8 wt%) concentrations that represents a newly identified glass type from the Pandanan. Trace elements have high concentrations with titanium (Ti) concentrations as high as 3500 ppm and U at 338 ppm. It seems that an immature sand like the one used for the m-Na-Al glass was melted with a magnesia-rich ingredient that would have been used as flux. High concentrations of iron (3.3 to 6.5 wt%) are certainly the cause of the dark color of the glass. Mg acts as the flux in this glass. It is an alkali-earth element, such as Ca that was used as a flux in Medieval European forest plant ash glass. It could have been a high alumina sand similar to that of the m-Na-Al glass mixed with a high magnesia (and high iron) ingredient. These newly identified high MgO - high Al_2O_3 beads were manufactured in a drawn technique common in India and could suggest that these beads were made there. We were curious if this recipe was similar to glass identified in the Cardamom Mountains of Cambodia, but that glass recipe has lower concentrations of both alumina (3–8 wt%) and magnesia (2–3 wt%) (Carter, et al. 2016) so we do not think they are the same.

4.6 Discussion and conclusion

In the Pandanan wreck, two glass types were identified:

- 29 samples are m-Na-Al Group 2 glass
- 11 samples are high MgO and Al_2O_3 glass

In the Santa Cruz wreck, three glass types were identified:

- 12 samples are m-Na-Al Group 2 glass
- 10 samples are m-Na-Al Group 4 glass
- 4 samples are Pb-K glass

In the RCSw2, one glass type was identified:

- 28 samples are Pb-K glass

The glass bead compositional groups identified with LA-ICP-MS, combined with ceramic contextual information, can help to recreate ancient exchanges. In the three shipwrecks in our study there are ceramics and glass beads, and their material patterns must be considered in a holistic manner (Fahy 2015). By doing so we can tie together associated assemblages. Here we summarize the earlier section on cargo ceramic seriation and associate them with our results on the glass bead cargo. The Pandanan cargo carried m-Na-Al group 2 and high MgO and Al_2O_3 glass beads inside the Thai Maenam Noi 1 jars (Cort 2017; Orillaneda 2003). The Santa Cruz cargo carried three different glass bead chemistries in either Thai or Chinese ceramics. The black m-Na-Al group 2 glass beads were stored inside the Thai Maenam Noi 2 jars (Cort 2017), the yellow m-Na-Al group 4 glass beads were packed in Thai ceramics of either tall-eared Maenam Noi jars or Si Satchanalai coconut-shaped jars and jarlets with ring-handles (Miksic 2013: 203; Orillaneda 2016b). The blue Pb-K glass beads were found associated with celadon (Orillaneda 2003), presumably from Longquan. The RCSw2 cargo carried exclusively Pb-K glass beads of varying colours in association with solely Chinese blue and white ceramics dated to the Wanli Dynasty (1573–1620 CE) (Goddio 1988:115). Beads and ceramics in the three Philippine shipwrecks discussed here are examples of the materials shipped as tribute.

Tribute shipments are the current hypothesis for why cargo associations exist in shipwrecks dated to the 15th to 17th century (Hall 2011; Miksic & Goh 2017). Tribute shipments are materials, services or ceremony that act as "tokens of subservice but not direct rule of distant provinces" (Miksic & Goh 2017: 42, 160). This extraction of tribute is largely associated with the Chinese Empire in relation to Southeast Asian vassals (Hall 1985; Miksic & Goh 2017). This time known as the Ming Ban commenced when Chinese emperors had forbidden private overseas trade in 1444 CE and lasted 123 years, until 1567 CE (Brown 2009; Miksic & Goh 2017:519; Reid 1988). This left a gap in Chinese products some note as the Ming Gap (1368-1488 AD) (Brown 2009). As mentioned earlier in the Ceramic Seriation section, Ayutthaya (Thai) ceramics monopolized the market at this time.

Ceramics from kilns in Si Satchanalai, Sukhothai, and Mae Namnoi/Bang Rachan flooded out from surrounding kilns of the Ayutthaya kingdom (1350–1767 AD) (Brown 2009: 23-29). During the 15th to 17th century (esp. 1448–1488 AD) this ceramic export largely shipped out the port of Nakhon Si Thammarat (on the east coast of the peninsula with access to the Gulf of Thailand), as it was a chief primary-rank city under the Ayutthaya Kingdom (Sukkham 2017). Until around 1584 CE when Si Satchanalai and Sukhothai wares disappeared from maritime trade routes, signaling the termination of their productions (Sukkham 2018:803, table 1).

Backgrounding the regional affairs signaled by ceramics and foregrounding the shipwrecks from our study provides the setting to contextualize our glass. In a timeline of the shipwrecks and contemporaneous regional affairs (Figure 4-4) the Pandanan occurs within the Ming Gap (1368-1488 AD), Santa Cruz during the period of the market being flooded with Ayutthaya products, and the RCSw2 after the end of the Ming Ban (1352-1567 AD).

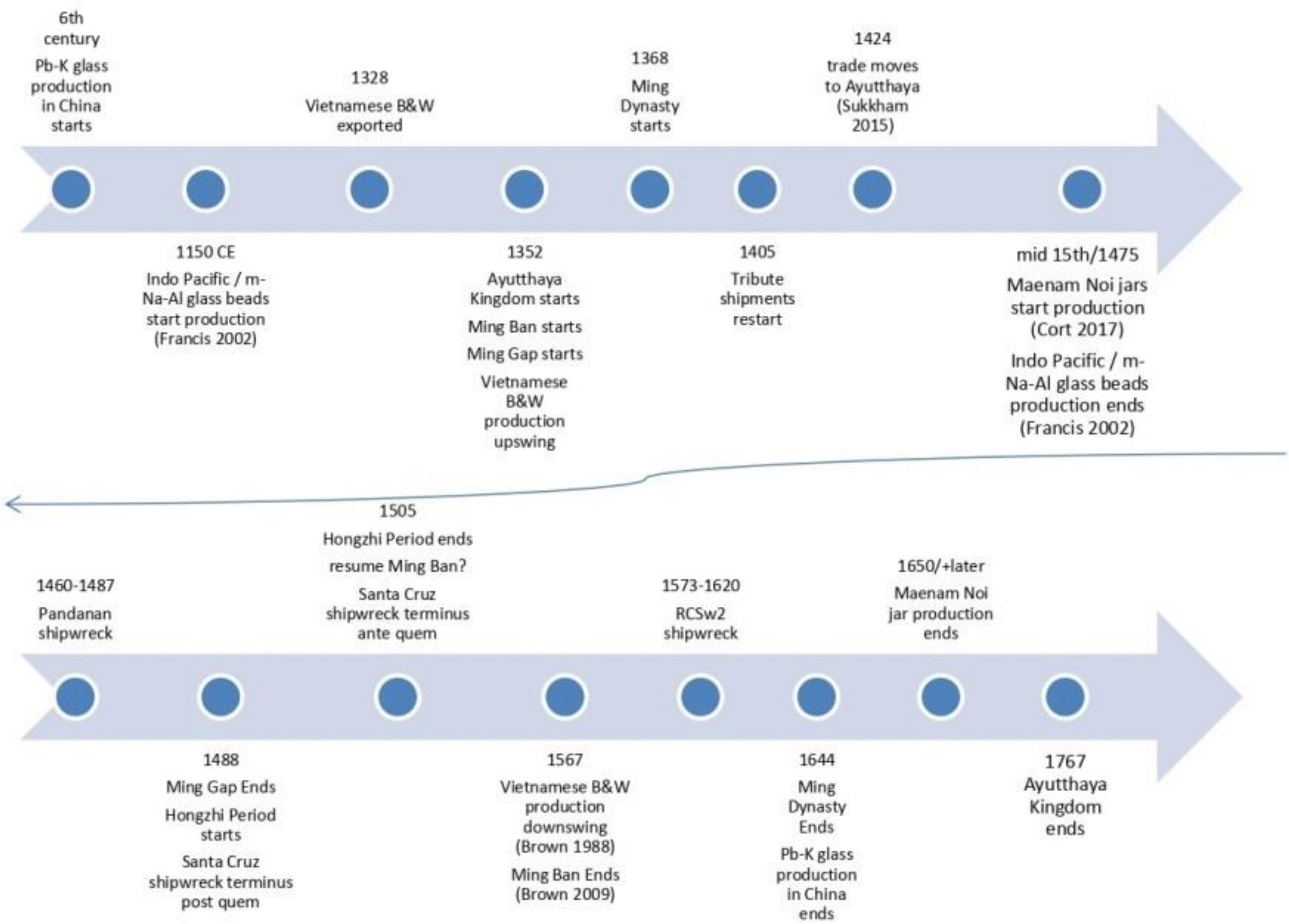


Figure 4-4 Timeline of events, glass and ceramic production of artifacts discussed, shipwreck dates.

Considering the timeline of events and the wrecking of the case studies (Figure 4-4) we can correlate the shifts in glass recipes with associated ceramics, which adds evidence to the maritime archaeology hypotheses of regional market shifts. The RCSw2 cargo of Pb-K glass in tandem with the re-entry of Chinese blue and white wares is likely an example of the market shift to Chinese products after the Ming Ban ceased in 1567 CE. In the case of the Santa Cruz, its cargo also included Pb-K glass in association with Chinese ceramics (in this case celadon). Our observation of patterns in glass cargo in tandem with the shift to Chinese ceramics adds to the mounting evidence in maritime archaeology that bootlegging occurred as the Ming Gap ended and was composed of very similar cargo to earlier tribute shipments (Fahy 2014; Orillaneda

2016b). Likewise, another noteworthy pattern is the drawn m-Na-Al glass beads and the Ayutthaya (Thai) Maenam Noi jars were traded together in both earlier shipwrecks. The cargo of the shipwrecks Pandanan (1460-1487 CE) and the Santa Cruz (1488-1505 CE) represent a shift away from Chinese products during the Ming Ban (Brown 2009), as Ayutthaya ceramic production and export peaked (Sukkham 2018). We observe a similar phenomenon with the Indo-Pacific glass evidence, increasingly associated with m-Na-Al glass recipe that both the glass recipe and Ayutthaya ceramic production increased. This likely indicates Francis' (2002) hypothesis, suggesting that production ceased as Maenam Noi ceramic production started, is incorrect. With the evidence of glass in these shipwrecks we can add to the argument, with Sumatran glass finds (Dussubieux 2009) and Cambodian burial jars (Carter, et al. 2016) that the date of m-Na-Al glass in Southeast Asia markets should move later from the mid-12th century to at least the late 15th century. Aside from adding further evidence into the questioning of Francis' Indo-Pacific bead production timeline, we also discovered a new glass recipe.

The most significant finding of this work is the newly identified high MgO and Al_2O_3 black glass beads. The manufacturing location of this glass is unknown. Very few beads have been analysed from the 15th–16th century CE across China, India and Southeast Asia; therefore, additional examinations and analyses of glass beads from other contemporary sites are needed in order to determine the origins and range of exchange of this new glass type.

References

AHMED, A.A., G.M. ASHOUR & T.M. EL-SHAMY. (1977). Effect of melting conditions on the crystallisation of cuprous oxide and copper in glass. In Proceedings of the XIth International Congress on Glass (pp. 177-87).

ALBA, L. (1984). The Genesis of Underwater Archaeology in the Philippines [Unpublished manuscript], Underwater Archaeology Section, National Museum of the Philippines.

ALBA, L. (1988). A Preliminary Report on the 1985 Royal Captain Shoal Expedition. [Unpublished manuscript], Records Section, National Museum of the Philippines.

BORELL, B. (2010). Glass from China and from India: finds of vessel glass from fourteenth century Singapore. *Archipel 80*:139-96.

BRILL, R.H. & N.D. CAHILL. (1988). A red opaque glass from Sardis and some thoughts on red opaques in general. *Journal of Glass Studies* (pp.16-27).

BRILL, R.H., S.S.C. TONG & D. DOHRENWEND. (1991). Chemical analyses of some early Chinese glasses. Scientific research in early Chinese glass (pp.31-64). Brill.

BROWN, R. (2009). Ming Gap and Shipwreck Ceramics in Southeast Asia: Towards a Chronology of Thai Trade Ware. Siam Society.

BROWN, R. (2008). Burma ceramics identified on Santa Cruz shipwreck: Twante kilns to Philippines. Southeast Asian Ceramics Museum Newsletter, May-June.

BROWN, R. M. (2004). History of shipwreck excavation in Southeast Asia. In J. Ward, Z. Kotitsa, & A. D'Angelo (Eds) The Belitung wreck: Sunken treasures from Tang China (pp. 40-55). Seabed Explorations.

BROWN, R. (1988). The ceramics of South-East Asia: their dating and identification. Oxford University Press.

CARTER, A. K., L. DUSSUBIEUX & N. BEAVAN. (2016). Glass Beads from 15th–17th Century CE Jar Burial Sites in Cambodia's Cardamom Mountains. *Archaeometry 58*(2), 401-412.

CAYRON, J. G. (2006). Stringing the Past: An Archaeological understanding of early Southeast Asian glass bead trade. In V. Paz (Ed), Contributions to Archaeology Series. The University of Philippines Press.

CORT, L.A. (2017). Container Jars from the Maenam Noi Kilns, Thailand Use and Reuse along Maritime Trade Routes in Asia. Bulletin de l'Ecole française d'Extrême-Orient 103, 267-296.

CURVAS, M. (1985). Typological Analysis of Beads from the Royal Captain wrecksite Underwater Archaeological Project. [Unpublished manuscript], Records Section, National Museum of the Philippines.

DIZON, E. Z. (1996a). Anatomy of a shipwreck: Archaeology of the 15th century Pandanan shipwreck. In C. Loviny (Ed), The pearl road, tales of treasure ships in the Philippines. (pp.62-75). Makati City.

DIZON, E.Z. (1996b). The archaeology of a 15th century AD shipwreck, located off Pandanan Island, Southern Palawan, Philippines. [Unpublished manuscript], Records Section, National Museum of the Philippines.

DIZON, E. Z. (2003). Underwater and maritime archaeology in the Philippines. Philippine Quarterly of Culture and Society 31(1/2), 1-25.

DUSSUBIEUX, L. & WOOD, M. (2021, In Press). Indian glass: chronology and distribution in Eastern Africa. In A.K.,Kanungo, & L. Dussubieux (Eds.) Ancient glass of south Asia – archaeology, ethnography and global connection. Springer Natyre and Gandhinagar.

DUSSUBIEUX, L., B. BELLINA, WIN HSAN OO, U. MAUNG SUN WIN, HTET MYET TUT, KALAYAR MYAT MYAT HTWE, & KHINSANDAR KYAW. (2020). First elemental analysis of glass from Southern Myanmar: replacing the region in the early Maritime Silk Road. Archaeological and Anthropological Sciences 12(7), 139. doi: 10.1007/s12520-020-01095-1.

DUSSUBIEUX, L. (2016). Potash glass: A view from South and Southeast Asia. In F. Gan, Q. Li & J. Henderson (Eds), Recent Progress of Scientific Research on Ancient Glass and Glaze: (pp. 95-111). Series on Archaeology and History of Science in China (Book 2) World Scientific Publishing Company.

DUSSUBIEUX, L. & GRATUZE, B. (2013). Glass in South Asia, in K. Janssens (Ed), Modern Methods for Analysing Archaeological and Historical Glass (pp. 399-413). John Wiley & Sons.

DUSSUBIEUX, L. & KANUNGO, A.K. (2013). Trace element analysis of glass from Kopia. In A.K. Kanungo (Ed.) Glass in ancient India: excavations at Kopia (pp. 360-366). Kerala Council for Historical Research.

DUSSUBIEUX, L., LANKTON, J.W., BELLINA-PRYCE, B. & CHAISUWAN, B. (2012). Early Glass Trade in South and Southeast Asia: New Insights from Two Coastal Sites, Phu Khao Thong in Thailand and Arikamedu in South India. In M.-L. Tjoa-Bonatz, A. Reinecke & D. Bonatz (Eds) Crossing Borders: Selected Papers from the 13th International Conference of the European Association of Southeast Asian Archaeologists, Volume 1. (pp. 307-328) NUS Press.

DUSSUBIEUX, L. & GRATUZE, B. (2010). Glass in Southeast Asia. in E.A.Bacus, B. Bellina, T.O. Pryce & C.J. Wisseman (Eds), 50 years of Archaeology in Southeast Asia: Essays in honour of Ian Glover (pp. 247–259). River Books.

DUSSUBIEUX, L., GRATUZE, B., & BLET-LEMARQUAND, M. (2010). Mineral soda alumina glass: occurrence and meaning. Journal of Archaeological Science 37 (7), 1646-1655.

DUSSUBIEUX, L. (2009). Compositional analysis of ancient glass fragments from North Sumatra. In D. Perret & H. Surachman (Eds), Histoire de Barus III. Regards sur une place marchande de l'océan Indien (pp.385–417). École Française d'Extrême-Orient, XIIe-milieu du XVIIe s. Association Archipel

DUSSUBIEUX, L., KUSIMBA, C. M., GOGTE, V., KUSIMBA, S. B., GRATUZE, B. & OKA, R. (2008). The Trading of Ancient Glass Beads: New Analytical Data from South Asian and East African Soda-Alumina Glass Beads. Archaeometry 50 (5), 797-821.

FAHY, B. (2015). Holistic shipwreck assemblages in 14th and 15th century southeast Asia. [Unpublished doctoral dissertation]. University of Oxford.

FAHY, B. (2014). Addressing Artefact Biases in Asian Shipwreck Assemblages. In Van Tilburg, H. B. Fahy, J. Kimura, V. Walker-Vadillo (Eds), Proceedings of 2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage, http://www.themua.org/collections/items/show/1603.

FAR EASTERN FOUNDATION FOR NAUTICAL ARCHAEOLOGY (FEFNA) (1999). Royal Captain Shoal Survey Report. [Unpublished manuscript], Records Section, National Museum of the Philippines.

FLECKER, M. (2005). The advent of Chinese sea-going shipping: A look at the shipwreck evidence. In Z. Peikai. (Ed.) Proceedings of the International Conference: Chinese Export Ceramics and Maritime Trade, 12th–15th Centuries. Zhonghua,

FLECKER, M. (2007). The South-China-Sea Tradition: the Hybrid Hulls of South-East Asia. International Journal of Nautical Archaeology 36(1), 75-90.

FRANCIS, P. (2002). Asia's maritime bead trade: 300 B.C. to the present. University of Hawai'i Press.

FUXI, G. (2009). Origin and Evolution of Ancient Chinese Glass. In R. Brill G. Fuxi, & T. Shouyun (Eds.) Ancient Glass Research along the Silk Road. World Scientific.

GODDIO, F. (1988). Discovery and archaeological excavation of a 16th century trading vessel in the Philippines. Ayala Museum of History and Iconographic Archives. In S. P. Ner & C.M. Reyes (Eds.). World Wide First and Ayala Museum of History and Iconographic Archives.

GODDIO, F., M. CRICK, P. LAM, S. PIERSON, & R. SCOTT. (2002). Lost at sea: the strange route of the Lena Shoal junk. Periplus

GODDIO, F., D. FABRE, & M. COIGNARD. (2014). On-going Archaeological Researches on shipwrecked Junks in Philippines. In Van Tilburg,H. B. Fahy, J. Kimura, V. Walker-Vadillo (Eds), Proceedings of 2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage. http://www.themua.org/collections/items/show/1636.

GRATUZE, B. (2001). Study of Glass Objects from the Wrecked Junk of Brunei. [Unpublished report]. Institut de Recherche sur les Archéomatériaux, Centre Ernest Babelon, Centre National de la Recherche Scientifique.

GREEN, J.N. (2011). Maritime archaeology of ships of Indian Ocean, Southeast Asia and East Asia, the Question of Bulkheads. In M. Staniforth, J. Craig, B. Orillaneda, C. Jago-on & L. Ligaya (Eds), Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage. National Museum of the Philippines. http://www.themua.org/collections/items/show/1573

GREEN, J.N., R. HARPER & V. INTAKOSI. (1987). The maritime archaeology of shipwrecks and ceramics in southeast Asia, the maritime connection. Special publication no. 4 Australian Institute for Maritime Archaeology.

HALL, K. R. (2011). A history of early Southeast Asia: maritime trade and societal development, 100-1500. Rowman & Littlefield.

HALL, K. R. (1985). Maritime trade and state development in early Southeast Asia. University of Hawaii Press.

HENDERSON, J., J. AN & H. MA. (2018). The Archaeometry and Archaeology of Ancient Chinese Glass: a Review. Archaeometry 60(1), 88-104.

HENDERSON, J., M. TREGEAR, & N. WOOD. (1989). The technology of sixteenth- and seventeenth-century Chinese cloisonné enamels. Archaeometry 31, 133-46.

JUNKER, L. (2018). Conflictive Trade, Values, and Power Relations in Maritime Trading Polities of the Tenth to the Sixteenth Centuries in the Philippines. In J. Myrdal, K. Kristiansen & T. Lindkvist (Eds.) Trade and Civilisation: Economic Networks and Cultural Ties, from Prehistory to the Early Modern Era, (pp. 354-388). Cambridge University Press.

KANUNGO, A.K. (2004). Glass Beads in Ancient India and Furnace-Wound Beads at Purdalpur: An Ethnoarchaeological Approach. Asian Perspectives 43(1), 123-50.

KETEL, C. (2011). Identification of export porcelains from early 17th Century VOC shipwrecks and the linkage to their cultural identification. In M. Staniforth, J.Craig, B.Orillaneda, C. Jago-on, L. Ligaya (Eds.) Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage, http://www.themua.org/collections/items/show/1253.

L'HOUR, M. (2001a). La mémoire engloutie de Brunei: Précis scientifique. Vol. 2. Textuel.

L'HOUR, M. (2001b). La mémoire engloutie de Brunei: une aventure archéologique sous-marine. Vol. 1: Textuel.

LIU, M. (2016). Early Maritime Cultural Interaction Between East and West: A Preliminary Study on the Shipwrecks of 16th–17th Century Investigated in East Asia. In C. Wu (Ed.) Early Navigation in the Asia-Pacific Region, (pp. 195-207). Springer Singapore.

MAARLEVELD, T. J. (1995). Type or technique. Some thoughts on boat and ship finds as indicative of cultural traditions. International Journal of Nautical Archaeology 24(1), 3-7. doi: 10.1111/j.1095-9270.1995.tb00706.x.

MANGUIN, P-Y. (2001, 28 sept. 2001-7 janv. 2002). Réseaux marchands et navires en mer de Chine méridionale. La mémoire engloutie de Brunei : une aventure archéologique sous-marine [Musée exposition] Conciergerie-Palais de la Cité.

MANGUIN, P. (1984). Relationship and Cross-influence between South-East Asian and Chinese Shipbuilding Traditions. [Unpublished manuscript] SPAFA Consultative Workshop on Research into Maritime History & Trade Networks in SE Asia, Indonesia.

MIKSIC, J. (Ed.). (2009). Research on ceramic trade, within Southeast Asia and between Southeast Asia and China. Southeast Asian Ceramics. New Light on Old Pottery. Southeast Asian Ceramic Society.

MIKSIC, J. (2013). Singapore and the Silk road of the Sea 1300-1800. NUS Press.

MIKSIC, J.N., & G. Y. GOH. (2017). Ancient Southeast Asia. Taylor & Francis.

ORILLANEDA, B. (2012). The Santa Cruz Shipwreck Excavation: A Reflection on the Practice of Underwater Archaeology in the Philippines. In A. Chong & H. Tan (Eds.) Marine Archaeology in Southeast Asia: Innovation and Adaptation, (pp. 86-104). Asian Civilizations Museum.

ORILLANEDA, B. (2011). Maritime Trade in Southeast Asia during the Early Colonial Period. In M. Staniforth, J.Craig, B.Orillaneda, C. Jago-on, L. Ligaya (Eds.) Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage, http://www.themua.org/collections/items/show/1606

ORILLANEDA, B. (2003). Santa Cruz hull. [Unpublished manuscript], Records Section, National Museum of the Philippines.

ORILLANEDA, B. (2001). Santa Cruz – Inventory of Artifacts. [Unpublished manuscript], Records Section, National Museum of the Philippines.

ORILLANEDA, B. (2000). The San Diego and Pandanan wrecks: Two underwater archaeological sites. Hukay 2(2):37-45.

ORILLANEDA, B. (2016a). Maritime Trade in the Philippines During the 15th Century CE. Moussons: Recherche en sciences sociales sure L'Asie du Sud-Est / Social Science Research on Southeast Asia 27 (The Sea Beyond all Borders: The Link between Southeast Asian Countries), 83-100. https://journals.openedition.org/moussons/3529?lang=en

ORILLANEDA, B. (2016b). Of Ships and Shipping: The Maritime Archaeology of Fifteenth Century CE Southeast Asia. In C.Wu (Ed.). Early Navigation in the Asia-Pacific Region: A Maritime Archaeological Perspective, (pp. 22-57). Springer.

ORTON, C. & HUGHES, M. (2013). Pottery in Archaeology (second edition). Cambridge University Press.

REID, A. (1988). Southeast Asia in the age of commerce, 1450-1680. Yale University Press.

SCHIBILLE, N., & I. C. FREESTONE. (2013). Composition, production and procurement of glass at San Vincenzo al Volturno: an early medieval monastic complex in Southern Italy. PLoS One 8 (10):e76479.

SUKKHAM, A., (2018). Si Satchanalai Figurines: Reconstruction of Ancient Daily Life, Beliefs, and Environment in Siam during the Sixteenth Century. International Journal of Historical Archaeology 22(4), 800-842.

SUKKHAM, A., (2015). Variability in Ceramics of the Bang Rachan (Mae Nam Noi) Kilns, Singburi, Thailand. In N. Hidelgo (Ed.). Selected Papers from the First SEAMEO SPAFA International Conference on Southeast Asian Archaeology, Chonburi, Thailand 2013. SEAMEO SPAFA Regional Centre for Archaeology and Fine Arts.

SUKKHAM, A., TAÇON, P. S.C. TAN, N.H. & BIN MUHAMAD, A. (2017). Ships and Maritime Activities in the North-eastern Indian Ocean: re-analysis of rock art of Tham Phrayanaga (Viking Cave), southern Thailand. International Journal of Nautical Archaeology 46(1), 108-131.

TAN, R.C. (1998/9). A Note on the Dating of Ming Minyao Blue and White Ware. Oriental Art 44(4).

Linking Passage 4: IOW Context

In the previous chapter I added further evidence to the questioning of Francis's Indo-Pacific bead production timeline: Francis (2002) proposed in his seminal work *Asia's Maritime Bead Trade* that Indo-Pacific beads started production in South Asia during 1150 CE and ended in the mid-15th century; while Chinese lead potash glass production started in the 10th century, although others argue the potential for 6th century (Henderson, et al. 2018), but likely another similar recipe was created later in the 15th century that finally superseded the demand of Indo-Pacific beads. The evidence from the shipwrecks here push the presence of Indo-Pacific beads to the early 16th century and adds evidence that a second phase of Chinese lead-potash glass enters the archaeological record in the late 15th century.

In the preceding chapter I observed patterns in glass cargo in tandem with the shift to Chinese ceramics, an example of holistic cargo analysis (Fahy 2014, 2016; Orillaneda 2016b), which supported evidence in maritime archaeology that bootlegging occurred as the Ming Gap ended. My research shows that the bootlegs were composed of cargo that was very similar to earlier tribute shipments.

Also in the preceding chapter I argue that to determine the origin and range of exchange of glass types additional examinations and analyses of glass beads from other contemporary sites is needed. To address this argument I propose to compare material and chronological patterns by amassing an IOW list of sites with the same glass recipes as the shipwrecks' glass beads. New studies are improving our knowledge of the geographical and chronological distribution glass beads across the IOW. I summarize the compositional analysis results for the 15th to 17th centuries that are already published on the IOW.

As I did in Chapter 3 about the Philippines, I now expand and compare available stylistic and glass chemistry data in the Indian Ocean world. The latter is a reliable marker for beads made of similar glass recipes (Francis 2002; Kelley 2016; Gratuze 2013a, 2013b, 2016; Lankton & Dussubieux 2013). The combination of the two analyses has proven useful for Iron Age glass in Southeast Asia (Carter 2013; Dussubieux & Bellina 2018; Dussubieux et al. 2020) and Medieval Age glass in East Africa (Wood 2011). I compare material and chronological patterns by amassing an IOW list of sites with the same glass recipes as the shipwrecks' glass beads. The data is not consistent across all sites so where some beads are described others are not, or portions of their descriptions are not available.

Type	**Morphology includes where possible form, manufacturing style, diaphaneity, color, and size References**	**Location / Archaeology Site**	**Site Type**	**Date**
IP m-Na-Al Group 2	Tube cylindrical drawn D. 2 to 3.5mm L. 1.2 to 4 mm shiny transparent turquoise, or rounded translucent blue and green (Robertshaw et al. 2010; Wood et al. 2017; Wood 2016)	Site K2 (Southern Africa)	confluence of the Shashe and Limpopo rivers	Mid 10th to 13th
	Drawn opaque red, green, yellow, black and white; Drawn translucent turquoise blue and dark blue (Dussubieux et al . 2008)	Chaul in Maharashtra (India)	Port settlement	9th to 19th c. 1400–1600 Bahmani Period
	Opaque yellow, green, red and white; Translucent turquoise and cobalt (Dussubieux et al. 2008)	Mtwapa (Kenya)	Settlement	9th–16th c.
	Black, yellow, light blue and green, red, dark blue (Beavan, et al. 2015; Carter et al. 2016)	Phnom Khnang Peung (KPP) Cardamom Mountains (Cambodia)	Jar burials	1420–1470 CE
	1581 glass wound, with spheres, oblates and cylinder D. 2-3.5 mm or D. 3.5-5 mm red, blue, black (Robertshaw et al. 2006)	Mahilaka (northwest Madagascar)	Vohemar burials	13th to 15th c
	Opaque cobalt, translucent white (Wood and Dussubieux in press; Wood 2016)	Khami (East Africa)	Settlement	Early 1400

	Opaque red biconal, lenticular, rough spheres D. 4 mm or D. 8-9 mm (Wood 2016, 2019) Drawn opaque red oblates (L:2-3.5mm/D:3-6mm) and barrels (L:2-10mm/D:3-5mm), drawn opaque black oblates (L: 2-3mm/D:3-4mm) Drawn opaque black oblates (L: 2-3mm/D:3-4mm) No morphological data (Dussubieux 2009) Opaque red; translucent turquoise (Dussubieux et al. 2008) Tube, oblate, cylinder Opaque orange, red, blue, green, black (Dussubieux and Wood in press) Oblate opaque red, green (Dussubieux and Wood in press)	Songo Mnara (Tanzania) Pandanan (Philippines) Santa Cruz (Philippines) Maski (India) Ungwana (Kenya) Takwa, Manda Island, Lamu archipelago (Kenya) Fort Jesus (Kenya)	Settlement Shipwreck shipwreck Settlement Settlement Settlement Settlement	15th c. 1460-1487 1488-1505 16th c. 16th -17th c 16th -17th c 16th c. onward
Type	**Morphology includes where possible form, manufacturing style, diaphaneity, color, and size References**	**Location / Archaeology Site**	**Site Type**	**Date**
high magnesia m-Na-Al	Drawn oblates opaque black beads, opaque light green translucent purple, yellow translucent greasy (Beavan et al. 2012; Beavan et al. 2015; Carter et al. 2016)	KPP + Okei Cardamom Mountains (Cambodia)	Jar burials	KPP 1420–1470 Okie “had no material for dating”
Very low soda - high magnesia-alumina	Drawn oblates opaque black beads (Craig and Dussubieux in press)	Pandanan (Philippines)	shipwreck	1460-1487
m-Na–Al Group 4	Drawn opaque red or orange beads (Carter and Dussubieux 2019) Red and orange drawn opaque beads (Dussubieux and Soedewo 2016). Opaque yellow (uneven bores 1–1.75 mm) irregularly shaped oblates 3 to 5.5 mm diameter (Beavan et al. 2015; Carter et al. 2016); Okie had only drawn beads (Beavan et al. 2012)	Angkor Thom Pulau Kampai, Sumatra KPP + Okie, Cardamom Mountains (Cambodia)	Settlement Settlement Jar burials	12^{th} to 14^{th} 11th -14th KPP 1420–1470 with possible use to 1485CE Okie “had no material for dating”

	Opaque yellow L:3–5mm, D:5-7mm, uneven bore 1.5-3mm	Santa Cruz (Philippines)	Shipwreck	1488-1505
	Opaque yellow (Gratuze 2001); bracelets, blown pieces of glass, beads or blocks of raw glass green, brown, dark blue, black, yellow (Dussubieux et al. 2010); cobalt dark blue bracelet, bead, blown glass and yellow glass beads 404R and 404P (Gratuze 2001)	Brunei shipwreck (Brunei)	Shipwreck	1488-1505
	Vessels or bracelets opaque black, turquoise, red, purple, white, yellow, green (Dussubieux 2009)	Bukit Haseng (north Sumatra)	Port Settlement	14^{th} – 16^{th}
	Vessels or bracelets opaque black, turquoise, red, purple, white, yellow, green (Dussubieux 2009)	Kota Kareueng (Aceh, Sumatra)	Port settlement	15th–16th
	Opaque yellow and black. (Dussubieux et al. 2008)	Bungule (Kenya)	Settlement	17th–19th
	Glass beads red or white (Dussubieux et al. 2010)	Muasya (Kenya)	Settlement	17th–19th
	Cobalt beads (Dussubieux et al. 2010)	Mangalkot, Deulpota, Harinarayanpur (NE India) Bangladesh	settlement	15th–16th
Type	**Morphology includes where possible form, manufacturing style, diaphaneity, color, and size References**	**Location / Archaeology Site**	**Site Type**	**Date**
Lead-potash	Yellow cobalt blue (Dussubieux and Carter 2019)	Prasat Ta Muong (Cambodia)	Settlement	12^{th}
	Wound Yellow, white, copper blue and green, purple (Dussubieux and Carter 2019)	Angkor Thom (Cambodia)	Settlement	12thto 14th
	High lead coil. Doughnut-shaped opaque red. (D. 1 to 2mm) yellow, black, blue, white, and green. +12,000 found with glass-making residues such as blobs and flux. (Miksic 2017)	Fort Canning (Singapore)	Settlement	14^{th}
	High lead coil doughnut-shaped, larger (13 millimetres in diameter, 6 millimetres thick) and dark blue in colour (Miksic, Yup, Li, and Wan 1994; Miksic 2017:350)	Midai, Pulau Tujuh group eastern Riau (Riau)	Burials	13^{th} to 15^{th}

	Coiled opaque white or **opaque light blue**, transparent dark purple/black (Carter and Beavan 2014; Carter et al. 2016)	KPP Cardamom Mountains (Cambodia)	Jar burials	1420–1470
	Coiled red–orange opaque (Carter et al. 2016), opaque light blue with radiocarboned string (Beavan et al. 2012)	Phnom Pel Cardamom Mountains (Cambodia)	Jar burials	1430–1470
	Thick wound opaque turquoise blue with peaks	Santa Cruz (Philippines)	Shipwreck	1488-1505
	Thin wound light blue similar to RCSw2 artifact 401 small light blue bead and yellow cabuchon (Huet 2001, Gratuze 2001);	Brunei shipwreck (Brunei)	Shipwreck	1488-1505
	Coiled opaque think with peaks blue or yellow, and coiled transparent purple (Tamura 2015 or Tamura 2013 in Carter et al. 2016)	Krang Kor, near Longvek (Cambodia)	Settlement	15^{th} -16th
	Wound opaque yellow, red (possibly) white (Craig & Dussubieux 2021)	Tanjay (Philippines)	Settlement	15^{th} to 17^{th}
	Opaque red, black, white and green	Undisclosed Philippines (Carter et al. 2016) Probably from Tanjay, Negros, Philippines	?	15^{th} to early 16^{th}
	Opaque and translucent orange, opaque white, translucent red, translucent dark, opaque yellow, opaque blue	RCSw2 (Philippines)	Shipwreck	1573-1620
	High lead glass beads on Kenyah bark-coat (Miksic 2017: 348)	Sarawak or Borneo	?	?
	Coil-wound 10 red, 3 orange, 2 green (Wood 2016)	Songo Mnara (Tanzania)	Settlement	15^{th}
Type	**Morphology includes where possible form, manufacturing style, diaphaneity, color, and size References**	**Location / Archaeology Site**	**Site Type**	**Date**

Table LP4: Glass chemistry available in the case study shipwrecks and glass bead morphological traits across the Indian Ocean world from archaeological sites between 1460 and 1620 CE (I borrow the structure of this table from Alison Carter's *Table of different glass types discussed in the text* (2016:21-22 Table 3)

When the results from the Philippines shipwreck sites are contextualized and merged with contemporary glass evidence across the IOW, the evidence refines the chronology and geographic distribution of mid-15th to mid-17th century glass.

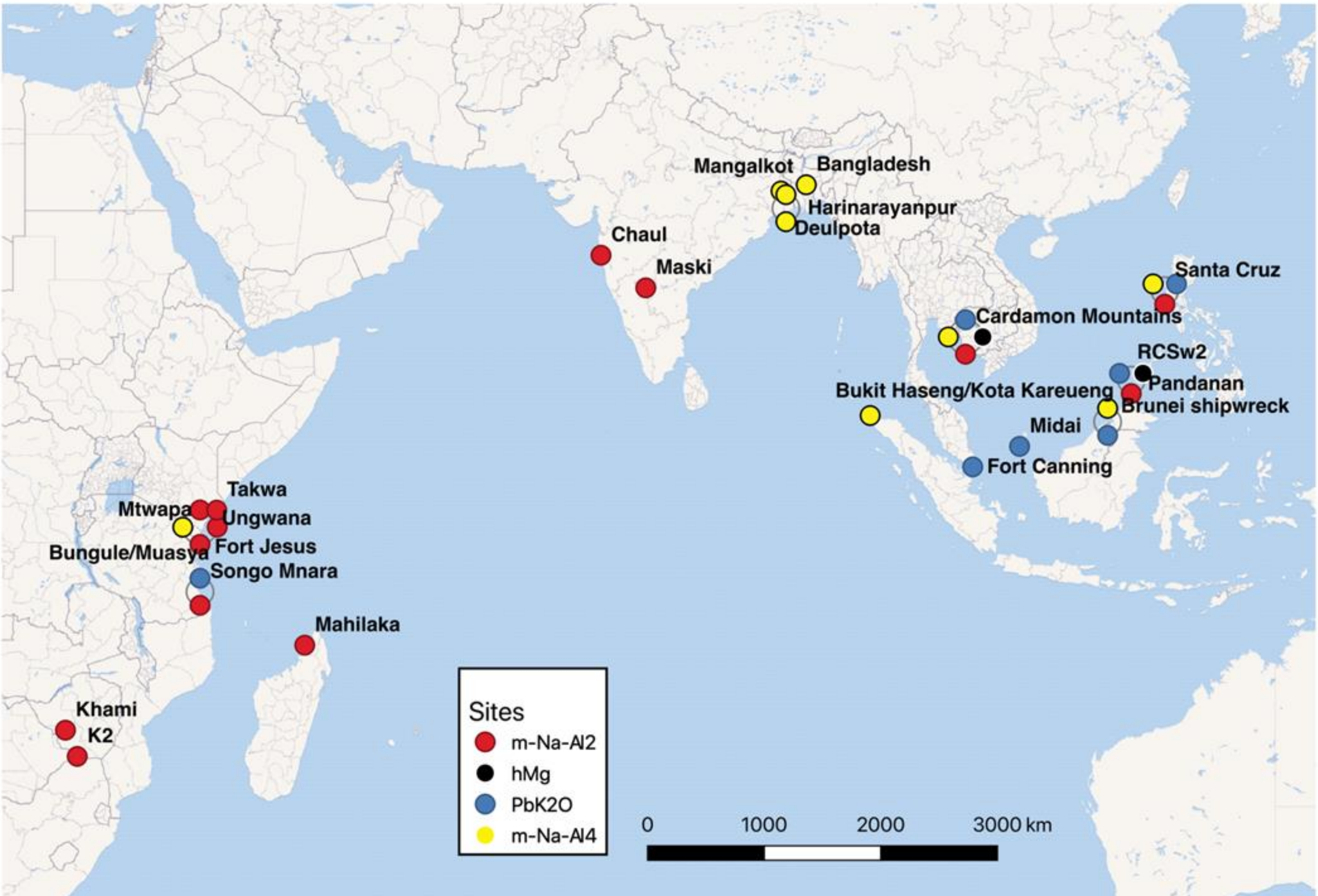


Figure LP4 Maritime Cultural Landscape of glass from archaeological sites dated from the 12th to 19th centuries across the Indian Ocean World. Sites with mineral soda alumina group 2 (mNaAl2) glass include a red dot. Sites with lead potash (PbK2O)glass include a blue dot. Sites with mineral soda alumina group 4 (mNaAl4) glass include a yellow dot. Sites with high magnesia (hMg) glass include a black dot.

Refining the chronology and geographic distribution of mid-15th to mid-17th century glass from shipwrecks and terrestrial archaeology sites provides a new way to contextualize and merge the connectivity of people from across the historic maritime cultural landscape. Multiple steps are required to refine the context of the glass distribution across the IOW. From the literature, the map in the Figure LP4 displays archaeological sites that share glass recipes that match those from the glass in the Philippines shipwreck cargoes. The archaeological sites displayed in the Figure LP4 are then separated into contemporary sites dated to 1460-1487 CE, 1488-1505 CE, and 1573-1620 CE. These are the relative dates of the shipwrecks Pandanan, Santa Cruz, and Royal Captain Shoal wreck 2 respectively. The contemporary archaeological sites are further narrowed to locations that share the specific morphological traits of the glass beads in the shipwrecks (details in the next chapter). The contextualized outcome is the distribution of contemporary bead types dated within timespans of 27, 18, and 47 years, respectively. This maritime cultural landscape unites specific objects both on land and underwater, proposing a connectivity of the people in the different locations. The final step—to merge the connectivity—requires turning to historic data on shipping.

Generally IOW shipping was timed and directed by monsoons (e.g. Burkhard & Alpers 2018; Campbell 2016). In the Indian Ocean the regional shipping pattern was a triangular trade, which occurred between the Middle East, East Africa, and India (Campbell 2017, 2019; Pearson 2003, 2015). In India, the port of Naggapattinum is singled out as an important place for glass bead market exchange in the triangular trade during the mid-15th to mid-17th centuries (Wood 2016). From this location in southern India, it is highly probable that glass beads were amongst the goods shipped out across the Bay of Bengal by Gujarati sailors who traded in Southeast Asia (Burningham 2019; Reid 1988, 1993). In the South China Sea the regional shipping pattern was a circuitous trade, which occurred between the continental mainland and the islands in the archipelago (Hall 2010, 2011; Lieberman 2010, 2003; Ptak 1992). The next chapter shows the merging of these two regional shipping patterns with the maritime cultural landscape of shipwreck glass. This connectivity of glass refines the chronology and geographic distribution of mid-15th to mid-17th century glass, a distribution indicating that broad patterns of exchange occurred in specific directions, which shifted within short periods of time.

CHAPTER 5

Indian Ocean World glass in the mid-15th to mid-17th centuries

Craig, J. 2021, In press. Shipwreck glass beads: mid-15th to mid-17th century Indian Ocean World glass. *Antiquity*.

5.1Abstract

The analysis of 85 glass beads from three Philippines archaeological shipwrecks that are relatively dated to AD 1460-1488, AD 1488-1505, and AD 1573-1620, when contextualized and merged with contemporary glass evidence across the Indian Ocean World refine the chronology and distribution of mid-15th to mid-17th century glass.

5.2 Discussion

This article merges regionalized studies on glass material in the Indian Ocean world (IOW), a geographic area expanding from East Africa, across the Middle East, Asia, and Southeast Asia to the western Pacific Ocean. The morphological and compositional analysis of 41, 26, and 18 glass beads from the shipwrecks Pandanan (AD 1460-1487), Santa Cruz (AD 1488-1505), and Royal Captain Shoal wreck 2 (AD 1573-1620) respectively, has added evidence to previously held hypotheses on drawn soda alumina and wound lead potash glass beads. The morphological analysis includes observing colour, size and the manufacturing style of glass beads by the striation direction in relation to the bead bore: drawn beads are parallel and wound beads are perpendicular. The compositional analysis was performed with laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS).

Compositional analysis on archaeological glass has produced multiple groups of soda alumina glass (Dussubieux et al. 2010; Dussubieux & Gratuze 2013) and is beginning to identify two groups of lead potash glass (Carter et al. 2019). Of relevance to this study are the soda alumina group 2 and group 4 glass, and the later lead potash glass. The three shipwrecks' glass beads were identified from the comparison of the LA-ICP-MS and statistical analysis results to known datasets of soda alumina and lead potash glass sub-types (Craig & Dussubieux in press).

Three maps illustrate the distribution of IOW glass identified from the shipwrecks, during the periods AD 1460-1487, AD 1488-1505, and AD 1573-1620 (Figures 5-1, 5-2, 5-3). The refined chronology and distribution of mid-15th to mid-17th century IOW glass indicates three broad directions of exchange flow over the three periods. In the two earlier periods spanning AD 1460 to 1505, drawn red and black soda alumina (group 2) glass was made in an unknown location and exchanged initially from Chaul out eastward (Robertshaw, et al. 2006; Robertshaw et al. 2010; Wood 2011, 2016, 2019; Dussubieux et al. 2008; Carter et al. 2016; Grave et al 2019; Dussubieux & Wood 2020; Shewan et al. 2020; Craig & Dussubieux in press). During the second period (AD 1488-1505) lead potash glass re-entered the IOW market from the east, likely China, in the form of wound blue beads (Tamura 2015; Carter et al. 2016; Carter et al. 2019; Craig & Dussubieux in press). At the same time from northeast India, a yellow variant of the soda alumina (group 4) glass was shipped eastward; possibly as raw glass to workshops in Southeast Asia, formed into different products and cross-exchanged westward (Gratuze 2001; Huet 2001; Dussubieux 2009; Carter 2016; Carter, et al. 2016; Craig & Dussubieux in press). This yellow glass also raises a complicating factor. Morphologically and chemically the glass matches between the Cardamom Mountains and Santa Cruz, but a person's bone radiocarbon dated to *cal* AD 1430-1465 (432±26 BP; GU31833) (Beavan et al. 2015) indicates these unique open burials were created earlier so possibly people returned to leave later beads as offerings. By the third period (AD 1573-1620) lead potash glass had expanded into multiple monochrome colours in the IOW east and eclipsed drawn soda alumina glass entirely (Carter, et al. 2016; Wood 2016, 2019; Carter, et al. 2019; Craig & Dussubieux in press).

When refined to shorter periods of exchange morphological and compositional analyses have increased our understanding of the chronology and distribution of mid-15th to mid-17th century glass.

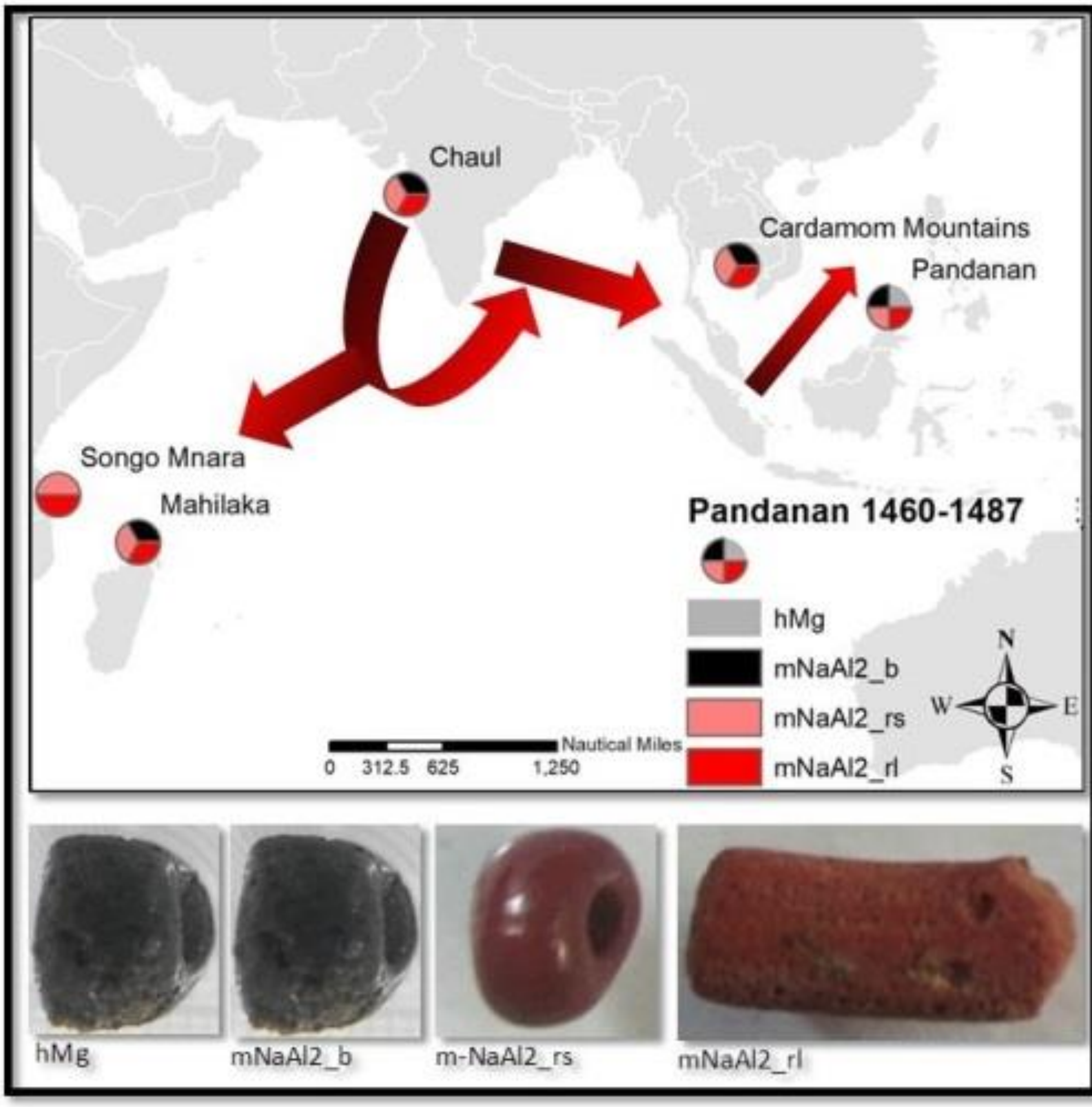


Figure 5-1 Glass distribution and general direction of exchange during AD 1460 to 1487 of drawn red and black soda alumina group 2 and drawn black high magnesium. Bead ratio formula sized beads (Wood 2011: 70 tables 1 and 2) as standard and long. Legend categorizations follow. hMg = drawn high magnesium black. mNaAl2_b = drawn soda alumina group 2 black. mNaAl2_rs = drawn soda alumina group 2 red standard (length 1-4 mm). mNaAl2_rl = drawn soda alumina group 2 red long (length 4.5-15 mm).

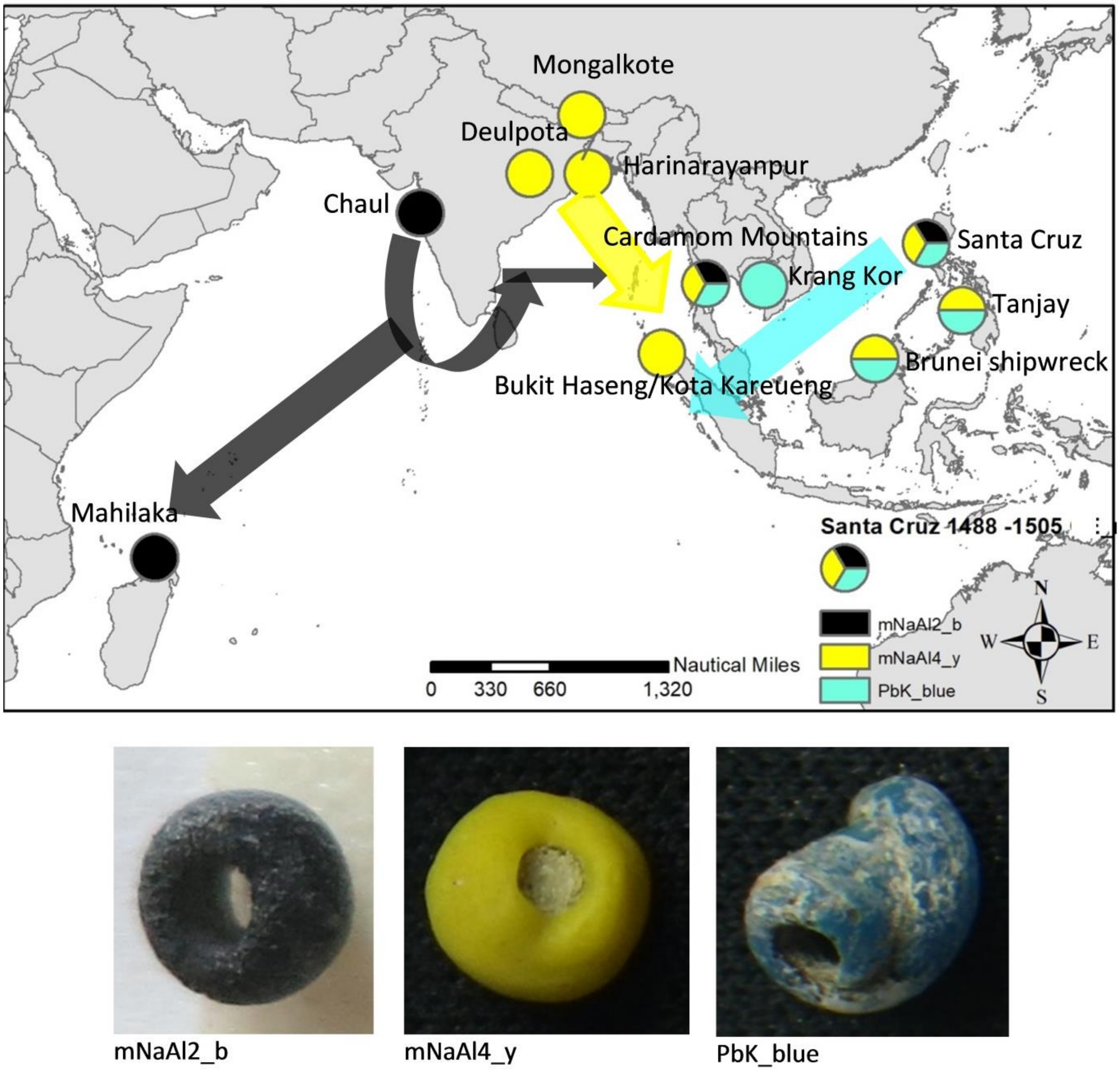


Figure 5-2 Glass distribution and general direction of exchange during AD 1488 to 1505 of drawn black soda alumina group 2, yellow soda alumina group 4, and wound blue lead potash. Legend categorizations follow. mNaAl2_b = drawn soda alumina group 2 black. mNaAl4_y = soda alumina group 4 yellow. PbK_blue = wound lead potash blue.

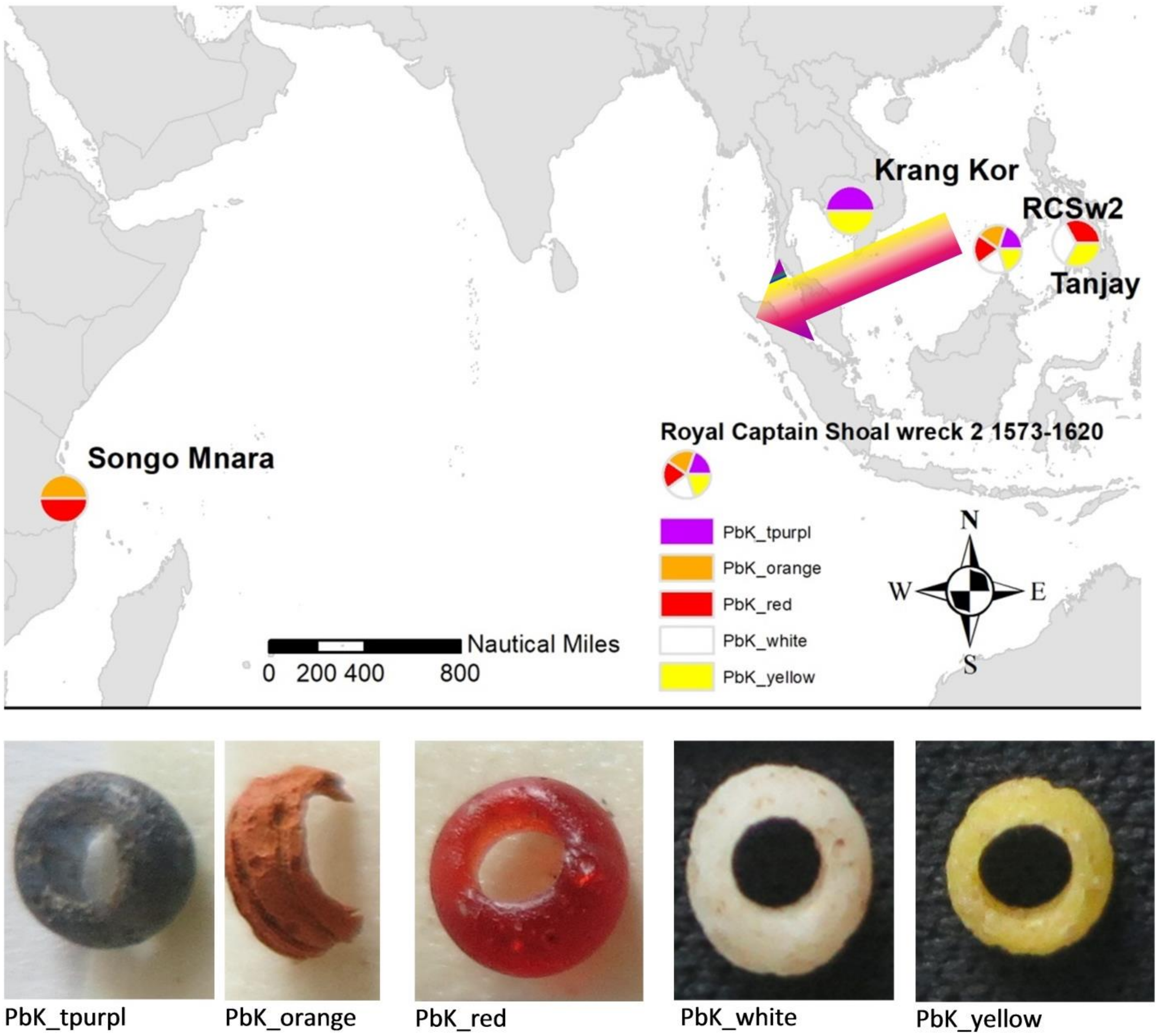


Figure 5-3 Glass distribution and general direction of exchange during AD 1573 to 1620 of wound purple, orange, red, white, and yellow lead potash. Legend categorizations follow. PbK_tpurple = wound lead potash transparent purple. PbK_orange = wound lead potash orange. Pbk_red = wound lead potash red. PbK_white = wound lead potash white. PbK_yellow = wound lead potash yellow.

References

BEAVAN, N., HAMILTON, D., SOKHA, T., & SAYLE, K. (2015). Radiocarbon Dates from the Highland Jar and Coffin Burial Site of Phnom Khnang Peung, Cardamom Mountains, Cambodia. *Radiocarbon 57,* 15-31.

CARTER, A. K. (2016). The production and exchange of glass and stone beads in Southeast Asia from 500 BCE to the early second millennium CE: an assessment of the work of Peter Francis in light of recent research. *Archaeological Research in Asia 6*, 16-29.

CARTER, A. K., L. DUSSUBIEUX & N. BEAVAN. (2016). Glass Beads from 15th–17th Century CE Jar Burial Sites in Cambodia's Cardamom Mountains. *Archaeometry 58*(2), 401-412.

CARTER, A., DUSSUBIEUX, L., POLKINGHORNE, M. & POTTIER, C. (2019). Glass artifacts at Angkor: evidence for exchange. *Archaeological and Anthropological Sciences*, *11*, 1013-1027.

CRAIG, J. & DUSSUBIEUX, L. (2021, In press). Shifting patterns of glass bead cargo of 15th – 17th century Philippines shipwrecks. In H. Walder & L. Dussubieux (Eds.) *Glass Bead Technology, Chronology, and Exchange, LA-ICP-MS Glass Compositions from the Field Museum's Elemental Analysis Facility*. Catholic University of Leuven.

DUSSUBIEUX, L. (2009). Compositional analysis of ancient glass fragments from North Sumatra. In D. Perret & H. Surachman (Eds), *Histoire de Barus III. Regards sur une place marchande de l'océan Indien* (pp.385–417). École Française d'Extrême-Orient, XIIe-milieu du XVIIe s. Association Archipel

DUSSUBIEUX, L. & GRATUZE, B. (2013). Glass in South Asia, in K. Janssens (Ed), *Modern Methods for Analysing Archaeological and Historical Glass* (pp. 399-413). John Wiley & Sons.

DUSSUBIEUX, L., GRATUZE, B., & BLET-LEMARQUAND, M. (2010). Mineral soda alumina glass: occurrence and meaning. *Journal of Archaeological Science 37* (7), 1646-1655.

DUSSUBIEUX, L., KUSIMBA, C. M., GOGTE, V., KUSIMBA, S. B., GRATUZE, B. & OKA, R. (2008). The Trading of Ancient Glass Beads: New Analytical Data from South Asian and East African Soda-Alumina Glass Beads. *Archaeometry 50* (5), 797-821.

DUSSUBIEUX, L. & WOOD, M. (2021, In Press). Indian glass: chronology and distribution in Eastern Africa. In A.K.,Kanungo, & L. Dussubieux (Eds.) *Ancient glass of south Asia – archaeology, ethnography and global connection*. Springer Natyre and Gandhinagar.

GRATUZE, B. (2001). *Study of Glass Objects from the Wrecked Junk of Brunei*. [Unpublished report]. Institut de Recherche sur les Archéomatériaux, Centre Ernest Babelon, Centre National de la Recherche Scientifique.

GRAVE, P., KEALHOFER, L., BEAVAN, N., TEP, S., STARK, M., EA, D. (2019). The Southeast Asian water frontier: coastal trade and mid-fifteenth c. CE hill tribe burials, southeastern Cambodia. *Archaeological and Anthropological Sciences 11*, 5023-5036.

HUET, N. (2001). Element de parure, bracelets, et perles. In: L'HOUR, M. (Ed.) *La Memorie engloutir de Brunei: Precis Scientifique*. TotalFinaElf.

ROBERTSHAW, P., RASOARIFETRA, B., WOOD, M., MELCHIORRE, E., POPELKA-FILCOFF, R. S. & GLASCOCK, M. D. (2006). Chemical Analysis of Glass Beads from Madagascar. *Journal of African Archaeology 4*, 91-109.

ROBERTSHAW, P., WOOD, M., MELCHIORRE, E., POPELKA-FILCOFF, R.S. & GLASCOCK, M.D. (2010). Southern African glass beads: chemistry, glass sources and patterns of trade. *Journal of Archaeological Science 37*, 1898-1912.

SHEWAN, L., ARMSTRONG, R., O'REILLY, D., HALCROW, S., BEAVAN, N. & SOKHA, T. (2020). Isotopic insights into the jar-and-coffin mortuary ritual of the Cardamom Mountains, Cambodia. *Antiquity 94*, 1575-1591.

TAMURA, T. (2015). *Scientific Study and Conservation Treatment of Artifacts Excavated from Krang Kor*. Nara National Research Institute for Cultural Properties.

WOOD, M. (2011). A Glass Bead Sequence for Southern Africa from the 8th to the 16th Century AD. *Journal of African Archaeology 9*, 67-84.

WOOD, M. (2016). Glass beads from pre-European contact sub-Saharan Africa: Peter Francis's work revisited and updated. *Archaeological Research in Asia 6*, 65-80. doi: https://doi.org/10.1016/j.ara.2016.02.007.

WOOD, M. (2019). Glass Beads and Trade in the Western Indian Ocean. In *Oxford Research Encyclopedia of Asian History*. https://doi.org/10.1093/acrefore/9780190277727.013.334

CHAPTER 6

Final Conclusion and Summary

This project's importance and uniqueness lies in the analysis of a large sample of beads from historic shipwrecks that offers new and valuable underwater data to archaeology. My contribution to knowledge, with the first chemical analysis of glass data from the mid-second millennium CE of collections excavated from the Philippines, builds on existing knowledge in the field of anthropological archaeology. As stated in the introduction chapter, being mindful of the teachings of water we can begin to connect past people through their material remains. Populating a maritime cultural landscape with the distribution of glass beads has proven to represent shifting patterns of exchange and connected geography of contemporary shipping networks. This dissertation uses combined contextual information on a maritime cultural landscape to recreate ancient exchanges. The goal is to add evidence to existing hypotheses in archaeological glass, evaluate tandem patterns of material evidence from archaeological shipwrecks (the value of which is discussed in Chapter 2) to correlate their shifts in material patterns against the backdrop of intra-regional affairs, and unite the underwater evidence with contemporary terrestrial archaeology sites to merge regionalized studies on glass material in the IOW.

Chapter 3 details the morphological analysis I conducted in the National Museum of the Philippines on the glass beads of three shipwrecks. These shipwrecks were used as case studies in maritime archaeology methodologies to address the goals discussed above.

Chapter 4 presents existing hypotheses in archaeological glass: 1) Indo-Pacific glass (increasingly associated with soda alumina glass from India) presence in Southeast Asia, especially the Philippines, declined in the mid-12th century (Francis 2002: 48, 71, 205); and 2) wound lead glass had two separate periods of production (Francis 2002: 76-78, 82; Carter & Dussubieux 2019). The evidence added from the shipwrecks glass to the argument from published terrestrial archaeological sites (Dussubieux 2009; Carter, et al. 2016) is also twofold: 1) soda alumina glass was present in Southeast Asia to the late 15th century; 2) trace elements of rubidium and lithium mark the different periods of lead potash glass, the later 15th to 17th century and the earlier 12th to 13th century (Craig & Dussubieux in press). Considering only the glass evidence of the shipwrecks this study addresses two hypotheses published in anthropological archaeology glass. And the new glass evidence can also be considered in its cargo context in tandem with other shipwreck data.

Chapter 4 evaluates tandem patterns of material evidence from archaeological shipwrecks to correlate their shifts in material patterns against the backdrop of intra-regional affairs. The material evidence from archaeological shipwrecks includes, in these case studies, the hull and two items in the cargo. Cargo such as Maenam Noi storage jars that carried the glass beads. These data contextualized together can add evidence to maritime archaeology hypotheses that some shipping identified as tribute (Goh & Miksic 2017; Hall 2011) may have been bootlegging (Craig & Dussubieux in press; Orillaneda 2016; Fahy 2014). The evidence of bootlegging came about by correlating tandem patterns in the cargo material shifts. Narrowing cargo correlations to short periods of time expanded the application of ceramics from the relative dating of the shipwreck sites to broader intra-regional affairs. These regional affairs were addressed by uniting underwater and terrestrial archaeological evidence to create a maritime cultural landscape. But **maritime cultural landscapes are primarily water-scapes, which are fluid, so what if the**

waters of regional boundaries were used as the basis to merge regionalized studies on glass material in the Indian Ocean world?

Finally, chapter 5 displays the maritime cultural landscape of merged regionalized studies on Indian Ocean world glass. Here, historic exchanges of finite periods of time are broadly recreated in maps. Maps are at the center of this chapter because the contextual information required to populate a maritime cultural landscape is geographic. Maritime cultural landscapes foreground connectivity of the artefacts over the entire landscape, uniting contemporaneous locations across water and land. This includes archaeological site location, contemporaneity of site occupation, and correlation of artefacts' material science. The maps suggest the breakdown of large contemporaneous datasets into shorter periods refines the chronology and distribution of specific glass varieties over centuries.

Next Steps

With refining the chronology and distribution of specific glass varieties we can return to archaeological sites or museum collections with new questions. There is a gap of time (1506-1572 CE) between the shipwrecks Santa Cruz and Royal Captain Shoal wreck 2. During this period Spanish colonialization began and much of Philippines history is locked into that narrative. I would like to investigate beyond that narrative and add more information on how the shipwrecks in the waters of the Philippines archipelago were connected to the Indian Ocean World. For example, **where was soda alumina group 4 raw glass shipped to in Southeast Asia and formed into beads?** It is curious that the archaeological site Tanjay, located in the central island Negros of the Philippines, has some strong evidence for the production and exchange of red, yellow and white glass beads. Conducing LA-ICP-MS on contextualized material culture collections in the National Museum of the Philippines has proven fruitful in this project, so more glass chemistry from Tanjay and other Philippines sites may inform us of the hypothesized secondary glass workshops. Finally, I am curious if the glass in the Pandanan cargo may have moved through Champa in northeast Vietnam, because the ship hull is identified as hybrid Vietnamese-Chinese and the ceramics are Cham. This would require glass manufacture evidence on contemporaneous sites and material science analysis in northeast Vietnam. I also cannot shake the niggling idea that the folks who built and occupied the Tanjay site in the Philippines were Cham diaspora that followed ancient networks of maritime exchange from the Sa Huynh-Kalanay Interaction Sphere (Hung et al. 2013) and brought glass bead-making skills with them. To explore this hypothesis it would require DNA mitochondrial analysis of the people buried in archaeological sites in the Philippines and Champa.

BIBLIOGRAPHY

ABRAHAM, S.A. (2016). Glass beads and glass production in early South India: Contextualizing Indo-Pacific bead manufacture. *Archaeological Research in Asia 6*:4-15. doi: http://dx.doi.org/10.1016/j.ara.2016.02.003.

ADAMS, J. (2001). Ships and boats as archaeological source material. *World Archaeology 32* (3):292-310. doi: 10.1080/00438240120048644.

AGIUS, D. A. (2002). *In the Wake of the Dhow: The Arabian Gulf and Oman*. Garnet-Ithaca Press.

AGIUS, D. A. (2008). *Classic Ships of Islam: From Mesopotamia to the Indian Ocean*. Brill.

AHMED, A.A., G.M. ASHOUR & T.M. EL-SHAMY. (1977). Effect of melting conditions on the crystallisation of cuprous oxide and copper in glass. In *Proceedings of the XIth International Congress on Glass* (pp. 177-87).

ALBA, L. (1984). *The Genesis of Underwater Archaeology in the Philippines* ［Unpublished manuscript］, Underwater Archaeology Section, National Museum of the Philippines.

ALBA, L. (1988). *A Preliminary Report on the 1985 Royal Captain Shoal Expedition*. ［Unpublished manuscript], Records Section, National Museum of the Philippines.

BACUS, E. A. (1996). Late Prehistoric Chiefly Polities in the Dumaguete-Bacong Area and Central Philippines Islands. *Philippine Quarterly of Culture and Society 24* (1/2):5-58.

BACUS, E. A. (1999). Prestige and Potency: Political Economies of Protohistoric Visayan Polities. *Archaeological Papers of the American Anthropological Association 9* (1):67-87. doi: 10.1525/ap3a.1999.9.1.67.

BACUS, E. A. (2004). The Archaeology of the Philippine Archipelago. In I. Glover & P. S. Bellwood (Eds.) *Southeast Asia: from prehistory to history* (pp. 257-281). RoutledgeCurzon.

BAUER, A. & JOHANSEN, P. (2021). Making megaliths and constituting collectives. In H.M. Ray (Ed.) *The Archaeology of Knowledge Traditions of the Indian Ocean* World (pp. 102-126). RoutledgeIndia. https://doi-org.proxy3.library.mcgill.ca/10.4324/9780429321856

BEAUJARD, P. (2012). *Les monde de l'océan Indien*. Armand Colin.

BEAUJARD, P. (2019). *The Worlds of the Indian Ocean: A Global History*. Cambridge University Press.

BEAVAN, N., HAMILTON, D., SOKHA, T., & SAYLE, K. (2015). Radiocarbon Dates from the Highland Jar and Coffin Burial Site of Phnom Khnang Peung, Cardamom Mountains, Cambodia. *Radiocarbon 57,* 15-31.

BECK, H. C. (1928). I.—Classification and Nomenclature of Beads and Pendants. *Archaeologia (Second Series) 77*:1-76. doi:10.1017/S0261340900013345.

BELLINA, B., & MAHAWITTHAYALAI, S. (2017). Khao Sam Kaeo: An early port-city between the Indian Ocean and the South China Sea. *Mémoires Archéologiques 28:1-675*.

BEYER, H.O. (1947). Outline Review of Philippine Archaeology by Islands and Provinces. *The Philippines Journal of Science 77* (3-4):205-309.

BLUE, L. K. & STAPLES, E. (2015, Feb February 14 to 16). Sewn-plank Boat Workshop, GU Tech, Muscat, Oman.

BLUNDELL, D., & ZERNEKE, J. (2014). Electronic Cultural Atlas Initiative: Early Austronesian Historian Voyaging in Monsoon Asia: Heritage and Knowledge for Museum Displays Utilizing Text, Archaeology, Digital Interactive Components, and GIS Approaches. *International Journal of Humanities and Arts Computing* (8):237-252.

BOLUNIA, M.J. (2013). Linking Butuan to the Southeast Asian Emporium of the 10th-13th Century C.E. [Unpublished doctoral dissertation]. National University of the Philippines.

BORELL, B. (2010). Glass from China and from India: finds of vessel glass from fourteenth century Singapore. *Archipel 80*:139-96.

BRILL, R.H. & N.D. CAHILL. (1988). A red opaque glass from Sardis and some thoughts on red opaques in general. *Journal of Glass Studies* (pp.16-27).

BRILL, R.H., S.S.C. TONG & D. DOHRENWEND. (1991). Chemical analyses of some early Chinese glasses. *Scientific research in early Chinese glass* (pp.31-64). Brill.

BRAUDEL, F. (1972). *The Mediterranean and the Mediterranean world in the age of Philip II*. Collins.

BREEN, C., W. FORSYTHE, P. LANE, T. MCERLEAN, R. MCCONKEY, A. L. OMAR, R. QUINN, and B. WILLIAMS. (2001). Ulster and the Indian Ocean? Recent maritime archaeological research on the East African coast. *Antiquity 75* (290):797-798. doi: doi:10.1017/S0003598X00089304.

BREEN, C., & LANE, P. (2004). Archaeological approaches to East Africa's changing seascapes. *World Archaeology 35* (3):469-489. doi: 10.1080/0043824042000185838.

BELFIORETTI, L. & VOSMER, T. (2010). Al-Balid ship timbers: preliminary overview and comparisons. procsemiarabstud Proceedings of the Seminar for Arabian Studies 40, 111-117.

BRONSON, B. (ed.) 1980. Exchange at the upstream and downstream ends: Notes toward a functional model of the coastal state in Southeast Asia, Michigan: The University of Michigan.

BROWN, R. (2009). *Ming Gap and Shipwreck Ceramics in Southeast Asia: Towards a Chronology of Thai Trade Ware*. Siam Society.

BROWN, R. (2008). Burma ceramics identified on Santa Cruz shipwreck: Twante kilns to Philippines. *Southeast Asian Ceramics Museum Newsletter*, May-June.

BROWN, R. M. (2004). History of shipwreck excavation in Southeast Asia. In J. Ward, Z. Kotitsa, & A. D'Angelo (Eds) *The Belitung wreck: Sunken treasures from Tang China* (pp. 40-55). Seabed Explorations.

BROWN, R. (1988). *The ceramics of South-East Asia: their dating and identification*. Oxford University Press.

CAMPBELL, G. (2012, Nov. 12). Keynote Opening Speech. In G. Campbell (Chair), *The Dimensions of the Indian Ocean World Past* ［Panel presentation］ Sources and Opportunities for interdisciplinary work in Indian Ocean World History, 9th -19th Centuries, Western Australia Museum, Fremantle, Australia.

CAMPBELL, G. (2013a, Nov. 8). *Africa in the Indian Ocean world in the first millennium CE* ［Conference session］. Proto-globalisation in the Indian Ocean world, University of Oxford, Oxford, UK.

CAMPBELL, G. (2013b, Nov. 22). *The Historical Debate over the Origins of the Malagasy* [Conference session]. East Africa and Early Trans-Indian Ocean World Interchange, McGill University, Montreal, Canada.

CAMPBELL, G. (2013c, Sept. 9). *Keynote Speech*. In G. Campbell (Chair), The Indian Ocean World [Panel presentation] The European Impact on the Indian Ocean World, McGill University, Montreal, Canada.

CAMPBELL, G. (2014, Oct. 23). *Keynote Opening Speech*. In G. Campbell (Chair), The Indian Ocean World [Panel presentation] Trade in Animals and Animal Products in the Indian Ocean World from early times to c.1900, McGill University, Montreal, Canada.

CAMPBELL, G. (2015, April 23). *Welcome Address*. In G. Campbell (Chair), The Indian Ocean World [Panel presentation] Currencies of Commerce in the Greater Indian Ocean World, McGill University, Montreal, Canada.

CAMPBELL, G. (2016). *Africa and the Early Indian Ocean World Trade to circa 1300*. Palgrave Macmillian.

CAMPBELL, G. (2017). Africa, the Indian Ocean World, and the 'Early Modern': Historiographical Conventions and Problems. *Journal of Indian Ocean World Studies 1* (1):24-37.

CAMPBELL, G. (2019). *Africa and the Indian Ocean World from early times to 1900*. Cambridge University Press.

CARTER, A. K. (2016). The production and exchange of glass and stone beads in Southeast Asia from 500 BCE to the early second millennium CE: an assessment of the work of Peter Francis in light of recent research. *Archaeological Research in Asia 6*, 16-29.

CARTER, A.K. (2015). Beads, Exchange Networks and Emerging Complexity: A Case Study from Cambodia and Thailand (500 bce–ce 500). *Cambridge Archaeological Journal 25*(4), 733 – 757. DOI: https://doi.org/10.1017/S0959774315000207

CARTER, A.K. (2013). *Trade, Exchange, and Socio-political Development in Iron Age (500 BC–AD 500) Mainland Southeast Asia: An Examination of Stone and Glass Beads from Cambodia and Thailand*. [Unpublished doctoral dissertation], University of Wisconsin-Madison.

CARTER, A. K., & BEAVAN, N. (2014). Beads in the mountains: glass beads from 15–17th century CE jar burials in Cambodia's Cardamom Mountains. *BEADS: The Journal of the Society of Bead Researchers 26*, 9-21.

CARTER, A. K., ELLIOTT, H.B., Klehm, C., & PANICH, L. (2021, In press). Chapter 2: Glass beads and human pasts. In H. Walder & L. Dussubieux (Eds.), *Glass Bead Technology, Chronology, and Exchange, LA-ICP-MS Glass Compositions from the Field Museum's Elemental Analysis Facility*, Catholic University of Leuven.

CARTER, A. K., L. DUSSUBIEUX & N. BEAVAN. (2016). Glass Beads from 15th–17th Century CE Jar Burial Sites in Cambodia's Cardamom Mountains. *Archaeometry 58*(2), 401-412.

CARTER, A., DUSSUBIEUX, L., POLKINGHORNE, M. & POTTIER, C. (2019). Glass artifacts at Angkor: evidence for exchange. *Archaeological and Anthropological Sciences, 11*, 1013-1027.

CARTER, A. K., DUSSUBIEUX, L. & BEAVAN, N. (2016). Glass Beads from 15th–17th Century CE Jar Burial Sites in Cambodia's Cardamom Mountains. *Archaeometry, 58,* 401-412.

CAYRON, J. G. (2015). The Archaeological Beads of Palawan. In H. Munnan & A. Macgillivray (Eds.) *Borneo International Beads Conference 2015: Stinging Past to Present*. (pp.27-46)

CAYRON, J. G. (2011). *Archaeology and exchange in Palawan Island, Philippines*. [Unpublished master`s thesis]. University of the Philippines.

CAYRON, J. G. (2006). Stringing the Past: An Archaeological understanding of early Southeast Asian glass bead trade. In V. Paz (Ed), *Contributions to Archaeology Series*. The University of Philippines Press.

CHISLOCK, M. F., DOSTER, E., ZITOMER, R. A. & WILSON, A. E. (2013). Eutrophication: Causes, Consequences, and Controls in Aquatic Ecosystems. *Nature Education Knowledge 4* (4):10.

CONWAY-JONES, H. (2006). *Purton Barge Graveyard*. http://www.gloucesterdocks.me.uk/canal/graveyard.htm.

COLE,F-C. (2004). *The Tinguian: Social, Religious, and Economic Life of a Philippine Tribe*. In J. Hellingman and the Distributed Proofreaders Team (Eds). https://www.gutenberg.org/files/12849/12849-h/12849-h.htm#d0e11994.

CORT, L.A. (2017). Container Jars from the Maenam Noi Kilns, Thailand Use and Reuse along Maritime Trade Routes in Asia. *Bulletin de l'Ecole française d'Extrême-Orient 103*, 267-296.

CRAIG, J. (2021, in-prep). *Shipwrecks & Glass Beads: Indian Ocean World connectivity across the historic maritime cultural landscape*. [Unpublished doctoral dissertation thesis]. McGill University.

CRAIG, J. & DUSSUBIEUX, L. (2021, In press). Shifting patterns of glass bead cargo of 15th – 17th century Philippines shipwrecks. In H. Walder & L. Dussubieux (Eds.) *Glass Bead Technology, Chronology, and Exchange, LA-ICP-MS Glass Compositions from the Field Museum's Elemental Analysis Facility*. Catholic University of Leuven.

CURVAS, M. (1985). *Typological Analysis of Beads from the Royal Captain wrecksite Underwater Archaeological Project*. [Unpublished manuscript], Records Section, National Museum of the Philippines.

DIZON, E. Z. (1994). A decade of archaeological research in the Philippines, 1982-1992. *Philippine Quarterly of Culture and Society 22* (3):197-222.

DIZON, E. Z. (1996a). Anatomy of a shipwreck: Archaeology of the 15th century Pandanan shipwreck. In C. Loviny (Ed), *The pearl road, tales of treasure ships in the Philippines*. (pp.62-75). Makati City.

DIZON, E.Z. (1996b). *The archaeology of a 15th century AD shipwreck, located off Pandanan Island, Southern Palawan, Philippines*. [Unpublished manuscript], Records Section, National Museum of the Philippines.

DIZON, E. Z. (2003). Underwater and maritime archaeology in the Philippines. *Philippine Quarterly of Culture and Society 31*(1/2), 1-25.

DIZON, E. Z. & RONQUILLO, W. (2010). Maritime and Underwater Archaeology in the Philippines. In J. Van Alphen (Ed.), *A Passage to Asia: 25 centuries of exchange between Asia and Europe* (pp.201-213). Bozar.

DUSSUBIEUX, L. (2009). Compositional analysis of ancient glass fragments from North Sumatra. In D. Perret & H. Surachman (Eds), *Histoire de Barus III. Regards sur une place marchande de l'océan Indien* (pp.385–417). École Française d'Extrême-Orient, XIIe-milieu du XVIIe s. Association Archipel

DUSSUBIEUX, L. (2016). Potash glass: A view from South and Southeast Asia. In F. Gan, Q. Li & J. Henderson (Eds), *Recent Progress of Scientific Research on Ancient Glass and Glaze*: (pp. 95-111). Series on Archaeology and History of Science in China (Book 2) World Scientific Publishing Company.

DUSSUBIEUX, L. & BELLINA, B. (2018). Glass ornament production and trade polities in the Upper-Thai Peninsula during the Early Iron Age. *Archaeological Research in Asia* 13, 25-36.

DUSSUBIEUX, L., B. BELLINA, WIN HSAN OO, U. MAUNG SUN WIN, HTET MYET TUT, KALAYAR MYAT MYAT HTWE, & KHINSANDAR KYAW. (2020). First elemental analysis of glass from Southern Myanmar: replacing the region in the early Maritime Silk Road. *Archaeological and Anthropological Sciences 12*(7), 139. doi: 10.1007/s12520-020-01095-1.

DUSSUBIEUX, L. & GRATUZE, B. (2000). *Indo-Pacific Beads*. Centre Ernest Babelon, Institut de Recherches sur les Archéomatériaux, Centre National de la Recherche Scientifique.

DUSSUBIEUX, L. & GRATUZE, B. (2010). Glass in Southeast Asia. in E.A.Bacus, B. Bellina, T.O. Pryce & C.J. Wisseman (Eds), *50 years of Archaeology in Southeast Asia: Essays in honour of Ian Glover* (pp. 247–259). River Books.

DUSSUBIEUX, L. & GRATUZE, B. (2013). Glass in South Asia, in K. Janssens (Ed), *Modern Methods for Analysing Archaeological and Historical Glass* (pp. 399-413). John Wiley & Sons.

DUSSUBIEUX, L., GRATUZE, B., & BLET-LEMARQUAND, M. (2010). Mineral soda alumina glass: occurrence and meaning. *Journal of Archaeological Science 37* (7), 1646-1655.

DUSSUBIEUX, L. & KANUNGO, A.K. (2013). Trace element analysis of glass from Kopia. In A.K. Kanungo (Ed.) *Glass in ancient India: excavations at Kopia* (pp. 360-366). Kerala Council for Historical Research.

DUSSUBIEUX, L., KUSIMBA, C. M., GOGTE, V., KUSIMBA, S. B., GRATUZE, B. & OKA, R. (2008). The Trading of Ancient Glass Beads: New Analytical Data from South Asian and East African Soda-Alumina Glass Beads. *Archaeometry 50* (5), 797-821.

DUSSUBIEUX, L., LANKTON, J.W., BELLINA-PRYCE, B. & CHAISUWAN, B. (2012). Early Glass Trade in South and Southeast Asia: New Insights from Two Coastal Sites, Phu Khao Thong in Thailand and Arikamedu in South India. In M.-L. Tjoa-Bonatz, A. Reinecke & D. Bonatz (Eds) *Crossing Borders: Selected Papers from the 13th International Conference of the European Association of Southeast Asian Archaeologists*, *Volume 1*. (pp. 307-328) NUS Press.

DUSSUBIEUX, L. & WOOD, M. (2021, In Press). Indian glass: chronology and distribution in Eastern Africa. In A.K.,Kanungo, & L. Dussubieux (Eds.) *Ancient glass of south Asia – archaeology, ethnography and global connection*. Springer Natyre and Gandhinagar.

EVANGELISTA, A. E. (1969). The Philippines: Archaeology in the Philippines to 1950. *Asian Perspectives 12*:97.

FAHY, B. (2015). *Holistic shipwreck assemblages in 14th and 15th century southeast Asia*. [Unpublished doctoral dissertation]. University of Oxford.

FAHY, B. (2014). Addressing Artefact Biases in Asian Shipwreck Assemblages. In Van Tilburg, H. B. Fahy, J. Kimura, V. Walker-Vadillo (Eds), *Proceedings of 2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage*, http://www.themua.org/collections/items/show/1603.

FAR EASTERN FOUNDATION FOR NAUTICAL ARCHAEOLOGY (FEFNA) (1999). *Royal Captain Shoal Survey Report*. [Unpublished manuscript], Records Section, National Museum of the Philippines.

FLECKER, M. (2000). A 9th-century Arab or Indian shipwreck in Indonesian waters. *International Journal of Nautical Archaeology 29* (2), 199-217. doi: 10.1111/j.1095-9270.2000.tb01452.x.

FLECKER, M. (2005). The advent of Chinese sea-going shipping: A look at the shipwreck evidence. In Z. Peikai. (Ed.) *Proceedings of the International Conference: Chinese Export Ceramics and Maritime Trade, 12th–15th Centuries*. Zhonghua,

FLECKER, M. (2007). The South-China-Sea Tradition: the Hybrid Hulls of South-East Asia. *International Journal of Nautical Archaeology 36*(1), 75-90.

FLECKER, M. (2008). A 9th-century Arab or Indian shipwreck in Indonesian Waters: Addendum. *International Journal of Nautical Archaeology 37*(2), 384-386. doi: 10.1111/j.1095-9270.2008.00193.x.

FOX, R., & SANTIAGO, R. (1985). Ancient beads from Philippine archaeological sites. *SEAMO Archaeology Fine Arts 1*(23), 4-13.

FOX, R. (1967). The Archeological Record of Chinese Influences in the Philippines. *Philippine Studies 15*(1), 41-62.

FRANCIS, P. (1985). Chinese beadmakers in Java ca. 1600? *Margretologist 1*(1), 4-6.

FRANCIS, P. (1989). The Type Collection of Beads from Archaeological Contexts in the Philippine National Museum: as developed and maintained by Rey Santiago under the initial inspiration and guidance of Robert B. Fox. *Center for Bead Research 5*, 1-28.

FRANCIS, P. (1992). Heirlooms of the Hills Southeast Asia *Beads and People 1*, 1-21.

FRANCIS, P. (1993). Bead Report: Ifugao Heirloom Beads. *Ornament 17*(1), 112-113.

FRANCIS, P. (1990). Glass Beads in Asia Part Two. Indo-Pacific Beads. *Asian Perspectives 29*(1), 1-23.

FRANCIS, P. (2002). *Asia's maritime bead trade: 300 B.C. to the present*. University of Hawai'i Press.

FUXI, G. (2009). Origin and Evolution of Ancient Chinese Glass. In R. Brill G. Fuxi, & T. Shouyun (Eds.) *Ancient Glass Research along the Silk Road*. World Scientific.

GLOVER, I. & P. BELLWOOD. (2004). Retrospect and Prospect. In I. Glover & P. Bellwood (Eds.) Southeast Asia: From prehistory to history. RoutledgeCurzon.

GODDIO, F. (1988). Discovery and archaeological excavation of a 16th century trading vessel in the Philippines. Ayala Museum of History and Iconographic Archives. In S. P. Ner & C.M. Reyes (Eds.). World Wide First and Ayala Museum of History and Iconographic Archives.

GODDIO, F., M. CRICK, P. LAM, S. PIERSON, & R. SCOTT. (2002). *Lost at sea: the strange route of the Lena Shoal junk*. Periplus

GODDIO, F., M. L'HOUR, F. RICHEZ, & V. GONZALEZ. (1987). Evénement archéologique sur les côtes des Philippines, la fouille exemplaire du Royal Captain Shoal, une jonque du XVIe sur un atol. Dossiers Histoire et Archeologie. *Archéologia 113*.

GODDIO, F., D. FABRE, & M. COIGNARD. (2014). On-going Archaeological Researches on shipwrecked Junks in Philippines. In Van Tilburg,H. B. Fahy, J. Kimura, V. Walker-Vadillo

(Eds), Proceedings of 2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage. http://www.themua.org/collections/items/show/1636.

GODDIO, F. (2007). *Topography and Excavation of Heracleion-Thonis and East Canopus (1996-2006): Underwater Archaeology in the Canopic region in Egypt*. Oxford Centre for Maritime Archaeology.

GRATUZE, B. (2001). *Study of Glass Objects from the Wrecked Junk of Brunei*. ［Unpublished report］. Institut de Recherche sur les Archéomatériaux, Centre Ernest Babelon, Centre National de la Recherche Scientifique.

GRATUZE, B. (2013a). Glass Characterisation Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry Methods. In K. Janssens (Ed.) *Modern Methods for Analysing Archaeological and Historical Glass*, (pp. 201-234). John Wiley & Sons, Ltd.

GRATUZE, B. (2013b). Provenance Analysis of Glass Artefacts. In K. Janssens (Ed.) *Modern Methods for Analysing Archaeological and Historical Glass*, (pp. 311-343). John Wiley & Sons, Ltd.

GRATUZE, B. (2016). Glass Characterization Using Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry Methods. In L. Dussubieux, M. Golitko & B. Gratuze (Eds.) *Recent Advances in Laser Ablation ICP-MS for Archaeology*, (pp. 179-196). Springer Berlin Heidelberg.

GRAVE, P., KEALHOFER, L., BEAVAN, N., TEP, S., STARK, M., EA, D. (2019). The Southeast Asian water frontier: coastal trade and mid-fifteenth c. CE hill tribe burials, southeastern Cambodia. *Archaeological and Anthropological Sciences 11*, 5023-5036.

GREEN, J.N. (1987). The genesis of underwater archaeology in the Philippines. In J.N. Green & R. Harper (Eds.) *The maritime archaeology of shipwrecks and ceramics in Southeast Asia*, (pp. 1-21). Australian Institute of Maritime Archaeology special publication.

GREEN, J.N. (2011). Maritime archaeology of ships of Indian Ocean, Southeast Asia and East Asia, the Question of Bulkheads. In M. Staniforth, J. Craig, B. Orillaneda, C. Jago-on & L. Ligaya (Eds), *Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage*. National Museum of the Philippines. http://www.themua.org/collections/items/show/1573

GREEN, J.N., R. HARPER & V. INTAKOSI. (1987). *The maritime archaeology of shipwrecks and ceramics in southeast Asia, the maritime connection.* Special publication no. 4 Australian Institute for Maritime Archaeology.

HALL, K. R. (2011). *A history of early Southeast Asia: maritime trade and societal development, 100-1500*. Rowman & Littlefield.

HALL, K. R. (1985). *Maritime trade and state development in early Southeast Asia*. University of Hawaii Press.

HENDERSON, J., J. AN & H. MA. (2018). The Archaeometry and Archaeology of Ancient Chinese Glass: a Review. *Archaeometry 60*(1), 88-104.

HENDERSON, J., M. TREGEAR, & N. WOOD. (1989). The technology of sixteenth- and seventeenth-century Chinese cloisonné enamels. *Archaeometry 31*, 133-46.

HUET, N. (2001). Element de parure, bracelets, et perles. In: L'HOUR, M. (Ed.) *La Memorie engloutir de Brunei: Precis Scientifique*. TotalFinaElf.

JACKSON, R. (2012). *Photo Logs: Construction*. http://www.jewelofmuscat.tv/image/tid/9.

JUNKER, L. (2018). Conflictive Trade, Values, and Power Relations in Maritime Trading Polities of the Tenth to the Sixteenth Centuries in the Philippines. In J. Myrdal, K. Kristiansen & T. Lindkvist (Eds.) *Trade and Civilisation: Economic Networks and Cultural Ties, from Prehistory to the Early Modern Era*, (pp. 354-388). Cambridge University Press.

JUNKER, L. (1999). *Raiding, trading, and feasting: The political economy of Philippine chiefdoms*. University of Hawai`i Press.

JUNKER, L. (1998). Integrating History and Archaeology in the Study of Contact Period Philippine Chiefdoms. *International Journal of Historical Archaeology 2*(4), 291-320.

JUNKER, L. (1994). Trade competition, conflict, and political transformations in sixth-to-sixteenth century Philippine chiefdoms. *Asian Perspectives 33*(2), 229-260.

JUNKER, L. (1990). The organization of intra-regional and long-distance trade in prehispanic Philippine complex societies. *Asian Perspectives 29*(2), 167-209.

KANUNGO, A. K. (2000). Glass beads in Indian archaeology: an ethnoarchaeological approach. *Bulletin of the Deccan College Research Institute 60*, 337-353.

KANUNGO, A.K. (2004). Glass Beads in Ancient India and Furnace-Wound Beads at Purdalpur: An Ethnoarchaeological Approach. *Asian Perspectives 43*(1), 123-50.

KANUNGO, A. K. (2016). *Mapping the Indo-Pacific beads vis-à-vis Papanaidupet*. Glass International Commission.

KARKLINS, K. (1985). *Glass Beads: Guide to the Description and Classification of Glass Beads*. Parks Canada.

KELLY, G. O. (2016). Heterodoxy, orthodoxy and communities of practice: Stone bead and ornament production in Early Historic South India (c. 400 BCE–400 CE). *Archaeological Research in Asia 6*, 30-50.

KETEL, C. (2011). Identification of export porcelains from early 17th Century VOC shipwrecks and the linkage to their cultural identification. In M. Staniforth, J.Craig, B.Orillaneda, C. Jago-on, L. Ligaya (Eds.) *Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage*, http://www.themua.org/collections/items/show/1253.

KIDD, K., & KIDD M.A. (1970). A classification system for glass beads for the use of field archaeologists. In Canadian Historic Sites (Eds.) *Occasional Papers in Archaeology and History*. National Historic Sites Service.

KOCK, J., & SODE, T. (1994). *Glass, Glassbeads and Glassmakers in Northern India*. THOT.

LACSINA, L. (2015). The Butuan Boats of the Philippines: Southeast Asian edge-joined and lashed-lug watercraft. *Journal of the Australasian Institute for Maritime Archaeology 39*, 126-132.

LANKTON, J. (2003). *A Bead Timeline, Vol. I: Prehistory to 1200 CE*. The Bead Society of Greater Washington.

LANKTON, J., & DUSSUBIEUX, L. (2013). Early Glass in Southeast Asia. In K. Janssens (Ed). *Modern Methods for Analysing Archaeological and Historical Glass*. John Wiley & Sons.

LANKTON, J., DUSSUBIEUX, D., & REHEN, T. (2008). A Study of Mid-first Millennium CE Southeast Asian Specialized Glass Beadmaking Traditions. In E. A. Bacus, I. Glover & P. D. Sharrock (Eds.) *Interpreting Southeast Asia's Past*, (pp. 335-356). NUS Press.

L'HOUR, M. (2001a). *La mémoire engloutie de Brunei: Précis scientifique*. *Vol. 2.* Textuel.

L'HOUR, M. (2001b). *La mémoire engloutie de Brunei: une aventure archéologique sous-marine*. *Vol. 1:* Textuel.

LILLIOS, K. (1999). Objects of Memory: The Ethnography and Archaeology of Heirlooms. *Journal of Archaeological Method and Theory 6*(3), 235-262.

LIU, M. (2016). Early Maritime Cultural Interaction Between East and West: A Preliminary Study on the Shipwrecks of 16th–17th Century Investigated in East Asia. In C. Wu (Ed.) *Early Navigation in the Asia-Pacific Region*, (pp. 195-207). Springer Singapore.

LOPEZ Jr, PT. (1967). *Marine Archaeology in the Philippines*. [Unpublished manuscript], Records Section, National Museum of the Philippines.

MAARLEVELD, T. J. (1995). Type or technique. Some thoughts on boat and ship finds as indicative of cultural traditions. *International Journal of Nautical Archaeology 24*(1), 3-7. doi: 10.1111/j.1095-9270.1995.tb00706.x.

MANGUIN, P-Y. (2013, Nov 21). *Early Shipbuilding and trans- Indian Ocean Voyages*. ［Conference session］. East Africa and Early Trans- Indian Ocean World Interchange, McGill University, Montreal, Canada,

MANGUIN, P-Y. (2001, 28 sept. 2001-7 janv. 2002). *Réseaux marchands et navires en mer de Chine méridionale.* La mémoire engloutie de Brunei : une aventure archéologique sous-marine [Musée exposition] Conciergerie-Palais de la Cité.

MANGUIN, P. (1984). *Relationship and Cross-influence between South-East Asian and Chinese Shipbuilding Traditions*. [Unpublished manuscript] SPAFA Consultative Workshop on Research into Maritime History & Trade Networks in SE Asia, Indonesia.

MCCARTHY, M. (2005). *Ships' fastenings from sewn boat to steamship*. Texas A&M University Press

MCGRAIL, S. (2001). *Boats of the world: from the Stone Age to medieval times*. Oxford University Press.

MCGRAIL, S. (2004). *Boats of the world: from the Stone Age to medieval times*. Oxford University Press.

MIKSIC, J. (Ed.). (2009). *Research on ceramic trade, within Southeast Asia and between Southeast Asia and China. Southeast Asian Ceramics. New Light on Old Pottery*. Southeast Asian Ceramic Society.

MIKSIC, J. (2013). *Singapore and the Silk road of the Sea 1300-1800*. NUS Press.

MIKSIC, J, N. (2017). Historical Archaeology in Southeast Asia. *Historical Archaeology 51*(4), 471-486. doi: 10.1007/s41636-017-0056-9.

MIKSIC, J.N, YAP, C.T. & YOUNAN, H. (1994). Archaeology and early Chinese glass trade in Southeast Asia. *Journal of Southeast Asian Studies 25*, 31-46.

MIKSIC, J.N., & G. Y. GOH. (2017). *Ancient Southeast Asia*. Taylor & Francis.

MUCKELROY, K. (1978). *Maritime archaeology*. Cambridge University Press.

ORILLANEDA, B. (2022, In-prep). *The Santa Cruz shipwreck: a 15th century Southeast Asian trade vessel*, ［unpublished doctoral dissertation], University of Oxford.

ORILLANEDA, B. (2016a). Maritime Trade in the Philippines During the 15th Century CE. Moussons: Recherche en sciences sociales sure L'Asie du Sud-Est / Social Science Research on Southeast Asia 27 (The Sea Beyond all Borders: The Link between Southeast Asian Countries), 83-100. https://journals.openedition.org/moussons/3529?lang=en

ORILLANEDA, B. (2016b). Of Ships and Shipping: The Maritime Archaeology of Fifteenth Century CE Southeast Asia. In C.Wu (Ed.). Early Navigation in the Asia-Pacific Region: A Maritime Archaeological Perspective, (pp. 22-57). Springer.

ORILLANEDA, B. (2013, June18). *The Santa Cruz Shipwreck Excavation: A Reflection on the Practice of Underwater Archaeology in the Philippines*. [Conference presentation held in conjunction with the exhibition Shipwrecked: Tang Treasures and Monsoon Winds] Marine Archaeology in Southeast Asia: Innovation and Adaptation. Singapore Asian Civilisations Museum. https://www.youtube.com/watch?v=YS7cnx_3IwY

ORILLANEDA, B. (2012). The Santa Cruz Shipwreck Excavation: A Reflection on the Practice of Underwater Archaeology in the Philippines. In A. Chong & H. Tan (Eds.) *Marine Archaeology in Southeast Asia: Innovation and Adaptation*, (pp. 86-104). Asian Civilizations Museum.

ORILLANEDA, B. (2011). Maritime Trade in Southeast Asia during the Early Colonial Period. In M. Staniforth, J.Craig, B.Orillaneda, C. Jago-on, L. Ligaya (Eds.) *Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage,* http://www.themua.org/collections/items/show/1606

ORILLANEDA, B. (2003). Santa Cruz hull. [Unpublished manuscript], Records Section, National Museum of the Philippines.

ORILLANEDA, B. (2001). Santa Cruz – Inventory of Artifacts. [Unpublished manuscript], Records Section, National Museum of the Philippines.

ORILLANEDA, B. (2000). The San Diego and Pandanan wrecks: Two underwater archaeological sites. *Hukay 2*(2):37-45.

ORILLANEDA, B. & RONQUILLO,W. (2011). Protecting and Preserving the Underwater Cultural Heritage in the Philippines: A Background Paper. In M. Staniforth, J.Craig, B.Orillaneda, C. Jago-on, L. Ligaya (Eds.) *Proceedings of the UNESCO Inaugural Asia Pacific Regional Conference on Underwater Cultural Heritage* http://www.themua.org/collections/items/show/1186

ORTON, C. & HUGHES, M. (2013). *Pottery in Archaeology (second edition)*. Cambridge University Press.

PALMA, P. & L.N. SANTHAKUMARAN. (2014). *Shipwrecks and Global 'Worming'*. Archaeopress.

PARKER, A. J. (1992). *Ancient shipwrecks of the Mediterranean & the Roman provinces*. Tempus Reparatum.

PATIENCE, K. (2006). *Shipwrecks and Salvage on the East African Coast*. Dar Akhbar Al Khaleej.

PEARSON, M. N. (2003). *The Indian Ocean*. London; New York: Routledge.

PEARSON, M. N. (Ed.). (2015). *Trade, Circulation, and Flow in the Indian Ocean World*. Palgrave Macmillan.

PERREAULT, C. (2019). *The Quality of the Archaeological Record*. University of Chicago Press.

QUINN, R., FORSYTHE, W., BREEN, C., BOLAND, D., LANE, P., & OMAR, A. L. (2007). Process-based models for port evolution and wreck site formation at Mombasa, Kenya. *Journal of Archaeological Science 34*(9), 1449-1460.

RAMLI, Z., RAHMAN N.H.S.A, & JUSOH, A. (2012). Sungai Mas and OC-EO Glass Beads: A Comparative Study. *Journal of Social Sciences 8*, 22-28. doi: 10.3844/jssp.2012.22.28.

RAY, H.M. (2021). The materiality of knowledge production. In H.M. Ray (Ed.) *The Archaeology of Knowledge Traditions of the Indian Ocean* World (pp. 97-102). RoutledgeIndia. https://doi-org.proxy3.library.mcgill.ca/10.4324/9780429321856

REID, A. (1988). *Southeast Asia in the age of commerce, 1450-1680*. Yale University Press.

RENFREW, C. (1977). Alternative Models of Exchange and Spatial Distribution. In T. Earle & J.E. Ericson (Eds). *Exchange Systems in Prehistory*. Academic Press.

ROBERTSHAW, P., RASOARIFETRA, B., WOOD, M., MELCHIORRE, E., POPELKA-FILCOFF, R. S. & GLASCOCK, M. D. (2006). Chemical Analysis of Glass Beads from Madagascar. *Journal of African Archaeology 4*, 91-109.

ROBERTSHAW, P., WOOD, M., MELCHIORRE, E., POPELKA-FILCOFF, R.S. & GLASCOCK, M.D. (2010). Southern African glass beads: chemistry, glass sources and patterns of trade. *Journal of Archaeological Science 37*, 1898-1912.

ROBINSON, C. (1983). *Black Marxism*. North Carolina University Press.

ROBINSON, D. (2013). *Heracleion in context: The maritime economy of the Egyptian Late Period*. Queen's College, University of Oxford, March 15th-17th.

RONQUILO, W. P. (1998). Philippine Underwater Archaeology. In L. E. Babits & H. Van Tilburg (Eds.) *Maritime Archaeology: A Reader of Substantive and Theoretical Contributions*, (pp. 127-133). Springer US.

SANTIAGO, R. (2003). Techniques in classifying beads recovered from archaeological sites. *Hukay 5*, 1-30.

SANTIAGO, R. (1970). *Bead Typology Plates of the National Museum of the Philippines.* [Unpublished manuscript], Archaeology Division, National Museum of the Philippines.

SCHIBILLE, N., & I. C. FREESTONE. (2013). *Composition, production and procurement of glass at San Vincenzo al Volturno: an early medieval monastic complex in Southern Italy*. PLoS One 8 (10):e76479.

SCHOTTENHAMMER, A. (2015, April 23). *Bronze Coins and Silver Ingots: The Major Currencies across the East Asian Mediterranean* ［conference presentation on comparison of 10th century shipwreck archaeological coins and historic documents in China, Japan and Korea］. Currencies of Commerce in the Greater Indian Ocean World, McGill University, Montreal, Canada.

SHEWAN, L., ARMSTRONG, R., O'REILLY, D., HALCROW, S., BEAVAN, N. & SOKHA, T. (2020). Isotopic insights into the jar-and-coffin mortuary ritual of the Cardamom Mountains, Cambodia. *Antiquity 94*, 1575-1591.

SUKKHAM, A. (2018). Si Satchanalai Figurines: Reconstruction of Ancient Daily Life, Beliefs, and Environment in Siam during the Sixteenth Century. *International Journal of Historical Archaeology 22*(4), 800-842.

SUKKHAM, A. (2015). Variability in Ceramics of the Bang Rachan (Mae Nam Noi) Kilns, Singburi, Thailand. In N. Hidelgo (Ed.). *Selected Papers from the First SEAMEO SPAFA International Conference on Southeast Asian Archaeology, Chonburi, Thailand 2013*. SEAMEO SPAFA Regional Centre for Archaeology and Fine Arts.

SUKKHAM, A., TAÇON, P. S.C. TAN, N.H. & BIN MUHAMAD, A. (2017). Ships and Maritime Activities in the North-eastern Indian Ocean: re-analysis of rock art of Tham Phrayanaga (Viking Cave), southern Thailand. *International Journal of Nautical Archaeology 46*(1), 108-131.

SUVRATHAN, U. (2021). Bullion, baubles and bowls. In H.M. Ray (Ed.) The Archaeology of Knowledge Traditions of the Indian Ocean World (pp. 127-145). RoutledgeIndia. https://doi-org.proxy3.library.mcgill.ca/10.4324/9780429321856

TAMURA, T. (2015). *Scientific Study and Conservation Treatment of Artifacts Excavated from Krang Kor*. Nara National Research Institute for Cultural Properties.

TAN, R.C. (1998/9). A Note on the Dating of Ming Minyao Blue and White Ware. *Oriental Art 44*(4).

VAN DER SLEEN, W. G. N. (1956). *Trade-Wind Beads*. *Man 56,* 27-29. doi: 10.2307/2794042.

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. *The Journal of the Royal Anthropological Institute of Great Britain and Ireland. 88*(2), 203-216.

VAN DER SLEEN, W. G. N. (1967). *A Handbook on Beads*. George Shumway.

VAN TILBURG, H., TRIPATI, S., WALKER-VADILLO, V., FAHY, F., KIMURA, J. (2014). *Proceedings of the 2014 Asia-Pacific Regional Conference on Underwater Cultural Heritage*. Vol 1: Sessions 1-7; Vol 2: Sessions 8-15. Electrical Pencil: Honolulu, Hawaii.

VOSMER, T. (1992). A Survey of Traditional Vessels of the Sultanate of Oman. [unpublished manuscript] Western Australia Maritime Museum, Department of Maritime Archaeology, The Omani Dhow Recording Project Field Research 69.

VOSMER, T., BELFIORETTI, L., STAPLES, E. & GHIDONI, A. (2011). The "Jewel of Muscat" Project: reconstructing an early ninth-century CE shipwreck. *procsemiarabstud Proceedings of the Seminar for Arabian Studies 41*, 411-424.

WEINER, A. B. (1985). Inalienable wealth. *American ethnologist 12*(2), 210-227.

WILLIAMS, B. (2001). Ulster and the Indian Ocean? Recent maritime archaeological research on the East African coast. *Antiquity 75*(290), 797-798. doi:10.1017/S0003598X00089304.

WILSON, A. (2011). Developments in Mediterranean shipping and maritime trade from the Hellenistic period to AD 1000. In D. Robinson & A. Wilson (Eds.) *Maritime Archaeology and Ancient Trade in the Mediterranean*, (pp. 33-59). Oxford Centre for Maritime Archaeology.

WOOD, M. (2011). A Glass Bead Sequence for Southern Africa from the 8th to the 16th Century AD. *Journal of African Archaeology 9*, 67-84.

WOOD, M. (2012). *Interconnections: glass beads and trade in southern and eastern Africa and the Indian Ocean - 7th to 16th centuries AD.* [unpublished doctoral dissertation]. Witwatersrand University.

WOOD, M. (2016). Glass beads from pre-European contact sub-Saharan Africa: Peter Francis's work revisited and updated. *Archaeological Research in Asia 6*, 65-80. doi: https://doi.org/10.1016/j.ara.2016.02.007.

WOOD, M. (2019). Glass Beads and Trade in the Western Indian Ocean. In *Oxford Research Encyclopedia of Asian History*. https://doi.org/10.1093/acrefore/9780190277727.013.334

WOOD, M., PANIGHELLO,S., ORSEGA,W.F., ROBERTSHAW, P., VAN ELTEREN, CROWTHER, A., HORTON, M., & BOIVIN, N. (2017). Zanzibar and Indian Ocean trade in the first millennium CE: the glass bead evidence. *Archaeological and Anthropological Sciences 9*(5), 879-901. doi: 10.1007/s12520-015-0310-z.

WOOD, M. & DUSSUBIEUX, L. (2021, in press). Indian glass: chronology and distribution in Eastern Africa. In A.K.Kanungo & L. Dussubieux (Eds). *Ancient glass of south Asia – archaeology, ethnography and global connection*. Springer Natyre and Gandhinagar

WESTERDAHL, C. (1992). The maritime cultural landscape. *International Journal of Nautical Archaeology 21*(1), 5-14.

WESTERDAHL, C. (2002). The maritime cultural landscape. In A. Catsambis, B. Ford, & D. L. Hamilton (Eds.). The Oxford Handbook of Maritime Archaeology, (pp. 733-762). Oxford University Press.

YAKAL, M. A. (2017). *Exotic Beads and Jar Burials: Social Status in the Old Kiyyangan Village, Ifugao, Philippines.* ［unpublished masters thesis］, University of California, Los Angeles.

YAHJA, A. (2014). *Shipwreck Exploration: A Prospect with Robotics and GIS*. ［ECAI Atlas of Maritime Buddhism. Buddhist Culture and Technology: New Strategies for Study］. Maritime Buddhism Workshop held in conjunction with the United Nations Day of Vesak Celebrations. http://ecaidata.org/organization/about/ecai-maritime-buddhism-project

Two hundred-sixty-two glass beads, representing a representative sample of approximately 25% of the Pandanan and Santa Cruz glass beads, and all the RCSw2 glass beads were permitted for export from the National Museum of the Philippines to the Elemental Analysis Laboratory of the Field Museum of Natural History in Chicago, USA. Non-destructive analysis identified the chemical composition of the glass in a Varian Inductively Coupled Plasma - Mass Spectrometer (ICP-MS) connected to a New Wave UP213 laser.

The parameters of the ICP-MS are optimized to ensure a stable signal with a maximum intensity over the full range of masses of the elements and to minimize oxides and double ionized species formation (XO^+/X^+ and $X^{++}/X^+ < 1$ to 2 %). For that purpose the argon flows, the RF power, the torch position, the lenses, the mirror and the detector voltages are adjusted using an auto-optimization procedure.

For better sensitivity, helium is used as a gas carrier in the laser. To be able to determine elements with concentrations in the range of ppm and below, we used a laser beam diameter of 55 μm, operating at 70 % of the laser energy (0.2 mJ) and at a pulse frequency of 15 Hz. A pre-ablation time of 20 seconds is set.

To improve reproducibility of measurements, the use of an internal standard is required to correct possible instrumental drifts or changes in the ablation efficiency. The isotope Si29 was used for internal standardization. In both cases soda-lime-silica glass was used in the standard reference materials SRM 610 and SRM 612 for calibration, with trace elements in the range of 500 ppm (SRM 610) and 50 ppm (SRM 612).

The detection limits range from 10 ppb to 1 ppm for most of the elements. Accuracy ranges from 5 to 10 % depending on the elements and their concentrations. A more detailed account of the performances of this technique can be found in Dussubieux et al. 2009.

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1575	A	glass	oblate	drawn	red	3.5	4	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	B	glass	oblate	drawn	red	3	3.5	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	C	glass	oblate	drawn	red	2	3	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	D	glass	oblate	drawn	red	2	3	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	E	glass	oblate	drawn	red	3	4	1.5	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	F	glass	oblate	drawn	red	3	4	1	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	G	glass	oblate	drawn	red	2	4	1.5?	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1575	H	glass	oblate	drawn	red	2	3.5	?	crizzel		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	I	glass	oblate	drawn	red	2	3	1.5	crizzel		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	J	glass	annular	drawn	red	2	4	2	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	K	glass	annular	drawn	red	2	4	2	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	L	glass	annular	drawn	red	2	4.5	2	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	M	glass	annular	drawn	red	2	4.5	2	crizzel? Dull, pitted		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	N	glass	annular	drawn	red	2	3.5	2	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1575	O	glass	annular	drawn	red	2	4	2	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	P	glass	annular	drawn	red	2	4	2	crizzel? Dull, pitted		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	Q	glass	lenticular/annular	drawn	red	2	4	1.5	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	R	glass	lenticular/annular	drawn	red	2	4	1	crizzel		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	S	glass	lenticular/annular	drawn	red	2	3.5	1	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	T	glass	lenticular/annular	drawn	red	1	4	2	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	U	glass	lenticular/annular	drawn	red	2	4	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1575	V	glass	barrel	drawn	red	2	3.5	2	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	W	glass	barrel	drawn	red	3	4	1	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	X	glass	barrel	drawn	red	3	3.5	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	Y	glass	barrel	drawn	red	4	3	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	Z	glass	barrel	drawn	red	3	3	1	striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	Ai	glass	barrel	drawn	red	2.5	3	1	crizzel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	Bi	glass	barrel	drawn	red	3	4	1	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1575	Ci	glass	barrel	drawn	red	2	3	1	faint striations parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1575	Di								indeterminate, multiple beads (approx. 12) in very poor condition		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1087	A	glass	barrel	drawn	red	10	5	2	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1087	B	glass	oblate/barrel	drawn	red	4	6	2	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1087	C	glass	oblate	drawn	red	2.5	3.5	1.5	strations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1087	D	glass	barrel/oblate	drawn	red	3	4	2	straitions parallel, dull		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1087	E	glass	oblate?	drawn	red	2	4	2	straitions parallel, dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-NA	A	glass	barrel	drawn	red	10.5	5.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	B	glass	barrel	drawn	red	9	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	C	glass	barrel	drawn	red	8	7	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	D	glass	barrel	drawn	red	7.5	4.5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	E	glass	barrel	drawn	red	10	4.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	F	glass	barrel	drawn	red	9	4	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	G	glass	barrel	drawn	red	7.5	6	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	H	glass	barrel	drawn	red	10	5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	I	glass	barrel	drawn	red	8	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	J	glass	barrel	drawn	red	9	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	K	glass	barrel	drawn	red	9	4.5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	L	glass	barrel	drawn	red	12.5	6	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	M	glass	barrel	drawn	red	7.5	7	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	N	glass	barrel	drawn	red	7.5	5.5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	O	glass	barrel	drawn	red	10	5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	P	glass	barrel	drawn	red	10.5	4.5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Q	glass	barrel	drawn	red	8.5	5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	R	glass	barrel	drawn	red	11	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	S	glass	barrel	drawn	red	13	5.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	T	glass	barrel	drawn	red	8.5	4.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	U	glass	barrel	drawn	red	12	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	V	glass	barrel	drawn	red	11	4	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	W	glass	barrel	drawn	red	13	5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	X	glass	barrel	drawn	red	8	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Y	glass	barrel	drawn	red	9.5	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Z	glass	barrel	drawn	red	7	4	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ai	glass	barrel	drawn	red	8.5	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Bi	glass	barrel	drawn	red	10	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ci	glass	barrel	drawn	red	7.5	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Di	glass	barrel	drawn	red	7	5	2	straitions parallel, dull, pitted	broken and worn away? Smoothed out edges/middle	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ei	glass	barrel	drawn	red	8	4.5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fi	glass	barrel	drawn	red	8.5	4	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gi	glass	barrel	drawn	red	8	5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hi	glass	barrel	drawn	red	8	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Hi	glass	barrel	drawn	red	9.5	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ji	glass	barrel	drawn	red	9	5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ki	glass	barrel	drawn	red	6	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Li	glass	barrel	drawn	red	8	5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mi	glass	barrel	drawn	red	12	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ni	glass	barrel	drawn	red	8	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Oi	glass	barrel	drawn	red	9	3	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Pi	glass	barrel	drawn	red	11	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qi	glass	barrel	drawn	red	8	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ri	glass	barrel	drawn	red	8	5	1.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Si	glass	barrel	drawn	red	8	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ti	glass	barrel	drawn	red	8.5	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ui	glass	barrel	drawn	red	9	4.5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vi	glass	barrel	drawn	red	7.5	4.5	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Wi	glass	barrel	drawn	red	7	4.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xi	glass	barrel	drawn	red	7	5	2	straitions parallel, dull, pitted	small extra 'dent' off main bore, all the way through to other end	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yi	glass	barrel	drawn	red	9	4.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zi	glass	barrel	drawn	red	10	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Aii	glass	barrel	drawn	red	7.5	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Bii	glass	barrel	drawn	red	8.5	5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cii	glass	barrel	drawn	red	8.5	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Dii	glass	barrel	drawn	red	10	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Eii	glass	barrel	drawn	red	7.5	4.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fii	glass	barrel	drawn	red	8	4	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gii	glass	barrel	drawn	red	7.5	4	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hii	glass	barrel	drawn	red	8.5	4.5	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Iii	glass	oblate/barrel	drawn	red	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jii	glass	oblate/barrel	drawn	red	2	3.5	2.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Kii	glass	oblate/barrel	drawn	red	3	4	3	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Lii	glass	oblate/barrel	drawn	red	3.5	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mii	glass	oblate/barrel	drawn	red	2.5	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Nii	glass	oblate/barrel	drawn	red	3	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Oii	glass	oblate/barrel	drawn	red	3	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Pii	glass	oblate/barrel	drawn	red	2.5	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qii	glass	oblate/barrel	drawn	red	3	4.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Rii	glass	oblate/barrel	drawn	red	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Sii	glass	oblate/barrel	drawn	red	2	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Tii	glass	oblate/barrel	drawn	red	3	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Uii	glass	oblate/barrel	drawn	red	3	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vii	glass	oblate/barrel	drawn	red	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wii	glass	oblate/barrel	drawn	red	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xii	glass	oblate/barrel	drawn	red	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Yii	glass	oblate/barrel	drawn	red	3.5	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zii	glass	oblate/barrel	drawn	red	3	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Aiii	glass	oblate/barrel	drawn	red	2	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Biii	glass	oblate/barrel	drawn	red	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ciii	glass	annular	drawn	red	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Diii	glass	oblate/barrel	drawn	red	3	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Eiii	glass	oblate/barrel	drawn	red	2.5	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Fiii	glass	oblate/barrel	drawn	red	2.5	3	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Giii	glass	oblate/barrel	drawn	red	3	3.5	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hiii	glass	oblate/barrel	drawn	red	2.5	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Iiii	glass	oblate/barrel	drawn	red	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jiii	glass	oblate/barrel	drawn	red	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kiii	glass	oblate/barrel	drawn	red	2	3	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Liii	glass	oblate/barrel	drawn	red	2.5	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Miii	glass	oblate/barrel	drawn	red	2.5	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Niii	glass	oblate/barrel	drawn	red	4	5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Oiii	glass	oblate/barrel	drawn	red	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Piii	glass	oblate/barrel	drawn	red	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qiii	glass	oblate/barrel	drawn	red	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Riii	glass	oblate/barrel	drawn	red	3	3	1.2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Siii	glass	oblate/barrel	drawn	red	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Tiii	glass	oblate/barrel	drawn	red	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Uiii	glass	oblate/barrel	drawn	red	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Viii	glass	oblate/barrel	drawn	red	3	4	1.5	straitions paralell, dull		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wiii	glass	oblate/barrel	drawn	red	3.5	4	1.5	straitions paralell, dull		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xiii	glass	oblate/barrel	drawn	red	2.5	4	2	striations parallel, shiney, crizzel		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yiii	glass	oblate/barrel	drawn	red	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ziii	glass	oblate/barrel	drawn	red	5	4.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Aiv	glass	barrel	drawn	red	15	5	2	straitions parallel, dull, pitted, spear ended=probably broken		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Biv	glass	barrel	drawn	red	10	5	2			1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Civ	glass	barrel	drawn	red	9	6	1.5			1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Div	glass	barrel	drawn	red	5	6.5	2	straitions parallel, dull, pitted, broken end?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Eiv	glass	barrel	drawn	red	7	6	2	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Fiv	glass	barrel	drawn	red	12	5	3	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Giv	glass	barrel	drawn	red	11	6	2.5	straitions parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hiv	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Iiv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jiv	glass	oblate	drawn	red	2	3	2.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kiv	glass	oblate	drawn	red	3	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Liv	glass	oblate	drawn	red	2	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Miv	glass	oblate	drawn	red	3	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Niv	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Oiv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Piv	glass	oblate	drawn	red	4	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qiv	glass	oblate	drawn	red	2	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Riv	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Siv	glass	oblate	drawn	red	2	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Tiv	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Uiv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Viv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wiv	glass	barrel	drawn	red	7	6	1	straitions parallel, dull, pitted, broken end?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xiv	glass	barrel	drawn	red	8	7	1	straitions parallel, dull, pitted, broken end?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yiv	glass	barrel	drawn	red	8.5	5	1.5	straitions paralle, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Ziv	glass	barrel	drawn	red	9	5	2	straitions paralle, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Av	glass	barrel	drawn	red	9	4	2.5	straitions paralle, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Bv	glass	barrel	drawn	red	7	5	2.5	straitions parallel, dull, pitted, broken end?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cv	glass	barrel	drawn	red	7.5	5	2	straitions parallel, dull, pitted, broken end?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Dv	glass	barrel	drawn	red	5.5	5	2	straitions parallel, dull, pitted, broken end?		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Ev	glass	oblate	drawn	red	3	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fv	glass	oblate	drawn	red	2.5	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Iv	glass	oblate	drawn	red	2.5	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jv	glass	oblate	drawn	red	2.5	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kv	glass	oblate	drawn	red	2	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Lv	glass	annular	drawn	red	2	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mv	glass	annular	drawn	red	2.5	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Nv	glass	oblate	drawn	red	2.5	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ov	glass	oblate	drawn	red	2	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Pv	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qv	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Rv	glass	oblate	drawn	red	3	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Sv	glass	barrel	drawn	red	13	5	1	straitios parallel, dull, pitted, two dentsv along bore on opposite 'sides' to one another=feels 'pinched' between index and thumb of left hand		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Tv	glass	barrel	drawn	red	9.5	5.5	1.5	strations parallel, dull, pitted	LOST during analysis	1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Uv	glass	barrel	drawn	red	9	4.5	1	strations parallel, dull, pitted, pointed end=broken ?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vv	glass	barrel	drawn	red	9	5	2	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wv	glass	barrel	drawn	red	7	4.5	2	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xv	glass	barrel	drawn	red	7	4	2	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yv	glass	barrel	drawn	red	6.5	5	2	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zv	glass	oblate	drawn	red	3.5	5	2	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Avi	glass	oblate	drawn	red	2.5	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Bvi	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cvi	glass	oblate	drawn	red	2	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Dvi	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Evi	glass	oblate	drawn	red	2	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fvi	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gvi	glass	annular	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Hvi	glass	lenticular	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ivi	glass	lenticular	drawn	red	2	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jvi	glass	lenticular	drawn	red	1	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kvi	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Lvi	glass	barrel	drawn	red	13	4	2	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mvi	glass	barrel	drawn	red	10	5	1	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Nvi	glass	barrel	drawn	red	9.5	5	1	strations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Ovi	glass	barrel/oblate	drawn	red	4.5	6	2	strations, parallel, dull, pitted, short=potentially broken?		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Pvi	glass	barrel	drawn	red	13	5	3	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qvi	glass	oblate	drawn	red	2	3	2.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Rvi	glass	oblate	drawn	red	2.5	3	2.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Svi	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Tvi	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Uvi	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vvi	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wvi	glass	oblate	drawn	red	3	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xvi	glass	oblate	drawn	red	3	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yvi	glass	oblate	drawn	red	2	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zvi	glass	oblate	drawn	red	3	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Avii	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Bvii	glass	oblate	drawn	red	2.5	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cvii	glass	oblate	drawn	red	3	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Dvii	glass	oblate	drawn	red	2.5	3.5	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Evii	glass	oblate	drawn	red	3	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fvii	glass	oblate	drawn	red	2.5	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gvii	glass	oblate	drawn	red	2.5	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hvii	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Ivii	glass	oblate	drawn	red	3	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jvii	glass	oblate	drawn	red	2	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kvii	glass	oblate	drawn	red	2.5	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Lvii	glass	oblate	drawn	red	3	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mvii	glass	oblate	drawn	red	2	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Nvii	glass	oblate	drawn	red	2.5	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ovii	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Pvii	glass	oblate	drawn	red	3	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qvii	glass	oblate	drawn	red	2.5	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Rvii	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Svii	glass	oblate	drawn	red	2	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Tvii	glass	oblate	drawn	red	2	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Uvii	glass	oblate	drawn	red	3	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vvii	glass	oblate	drawn	red	2.5	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Wvii	glass	oblate	drawn	red	2.5	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xvii	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yvii	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zvii	glass	oblate	drawn	red	2	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Aviii	glass	oblate	drawn	red	3	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Bviii	glass	oblate	drawn	red	2	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cviii	glass	oblate	drawn	red	3	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Dviii	glass	oblate	drawn	red	3	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Eviii	glass	oblate	drawn	red	3	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fviii	glass	oblate	drawn	red	2.5	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gviii	glass	oblate	drawn	red	3	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hviii	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Iviii	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jviii	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Kviii	glass	oblate	drawn	red	3	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Lviii	glass	oblate	drawn	red	3	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mviii	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Nviii	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Oviii	glass	oblate	drawn	red	2	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Pviii	glass	oblate	drawn	red	2.5	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qviii	glass	oblate	drawn	red	3	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Rviii	glass	oblate	drawn	red	2.5	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Sviii	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Tviii	glass	oblate	drawn	red	2.5	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Uviii	glass	oblate	drawn	red	3	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vviii	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wviii	glass	oblate	drawn	red	3	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xviii	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Yviii	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zviii	glass	oblate	drawn	red	2.5	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Aix	glass	oblate	drawn	red	2	4	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Bix	glass	oblate	drawn	red	2	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cix	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Dix	glass	oblate	drawn	red	3	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Eix	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Fix	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gix	glass	oblate	drawn	red	2.5	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Hix	glass	oblate	drawn	red	2	3.5	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Iix	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jix	glass	oblate	drawn	red	2	3.5	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kix	glass	oblate	drawn	red	2	4	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Lix	glass	oblate	drawn	red	2	3	1.5	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Mix	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Nix	glass	oblate	drawn	red	2	3	2	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Oix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Pix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Rix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Six	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Tix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Uix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Wix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xix	glass	oblate	drawn	red	1	4	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zix	glass	oblate	drawn	red	2	3	1	straitions parallel, shiney		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Ax	glass	multiple	drawn	red			2	crizzel, 7 beads		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Bx	glass	multiple	drawn	red			1	strung tigether in twos or threes		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cx	glass	barrel	drawn	red	10	4.5	1	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Dx	glass	barrel	drawn	red	9	4		striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ex	glass	barrel	drawn	red	8.5	5		striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fx	glass	barrel	drawn	red	7	5	2	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gx	glass	barrel	drawn	red	6	5	2	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Hx	glass	barrel	drawn	red	7	4	3	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ix	glass	barrel	drawn	red	6	5	2	straitions parallel, slight shine		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Jx	glass	barrel	drawn	red	4.5	5	2	striations parallel, dull, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Kx	glass	barrel	drawn	red	4.5	5	2	broken?, chip out but still pitted and dull, like all others		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Lx	glass	oblate	drawn	red	3	4	2	straitions parallel, slighht shine, pitted		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Mx	glass	barrel	drawn	red	9	5	2	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Nx	glass	barrel	drawn	red	14	6	2	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ox	glass	barrel	drawn	red	10	6	2	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Px	glass	barrel	drawn	red	14.5	6.5	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Qx	glass	barrel	drawn	red	12	6	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Rx	glass	barrel	drawn	red	10	6	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Sx	glass	barrel	drawn	red	11	6	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Tx	glass	barrel	drawn	red	14	5.5	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Ux	glass	barrel	drawn	red	13.5	5	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Vx	glass	barrel	drawn	red	11	4.5	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-NA	Wx	glass	barrel	drawn	red	8	4.5	3	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Xx	glass	barrel	drawn	red	11	5	2	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Yx	glass	barrel	drawn	red	10.5	5	2.5	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Zx	glass	barrel	drawn	red	11	5	2	striations parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Axi	glass	barrel	drawn	red			2	striations parallel, dull, pitted	came on a copper metal string with 10 total beads	1993-19; 1995-16; 1995-45; 1996-2

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-NA	Bxi	glass	barrel	drawn	red			3	striations parallel, dull, pitted	came in a baggy with mixed forms 5 whole and 2 halfs	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Cxi	glass	none	drawn	red			2	?	came in a baggy with mixed forms; 2 pieces	1993-19; 1995-16; 1995-45;
IV-1993-V-NA	Dxi	glass	multiple	drawn	red				striations parallel, dull, pitted	came in a baggy with mixed forms; 15 broekn pieces, 2 whole beads	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Exi	glass	barrel	drawn	red				straitions parallel, dull, pitted	came on a copper metal string with 20 total beads and a tape with the number 20 written on it; the copper has no sign of saltwater disintegration; 6 beads with this ID	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Fxi	glass	multiple	drawn	red				straitions parallel, dull	came on copper string, no degredation; 80 total-79 whole, 1 broken; smallest sizes I can remember from assemblage	1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-NA	Gxi	glass	multiple	drawn	red				straitions parallel, dull	came on copper string, no degredation; 103 total	1993-19; 1995-16; 1995-45;

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1132	A	glass	barrel	drawn	black	5 five	5	2	striations parallel	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	H	glass	barrel	drawn	moslt grey / beige	2.5	4	1	striations parallel		1993-19; 1995-16; 1995-45; 1996-2
IV-1993-V-1132	M	glass	barrel	drawn	grey	3	4	1	striations parallel	crumbed during handleing	1993-19; 1995-16; 1995-45; 1996-3
IV-1993-V-1132	N	glass	barrel	drawn	black	3	3	1	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-4
IV-1993-V-1132	O	glass	barrel	drawn	beige / black	4	5	2	striations parallel	shiney, grainy, cracked	1993-19; 1995-16; 1995-45; 1996-5
IV-1993-V-1132	P	glass	barrel	drawn	black	4	3.5	1	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-6

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1132	Q	glass	barrel	drawn	black	3	4	2	striations parallel	shiney, crackeled	1993-19; 1995-16; 1995-45; 1996-7
IV-1993-V-1132	R	glass	barrel	drawn	beige	4	4	2	striations parallel	shiney, crackeled	1993-19; 1995-16; 1995-45; 1996-8
IV-1993-V-1132	S	glass	barrel	drawn	black / beige	3	3.5	2	striations parallel	shiney, sparkely	1993-19; 1995-16; 1995-45; 1996-9
IV-1993-V-1132	T	glass	barrel	drawn	black /grey	three to two	3.5	1	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-10
IV-1993-V-1132	Fi	glass	barrel	drawn	black	3	4	1.5	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-11
IV-1993-V-1132	Ii	glass	barrel	drawn	beige	3	4	2	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-12

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Li	glass	barrel	drawn	black	3	3	1	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-13
IV-1993-V-1132	Oi	glass	barrel	drawn	brown	3	4.5	2	striations parallel	crizzeled	1993-19; 1995-16; 1995-45; 1996-14
IV-1993-V-1132	Pi	glass	barrel	drawn	black	2	5	?	striations parallel	crizzeled	1993-19; 1995-16; 1995-45; 1996-15
IV-1993-V-1132	Wi	glass	barrel	drawn	beige	3	3	2	striations parallel	shiney, crackely	1993-19; 1995-16; 1995-45; 1996-16
IV-1993-V-1132	Eii	glass	barrel	drawn	brown	4	3.5	1.5	striations parallel	shiney/crackeled	1993-19; 1995-16; 1995-45; 1996-17
IV-1993-V-1132	Fii	glass	barrel	drawn	black / beige	2	4	2	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-18

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Gii	glass	barrel	drawn	dark grey	4	4	1.5	striations parallel	dull shine	1993-19; 1995-16; 1995-45; 1996-19
IV-1993-V-1132	Kii	glass	barrel	drawn	brown	2	4	1	striations parallel	shiney/crackeled	1993-19; 1995-16; 1995-45; 1996-20
IV-1993-V-1132	Qii	glass	barrel	drawn	black	3	5	2	striations parallel, shiney	shiney; lightly crackled	1993-19; 1995-16; 1995-45; 1996-21
IV-1993-V-1132	Tii	glass	barrel	drawn	black	3	4	1	striations parallel	dull shine	1993-19; 1995-16; 1995-45; 1996-22
IV-1993-V-1132	Yii	glass	barrel	drawn	black	3.5	5	2	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-23
IV-1993-V-1132	Ciii	glass	barrel	drawn	brown	3	4	?	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-24

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Diii	glass	barrel	drawn	dark grey	3	?	?	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-25
IV-1993-V-1132	Eiii	glass	barrel	drawn	black	3	3	2	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-26
IV-1993-V-1132	Fiii	glass	barrel	drawn	brown	?	4	1.5	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-27
IV-1993-V-1132	Giii	glass	barrel	drawn	dark grey / brown	2.5	4	2	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-28
IV-1993-V-1132	Hiii	glass	barrel	drawn	black	2	4	2	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-29
IV-1993-V-1132	Iiii	glass	barrel	drawn	grey	3	3	1.5	striations parallel	dull shine	1993-19; 1995-16; 1995-45; 1996-30

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Jiii	glass	barrel	drawn	black	3	4	1.5	striations parallel	matte	1993-19; 1995-16; 1995-45; 1996-31
IV-1993-V-1132	Kiii	glass	barrel	drawn	black / beige	3	4	1.5	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-32
IV-1993-V-1132	Liii	glass	barrel	drawn	dark grey	2	3.5	2	striations parallel	shiney	1993-19; 1995-16; 1995-45; 1996-33
IV-1993-V-1132	Miii	glass	barrel	drawn	beige	2	4	1	striations parallel	surface matt, some sparkle inside	1993-19; 1995-16; 1995-45; 1996-34
IV-1993-V-1132	Niii	glass	barrel	drawn	dark grey / brown	2	4	2	striations parallel	matte	1993-19; 1995-16; 1995-45; 1996-35
IV-1993-V-1132	Kiv	glass	barrel	drawn	dark grey / brown	3	3	1.5	striations parallel	shiney; broken edge	1993-19; 1995-16; 1995-45; 1996-36

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Qiv	glass	barrel	drawn	brown / beige	3	3	1	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-37
IV-1993-V-1132	Yiv	glass	barrel	drawn	dark grey	2.5	3.5	2	striations parallel	shiney, pitted	1993-19; 1995-16; 1995-45; 1996-38
IV-1993-V-1132	Bv	glass	barrel	drawn	grey	2	4	2	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-39
IV-1993-V-1132	Cv	glass	barrel with tip	drawn	black	3	4	2	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-40
IV-1993-V-1132	Dv	glass	barrel	drawn	grey	4	3	2	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-41
IV-1993-V-1132	Ev	glass	barrel	drawn	grey	2	3.5	2	striations parallel	shiney; crackeled	1993-19; 1995-16; 1995-45; 1996-42

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Fv	glass	barrel	drawn	grey	2	4		striations parallel	shiney/crackeled	1993-19; 1995-16; 1995-45; 1996-43
IV-1993-V-1132	Mv	glass	oblate	drawn	brown	3	4	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Tv	glass	barrel	drawn	black / grey	4	4	1.5	strations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Uv	glass	annular	drawn	brown	2	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vv	glass	barrel	drawn	black / grey	3	4	1.5	strations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wv	glass	barrel	drawn	brown	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Xv	glass	barrel	drawn	black	3	4		strations parallel to bore; shiney	concretions around/thjrough bore	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yv	glass	?	drawn	black	3	4	1.5	strations parallel to bore; shiney	barrel or oblate	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zv	glass	lenticular	drawn	grey / black	2	4	2	strations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Avi	glass	barrel	drawn	brown	4	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bvi	glass	oblate	drawn	brown	2	4.5	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cvi	glass	oblate	drawn	brown	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Dvi	glass	oblate	drawn	brown	3	4	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Evi	glass	oblate	drawn	brown	2	4			broke during analysis; crackeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fvi	glass	oblate	drawn	brown	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gvi	glass	oblate	drawn	brown	2	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hvi	glass	oblate	drawn	brown	3	5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ivi	glass	oblate	drawn	black / grey	3	4	1	strations parallel to bore; shiney; sparkley		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1132	Jvi	glass	barrel	drawn	brown	4	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kvi	glass	barrel	drawn	black / grey	4	4	1	striations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lvi	glass	barrel	drawn	black	3	4	2	strations parallel to bore; shiney; sparkley		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mvi	glass	barrel	drawn	black	3	3.5	2	striations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nvi	glass	lenticular	drawn	black /grey	3	4	2	striations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ovi	glass	lenticular	drawn	black	2	4	2	striations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Cviii	glass	oblate	drawn	black	3	4	1.5	striations pararllel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dviii	glass	oblate	drawn	brown	4	3	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Eviii	glass	oblate	drawn	brown	2	4.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fviii	glass	oblate	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gviii	glass	oblate	drawn	brown	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hviii	glass	oblate	drawn	brown	3	5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Iviii	glass	oblate	drawn	brown	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jviii	glass	barrel	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kviii	glass	barrel	drawn	brown	3	3.5	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lviii	glass	barrel	drawn	brown				BROKEN/DEGRADED	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mviii	glass	barrel	drawn	brown	3	3	?		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nviii	glass	lenticular	drawn	brown	2.5	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Oviii	glass	lenticular	drawn	brown	2.5	3.5	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pviii	glass	lenticular	drawn	black	2	4.5	2	striations parallel to bore; dull		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qviii	glass	oblate	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rviii	glass	annular	drawn	brown	2	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sviii	glass	oblate	drawn	brown	2.5	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Tviii	glass	oblate	drawn	brown	2.5	4.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Uviii	glass	oblate	drawn	brown	3	3.5	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vviii	glass	oblate	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wviii	glass	oblate	drawn	brown	2	4	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xviii	glass	oblate	drawn	brown	2.5	4.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yviii	glass	annular	drawn	brown	2	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zviii	glass	barrel	drawn	brown	3	4.5	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Aix	glass	barrel	drawn	brown	3	4	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bix	glass	barrel	drawn	brown	4	4.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cix	glass	barrel	drawn	brown	3	4			crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dix	glass	barrel	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Eix	glass	barrel	drawn	brown	2.5	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fix	glass	barrel	drawn	brown	3	3	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Gix	glass	barrel	drawn	brown	3	3	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hix	glass	barrel	drawn	brown	3	3.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Iix	glass	barrel	drawn	brown	3	3	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jix	glass	barrel	drawn	brown	2	3	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kix	glass	barrel	drawn	brown	4	3.5	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lix	glass	barrel	drawn	brown	2	3	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Mix	glass	barrel	drawn	brown	2	3.5	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nix	glass	barrel	drawn	brown	3	3.5	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oix	glass	barrel	drawn	brown	2.5	3	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pix	glass	barrel	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qix	glass	barrel	drawn	brown	3	3.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rix	glass	annular	drawn	brown	3	5;5	2		crizzeled; fell apart during analysis	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1132	Ixi	glass	barrel	drawn	brown	3	3	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxi	glass	barrel	drawn	multiple	4	5		straitions parallel to bore; shiney	crizzeled; black/brown	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxi	glass	barrel	drawn	multiple	3	4.5	2	straitions parallel to bore; shiney	crizzeled; black/brown	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxi	glass	barrel	drawn	multiple	3	4	1	straitions parallel to bore; shiney	crizzeled; black/brown	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxi	glass	barrel	drawn	multiple	3.5	4	2	straitions parallel to bore; shiney	crizzeled; black/brown	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxi	glass	barrel	drawn	multiple	4	3	3	straitions parallel to bore; shiney	crizzeled; black/brown	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Oxi	glass	barrel	drawn	black	2.5	4	1.5	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxi	glass	barrel	drawn	black	2.5	4	2	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxi	glass	barrel	drawn	black	3	4	2	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxi	glass	barrel	drawn	black	3.5	4	2	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sxi	glass	barrel	drawn	black	3	3.5	2	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txi	glass	barrel	drawn	black	3	3	1.5	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Uxi	glass	barrel	drawn	black	3	3	1.5	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxi	glass	barrel	drawn	black	4	3	1	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wxi	glass	barrel	drawn	black	2	3	1	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gxii	glass	annular	drawn	black	3	5	2	straitions parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxii	glass	annular	drawn	brown	2	5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixii	glass	annular	drawn	black / brown	2	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Jxii	glass	annular	drawn	black / brown	2	4	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxii	glass	annular	drawn	black / brown	2	4	2	striations parallel to bore; shiney	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxii	glass	annular	drawn	white	2	4	2	shiney, pitted	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxii	glass	barrel	drawn	black	2	4	1	striations parallel to bore; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxii	glass	oblate	drawn	white / grey	2.5	4	1.5	striations parallel to bore; dull	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxii	glass	barrel	drawn	black	3	4	2	striations parallel; shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Pxii	glass	barrel	drawn	black	3	4	2	straitions parallel; shiney	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxii	glass	oblate	drawn	brown	3	4.5	1			1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cxiii	glass	barrel	drawn	brown	3	4	2	shiney	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxiii	glass	barrel	drawn	brown	3	4.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Exiii	glass	barrel	drawn	brown	3	4	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxiii	glass	barrel	drawn	brown	3	3.5	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Gxiii	glass	barrel	drawn	brown	2.5	3.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxiii	glass	barrel	drawn	brown	3	3	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixiii	glass	barrel	drawn	brown	3	3	1		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxiii	glass	barrel	drawn	brown	3	3.5	2		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxiii	glass	oblate	drawn	brown	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxiii	glass	oblate	drawn	brown	3	5	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Mxiii	glass	oblate	drawn	black	3	4	1.5		crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxiii	glass	oblate	drawn	white / grey	2.5	4	1.5	pitted	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxiii	glass	annular	drawn	white / grey	1	3.5	2	pitted	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxiii	glass	annular?	drawn	brown	2			broken	crizzeled	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxiii	glass	?	drawn	brown	3	5	2	thick one side, thin and small break on other side	crizzeled; thick one side, thin and small break on other side	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxiii	glass	barrel	drawn	grey	3	5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Sxiii	glass	barrel	drawn	black	2	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txiii	glass	barrel	drawn	black	3	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Uxiii	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxiii	glass	barrel	drawn	black	3	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Axiv	glass	barrel	drawn	grey	4	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxiv	glass	barrel	drawn	black	4	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Cxiv	glass	barrel	drawn	black	3	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxiv	glass	barrel	drawn	black	3	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Exiv	glass	barrel	drawn	black	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxiv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gxiv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxiv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Ixiv	glass	barrel	drawn	black	3	3.5	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxiv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxiv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxiv	glass	barrel	drawn	black	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxiv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxiv	glass	barrel	drawn	black	4	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Oxiv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxiv	glass	barrel	drawn	black	4	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxiv	glass	barrel	drawn	black	2	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxiv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sxiv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txiv	glass	barrel	drawn	black	3	5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Uxiv	glass	barrel	drawn	black	3	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxiv	glass	barrel	drawn	black	3.5	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wxiv	glass	barrel	drawn	black	4	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxiv	glass	barrel	drawn	black	2	3.5	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yxiv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxiv	glass	barrel	drawn	black	3.5	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Axv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cxv	glass	barrel	drawn	black	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxv	glass	barrel	drawn	black	3	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Exv	glass	barrel	drawn	black	3	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1132	Gxv	glass	barrel	drawn	black	3	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxv	glass	barrel	drawn	black	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixv	glass	barrel	drawn	black	3	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxv	glass	barrel	drawn	black	3	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxv	glass	barrel	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxv	glass	barrel	drawn	black	2.5	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Mxv	glass	barrel	drawn	black	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxv	glass	barrel	drawn	black	2.5	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxv	glass	barrel	drawn	black	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxv	glass	barrel	drawn	black	2.5	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxv	glass	barrel	drawn	black	2	?	?	striations parallel, shiney	broken during anaylsis	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxv	glass	barrel	drawn	black	3	5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Sxv	glass	barrel	drawn	black / brown	2.5	3	1.5	striations parallel, shiney	crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txv	glass	barrel	drawn	black / brown	2.5	4	?	striations parallel, shiney	crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Uxv	glass	barrel	drawn	black / brown	2	4	2	striations parallel, shiney	crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxv	glass	barrel	drawn	black / brown	2	3	1	striations parallel, shiney	crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wxv	glass	barrel	drawn	brown	4	5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxv	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Yxv	glass	barrel	drawn	brown	3	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxv	glass	barrel	drawn	brown	3.5	3	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Axvi	glass	barrel	drawn	brown	2.5	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxvi	glass	barrel	drawn	brown	2	3.5	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cxvi	glass	barrel	drawn	brown	3	3.5	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxvi	glass	barrel	drawn	brown	3	3	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Exvi	glass	barrel	drawn	brown	2.5	4	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxvi	glass	barrel	drawn	brown	3	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gxvi	glass	barrel	drawn	brown	2	4	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxvi	glass	barrel	drawn	brown	3.5	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixvi	glass	barrel	drawn	brown	3	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxvi	glass	barrel	drawn	brown	3	3	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Kxvi	glass	barrel	drawn	brown	3	4.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxvi	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxvi	glass	barrel	drawn	brown	2	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxvi	glass	barrel	drawn	brown	3.5	4	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxvi	glass	barrel	drawn	brown	2.5	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxvi	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Qxvi	glass	barrel	drawn	brown	3	4	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxvi	glass	barrel	drawn	brown	3	4	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sxvi	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txvi	glass	barrel	drawn	brown	2	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Uxvi	glass	barrel	drawn	brown	2.5	3	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxvi	glass	barrel	drawn	white	2	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48'' N 117º 13'6'' E NAMRIA Nav. Chart 4324 /8º19'54'' N 117º 13'46'' E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Wxvi	glass	barrel	drawn	brown	2	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxvi	glass	barrel	drawn	brown	2	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yxvi	glass	barrel	drawn	black	2.5	4	1.5	straitions parallel, dull	crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxvi	glass	barrel	drawn	brown	3	3	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Axvii	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxvii	glass	barrel	drawn	brown	4	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Cxvii	glass	barrel	drawn	brown	2.5	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxvii	glass	barrel	drawn	brown	2.5	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Exvii	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxvii	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gxvii	glass	barrel	drawn	brown	3.5	4.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxvii	glass	barrel	drawn	brown	2	4	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Ixvii	glass	barrel	drawn	brown	3	4	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxvii	glass	barrel	drawn	brown	2	3	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxvii	glass	barrel	drawn	brown	3	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxvii	glass	barrel	drawn	brown	3	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxvii	glass	barrel	drawn	brown	3	4	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxvii	glass	barrel	drawn	brown	3	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Oxvii	glass	barrel	drawn	brown	4	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxvii	glass	barrel	drawn	brown	3	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxvii	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxvii	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sxvii	glass	barrel	drawn	brown	2	3.5	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txvii	glass	barrel	drawn	brown	3	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Uxvii	glass	barrel	drawn	brown	3	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxvii	glass	barrel	drawn	brown	3	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wxvii	glass	barrel	drawn	brown	3	4	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxvii	glass	barrel	drawn	brown	2	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yxvii	glass	barrel	drawn	brown	2	3.5	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxvii	glass	barrel	drawn	brown	2	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Axviii	glass	annular	drawn	brown	3	5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxviii	glass	annular	drawn	brown	2.5	4.5	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cxviii	glass	annular	drawn	brown	2	4	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxviii	glass	annular	drawn	brown	2	4	3		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Exviii	glass	annular	drawn	brown	2	4	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxviii	glass	annular	drawn	brown	2	4.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1

Appendix 2: Morphology Analysis

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Gxviii	glass	annular	drawn	brown	3	5	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxviii	glass	annular	drawn	brown	2	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixviii	glass	annular	drawn	brown	3	4	?		crizzel; fell apart during analysis	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxviii	glass	annular	drawn	brown	2	4	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxviii	glass	annular	drawn	black	1.5	4	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxviii	glass	annular	drawn	black	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Mxviii	glass	annular	drawn	black	2	4.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxviii	glass	annular	drawn	black	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxviii	glass	annular	drawn	black	1.5	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxviii	glass	annular	drawn	black	2	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxviii	glass	annular	drawn	black	2	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxviii	glass	annular	drawn	black	1	3.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Sxviii	glass	annular	drawn	black	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txviii	glass	annular	drawn	black	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Uxviii	glass	annular	drawn	black	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxviii	glass	annular	drawn	black	2	5	3	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wxviii	glass	annular	drawn	black	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxviii	glass	annular	drawn	white	2	3.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Yxviii	glass	annular	drawn	white	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxviii	glass	annular	drawn	white	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Axix	glass	annular	drawn	white	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxix	glass	oblate	drawn	brown	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Cxix	glass	oblate	drawn	brown	3	5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxix	glass	oblate	drawn	brown	3	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Exix	glass	oblate	drawn	brown	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxix	glass	oblate	drawn	brown	3.5	5	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gxix	glass	oblate	drawn	brown	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxix	glass	oblate	drawn	brown	3	5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixix	glass	oblate	drawn	brown	4	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxix	glass	oblate	drawn	brown	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Kxix	glass	oblate	drawn	brown	2.5	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxix	glass	oblate	drawn	brown	2.5	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxix	glass	oblate	drawn	brown	2.54	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxix	glass	oblate	drawn	brown	2.5	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxix	glass	oblate	drawn	brown	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxix	glass	oblate	drawn	brown	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Qxix	glass	oblate	drawn	brown	3	4.5	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxix	glass	oblate	drawn	brown	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sxix	glass	oblate	drawn	brown	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Uxix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Wxix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yxix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxix	glass	oblate	drawn	brown	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Axx	glass	oblate	drawn	brown	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxx	glass	oblate	drawn	brown	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Cxx	glass	oblate	drawn	brown	2	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Dxx	glass	oblate	drawn	brown	2	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Exx	glass	oblate	drawn	black	3	4.5	2.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Fxx	glass	oblate	drawn	black	2.5	3.5	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Gxx	glass	oblate	drawn	black	3	47	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Hxx	glass	oblate	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Ixx	glass	oblate	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxx	glass	oblate	drawn	black	3	4.5	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Kxx	glass	oblate	drawn	black	3	4.5	?	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Lxx	glass	oblate	drawn	black	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Mxx	glass	oblate	drawn	black	3	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxx	glass	oblate	drawn	black	2.5	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Oxx	glass	oblate	drawn	black	2	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Pxx	glass	oblate	drawn	black	3	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxx	glass	oblate	drawn	black	2.5	4	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Rxx	glass	oblate	drawn	black	2.5	4	2	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Sxx	glass	oblate	drawn	black	2	3	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Txx	glass	oblate	drawn	white	2	4	1	striations parallel, pitted	calipers left a straight indent on one end of bead	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
IV-1993-V-1132	Uxx	glass	oblate	drawn	red	2	3	1.5	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Vxx	glass	oblate	drawn	red	2	4	1	striations parallel, shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Wxx	glass	oblate	drawn	brown	2.5	3.5	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Xxx	glass	oblate	drawn	brown	2	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yxx	glass	oblate	drawn	brown	3	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Zxx	glass	oblate	drawn	brown	2	3.5	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Axxi	glass	annular	drawn	brown	2	4	2.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Bxxi	glass	barrel	drawn	brown	3	3.5	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Ixxi	glass	oblate	drawn	brown	2.5	3	2		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Jxxi	glass	oblate	drawn	brown	2.5	3	1.5		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Nxxi	glass	oblate	drawn	black	2	3.5	1.5	striatioins parallel; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxxi	glass	oblate	drawn	black	3	4	2	striatioins parallel; shiney		1993-19; 1995-16; 1995-45; 1996-1

PANDANAN

Northing Easting Location: 8º 9'48" N 117º 13'6" E NAMRIA Nav. Chart 4324 /8º19'54" N 117º 13'46" E Magellan Sat Nav

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
IV-1993-V-1132	Pxxi	glass	oblate	drawn	black	3	4	1.5	striatioins parallel; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Qxxi	glass	oblate	drawn	brown	2.5	3	1		crizzel	1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Yxxii	glass	barrel	drawn	black	3	4	2	striations parallel; shiney		1993-19; 1995-16; 1995-45; 1996-1
IV-1993-V-1132	Oxxiv	glass	barrel	drawn	black / brown	2	3	1	crizzel; straitions parallel		1993-19; 1995-16; 1995-45;

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
III-2001-Z-1171	A	glass		multiple coiled	blue	4.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	B	glass		multiple coiled	blue	6.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	C	glass		multiple coiled	blue	5.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	D	glass		multiple coiled	blue	5.5	5.0	0.2 with obstrctions	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	E	glass		multiple coiled	blue	5.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	F	glass		multiple coiled	blue	4.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	G	glass		multiple coiled	blue	4.0	5.0	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	H	glass		multiple coiled	blue	7.0	5.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	I	glass		multiple coiled	blue	6.0	5.5	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	J	glass		multiple coiled	green, iradecent	6.5	5.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	K	glass		multiple coiled	blue	5.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	L	glass		multiple coiled	blue	4.0	6.0	0.3	plain; round	curly wind with deep striations along profile	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
III-2001-Z-1171	M	glass		multiple coiled	blue	5.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	N	glass		multiple coiled	blue	5.5	6.0	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	O	glass		multiple coiled	blue	5.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	P	glass		multiple coiled	blue	6.0	4.0	0.3-0.25	plain, oblong/oval	curly wind with deep striations along profile	
III-2001-Z-1171	Q	glass		multiple coiled	blue	4.5	5.0	BROKEN	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	R	glass		multiple coiled	blue	5.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	S	glass		multiple coiled	blue	5.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	T	glass		multiple coiled	blue	4.0	5.5	0.25-0.35	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	U	glass		multiple coiled	blue	6.0	7.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	V	glass		multiple coiled	blue	6.0	5.0	0.2-0.3 (outer ring)	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	W	glass		multiple coiled	blue	6.0	6.0	0.2 partly filled	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	X	glass		multiple coiled	blue	6.0	5.0	0.3	plain; round	curly wind with deep striations along profile	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
III-2001-Z-1171	Y	glass		multiple coiled	blue	7.0	5.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Z	glass		multiple coiled	blue	5.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ai	glass		multiple coiled	blue	5.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Bi	glass		multiple coiled	blue	6.0	5.0	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ci	glass		multiple coiled	blue	5.0	5.0	0.2 partly filled	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Di	glass		multiple coiled	blue	5.0	5.5	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ei	glass		multiple coiled	blue	4.0	6.0	0.3	filled; round	curly wind with deep striations along profile	
III-2001-Z-1171	Fi	glass		multiple coiled	green	4.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Gi	glass		multiple coiled	blue	4.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Hi	glass		multiple coiled	blue	4.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ii	glass		multiple coiled	blue	5.0	5.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ji	glass		multiple coiled	blue	4.0	6.0	0.25	plain; round	curly wind with deep striations along profile	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
III-2001-Z-1171	Ki	glass		multiple coiled	blue	3.5	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Li	glass		multiple coiled	blue	3.0	6.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Mi	glass		multiple coiled	blue	4.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ni	glass		multiple coiled	blue	4.0	5.0	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Oi	glass		multiple coiled	blue	4.5	4.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Pi	glass		multiple coiled	blue	5.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Qi	glass		multiple coiled	blue	4.0	5.5	0.35	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ri	glass		multiple coiled	blue	5.0	5.5	0.25	filled; round	curly wind with deep striations along profile	
III-2001-Z-1171	Si	glass		multiple coiled	blue	5.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ti	glass		multiple coiled	blue	3.0	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Ui	glass		multiple coiled	blue	4.0	4.5	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Vi	glass		multiple coiled	blue	3.0	5.5	0.3	plain; round	curly wind with deep striations along profile	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
III-2001-Z-1171	Wi	glass		multiple coiled	blue	4.0	4.5	0.25	partly filled; round	curly wind with deep striations along profile	
III-2001-Z-1171	Xi	glass		multiple coiled	blue	4.0	5.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Yi	glass		multiple coiled	blue	3.5	5.0	0.3	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Zi	glass		multiple coiled	blue	3.0	5.0	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Aii	glass		multiple coiled	color not very distinguishable; maybe green/grey	3.5	5.0	0.2	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Bii	glass		multiple coiled	blue	3.0	5.5	0.25	plain; round	curly wind with deep striations along profile	
III-2001-Z-1171	Cii	glass		multiple coiled	blue	4.0	4.0	0.2	plain; round	curly wind with deep striations along profile	

not clear on Inventory number the (1/J) means its either one or the letter 'j'; (0/C) means its either a zero or the letter 'c' - this was discussed with people from the Underwater Unit and agreed to the ID recorded here

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form	Glass Manufacture Type	Color	Height	Width	Bore size	surface features	Notes	Report ID
17J 50CMS 7/22	F	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.1;0.2	elipse/round		very chipped at one end, smooth surrounding other end

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
17J 50CMS 7/23	G	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0		elipse/round		smoth both ends with largerhole end concave and smaller hole end convex; flattened-'lip' around larger hole
III-2001-Z-0211	A	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.5	0.1;0.3 0.2-0.1	filled; round/tear-drop		larger hole end has 'lip'; other end relatively flat; smaller perforation 1mm
III-2001-Z-0211	B	glass	convex bicone	pressed? Coiled? Folded?	yellow	5.0	6.0	0.25; 0.2	filled; round		larger hole end has 'lip'; dip along mid-point of 'lip'; other end relatively flat
III-2001-Z-0211	C	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.3- 0.2	filled; round		larger hole end has 'lip', half broken?; otherside relatively flat
III-2001-Z-0211	D	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	7.0	0.15	filled; round		only one side has a hole

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0211	E	glass	convex bicone	pressed? Coiled? Folded?	yellow	3.0	5.5	0.2; 0.1	partly-filled; round/elipse		larger hole end has 'lip', half broken?; otherside relatively flat
III-2001-Z-0211	F	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2-0.1	partly-filled; round		larger hole end has 'lip'; otherside relatively flat; small indent on either side of larger bore
III-2001-Z-0211	G	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.15-0.1	plain; round		larger side has 'boken' lip'; small rise to smaller bore
III-2001-Z-0211	H	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.5	5.5	0.2-0.1	plain; round		larger side has lip' with indent across bore; small rise to smaller bore
III-2001-Z-0211	I	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.1	plain; round		larger side has lip' with indent across bore; small rise to smaller bore

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
III-2001-Z-0211	J	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.1	plain; round		larger side has lip' with indent across bore; small rise to smaller bore
III-2001-Z-0211	K	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.5	0.2; 0.1	plain; round		larger hole end has 'lip', half broken?/worn away; otherside relatively flat
III-2001-Z-0211	L	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.5	0.25; 0.1	plain; larger oblong; smaller round		larger hole end has 'lip'; otherside relatively flat
III-2001-Z-0211	M	glass	convex bicone	pressed? Coiled? Folded?	yellow	5.0	7.0			BROKEN half; strations raditating out from one area; insitu from Jar J17 /07 GL	
III-2001-Z-0211	N	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0				BROKEN pieces; insitu from Jar J17 /07 GL	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0213	A	glass	convex bicone	pressed? Coiled? Folded?	yellow	5.0	6.0	0.2; 0.1	plain; round	straitions running parallel from one edge to the other; closest form to Beck's (1928: 7) standard convex bicone (C1e) group one cicular IC1e; instu from Jar S20 AR I	
III-2001-Z-0213	B	glass	convex bicone	pressed? Coiled? Folded?	yellow	5.0	6.0	0.2; 0.1	plain; round	straitions radiating out from perforation; instu from Jar S20 AR I	
III-2001-Z-0213	C	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.5	0.2; 0.2	plain; round	straitions running parallel from one edge to the other; instu from Jar S20 AR I	
III-2001-Z-0213	D	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	7.0	0.2; 0.1	plain; round	straitions run multidirectional but straight, some curved round perforation; instu from Jar S20 AR I	
III-2001-Z-0213	E	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2; 0.15	plain; round/oblong	cannot see straitions with naked eye; instu from Jar S20 AR I	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0213	F	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2; 0.1	plain; round	straitions run from perforation to perforation and twist around the smaller perforation; instu from Jar S20 AR I	
III-2001-Z-0213	G	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.1; 0.05	plain; round	straitions run parallel to perforation; instu from Jar S20 AR I	
III-2001-Z-0213	H	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2; 0.1	plain; round	the flat side has shiney bits. I separated this one from another bead; instu from Jar S20 AR I	
III-2001-Z-0213	I	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.15	filled; oblong/filled	instu from Jar S20 AR I	
III-2001-Z-0213	J	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2; 0.1	filled; oblong/filled	instu from Jar S20 AR I	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0213	K	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.13	filled; round	straitions run from perforation to perforation and twist around the smaller perforation; instu from Jar S20 AR I	
III-2001-Z-0213	L	glass	convex bicone	pressed? Coiled? Folded?	yellow	5.0	6.0	0.2; 0.15	filled; round	straitions run from perforation to perforation; not completely visible with naked eye; instu from Jar S20 AR I	
III-2001-Z-0213	M	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2; 0.15	filled; round	straitions run from end to end and twist around the smaller perforation; instu from Jar S20 AR I	
III-2001-Z-0213	N	glass	convex bicone	pressed? Coiled? Folded?	yellow					BROKEN piece; instu from Jar S20 AR I	

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0214	A	glass	convex bicone	pressed? Coiled? Folded?	yellow	3.0	5.0	0.15	round; filled, only one hole and small bulge where perhaps second bore did not pierce		
III-2001-Z-0214	B	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.1	partly filled; round		larger side has lip' with indent across bore; relatively flat on the side with the smaller bore
III-2001-Z-0214	C	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.5	0.1; 0.1	partly filled; round		soft roundness to whole bead
III-2001-Z-0214	D	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.5	0.1; 0.1	plain; round		soft roundness to whole bead
III-2001-Z-0214	E	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2; 0.1	plain; round		larger side has lip' with dip to one side; small rise to smaller bore

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0214	F	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.2 only measure	plain; round		BROKEN; only measured side where hole is complete
III-2001-Z-0214	G	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	4.0	0.2; 0.1	plain; round		larger side has lip' with indent across bore; relatively flat on the side with the smaller bore
III-2001-Z-0214	H	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.1	plain; round		larger side has lip' with dip to one side; small rise to smaller bore
III-2001-Z-0214	I	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	5.0	0.15; 0.1	partly filled; round		larger side has lip' with dip to one side; small rise to smaller bore
III-2001-Z-0214	J	glass	convex bicone	pressed? Coiled? Folded?	yellow	5.0	6.0	0.2; 0.1	plain; round		larger side has lip' with dip to one side; small rise to smaller bore

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-0214	K	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.1	plain		larger side has lip' with indent across bore; relatively flat on the side with the smaller bore
III-2001-Z-0214	L	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	6.0	0.2; 0.2	plain		larger side has lip' with dip to one side; small rise to smaller bore
III-2001-Z-0214	M	glass	convex bicone	pressed? Coiled? Folded?	yellow	3.0	5.0	0.15; 0.1	plain		realitvely small to no rise between bores
III-2001-Z-0214	N	glass	convex bicone	pressed? Coiled? Folded?	yellow	4.0	7.0	0.2; 0.1	partly filled; round		realitvely small to no rise between bores

N.A. = no ascension; these were found in a plastic bag marked Black Beads. No other identification with them. The beads were heavily encrusted with conglomerate made of silty grey mud and sand particles. When speaking with Ed Bersamira and Larry Alba they spokeof their time diving on the Santa Cruz and the Pandanan sites. They discussed the environment. Santa Cruz was on a mud bottom and Pandanan on a sand bottom. The conglomerate these beads are in is only possible from a mud strata therefore from these conversations we inferred the Black Beads are from the Santa Cruz site.

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-N.A.	A	glass	oblate	drawn	grey	3	5	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	B	glass	barrel	drawn	black	2.5	4	1.5	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	C	glass	annular	drawn	black	2	4	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were in Hvdrocloric acid
III-2001-Z-N.A.	D	glass	annular	drawn	black	1.5	3	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	E	glass	annular/lenticular	drawn	black	2	6	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	F	glass	barrel	drawn	black	3	3.5	2	oblong/narrow		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	G	glass	barrel	drawn	black	3	4	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-N.A.	H	glass	annular	drawn	black	2	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	I	glass	barrel	drawn	black	3	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	J	glass	barrel	drawn	black	3	3.5	1.25	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	K	glass	barrel	drawn	black	2.5	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	L	glass	barrel	drawn	black	3	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	M	glass	barrel	drawn	black	3	3.5	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	N	glass	barrel	drawn	black	2	4	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-N.A.	O	glass	annular	drawn	black	2	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	P	glass	annular	drawn	black	2	5	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	Q	glass	annular	drawn	black	2	4	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	R	glass	annular	drawn	black	2	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	S	glass	barrel	drawn	black	2	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	T	glass	barrel	drawn	black	3	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	U	glass	oblate	drawn	black	3	4.5	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-N.A.	V	glass	barrel	drawn	black	2.5	3	1.5	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	W	glass	barrel/oblate	drawn	black	3	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	X	glass	barrel	drawn	black	4	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	Y	glass	barrel	drawn	black	3.5	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	Z	glass	barrel	drawn	black	3	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were
III-2001-Z-N.A.	Ai	glass	barrel	drawn	black	3	3.5	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	Bi	glass	barrel	drawn	black	2.5	4	2	oblong		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid

Santa Cruz

Northing Easting Location: 15°44'6"N 119°49'31"E (coordinates for Hermana Menor Island) [source Orillaneda 2013 video]

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
III-2001-Z-N.A.	Ci	glass	oblate	drawn	black	3	4	2	round		these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid cleaning during the time spent in Manila
III-2001-Z-N.A.	Di; Ei; Fi	glass	barrel; annular/barrel; annular/barrel	drawn	black	2.5;2; 2	4;3.5; 3	2;2; 2	round	multiple beads measured and stored in same pill box because not enough space for individual boxes	these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	Gi, Hi	glass	barrel	drawn	black	2; 2	4; 4	2; 2	round	multiple beads measured and stored in same pill box because not enough space for individual boxes	these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid
III-2001-Z-N.A.	Ii, Ji, Ki	glass	oblate/barrel	drawn	black	3; 2.5; 2	4.5; 4; 4	2; 1.5; 2	round	multiple beads measured and stored in same pill box because not enough space for individual boxes	these are measured in Muscat, Oman April 7th 2014. These were in Hydrocloric acid cleaning during the time spent in Manila and only 36 samples taken for export.

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	A	glass	annular	coiled/segmented?	translucent red	4	4	2.5	striations perpendicular	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled). This is a single whole bead and one half bead with a fusion between both. This fusion looks to be part of its manufacture.	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-8
1985	Ei	glass	**annular**	coiled	white	2; 1.5	4	2.5; thinner bead is 2.75	striations perpendicular	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled). 1 piece, 2 whole beads but very thin and fragile.	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-8

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Eii	glass	**annular**	coiled	white	3	5	3	striations perpendicular	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-8
1985	Eiii	glass	**annular**	coiled	white	2.5	4.5	3	striations perpendicular	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-9

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Eiv	glass	**annular**	coiled	white	2.5	4.5	3	striations perpendicular	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-10
1985	Fi	glass	unknown	coiled	orange	3			opaque, striations parallel	photos record F, not Fi. These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-11

Appendix 2: Morphology Analysis

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Fii	glass	unknown	coiled	translucent orange	2			very porus	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-12
1985	D	glass	annular; unknown	coiled	translusent black, grey, blue	2;2;3;1.5	5	3	striations perpendicular; very porus	see photos for order: first measure whole bead, then light greyish-translucent, then black, then very thin black-transulcent, piece with brown interior not measured. These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-13

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Ci	glass	annular	coiled	translucent yellow	3	5	3	striations perpendicular; very porus	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-14
1985	Civ	glass	annular	coiled	translucent yellow	3	4	2.5	striations perpendicular; very porus	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-15

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Cii	glass	annular	coiled	translucent yellow	2.5	4	2.75	striations perpendicular; very porus	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-16
1985	Ciii	glass	annular; unknown	coiled	translucent yellow	2; 2;2;1.5	5	3	striations perpendicular; very porus	see photos for order: first measure whole bead, then pieces to thinnest. These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-17

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bi	glass	annular	coiled	translucent ruby red	2	5	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-18
1985	Bii	glass	annular	coiled	translucent ruby red	2.5	5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-19

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Biii	glass	annular	coiled	translucent ruby red	2.5	5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-20
1985	Biv	glass	annular	coiled	translucent ruby red	2.5	5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-21

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bv	glass	annular	coiled	translucent ruby red	3	4.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-22
1985	Bvi	glass	annular	coiled	translucent ruby red	2.25	4	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-23

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bvii	glass	annular	coiled	translucent ruby red	2	4.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-24
1985	Bviii	glass	annular	coiled	translucent ruby red	2.5	4.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-25

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bix	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-26
1985	Bx	glass	annular	coiled	translucent ruby red	2.5	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-27

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxi	glass	annular	coiled	translucent ruby red	2	3.5	2	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-28
1985	Bxii	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-29

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxiii	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-30
1985	Bivx	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-31

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxv	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-32
1985	Bxvi	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-33

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxvii	glass	annular	coiled	translucent ruby red	2	3.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-34
1985	Bxviii	glass	annular	coiled	opaque ruby red	1.75	3.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-35

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxix	glass	annular	coiled	opaque ruby red	2	3.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-36
1985	Bxx	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-37

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	**Independent Bead Code**	**Material (preliminary)**	**Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)**	**Glass Manufacture Type**	**Color**	**Dimensions**			**surface features**	**Notes**	**Report ID**
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxxi	glass	annular	multi wound coiled	translucent redish grey	2	4	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-38
1985	Bxxii	glass	annular	multi wound coiled	translucent greyish red	2	4	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-39

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxxiii	glass	annular	coiled	translucent ruby red	2	4	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-40
1985	Bxxiv	glass	annular	coiled	translucent ruby red	2	4	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-41

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	**lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple**	**Coiled; Drawn; segmented/pressed**	**Blue; Red; Green; Yellow; Orange; Black; Grey; Brown**	**Height (parallel to bore - mm)**	**Width (perpendicular to bore - mm)**	**Bore Size**	**facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular**	**crackeled/crizzeled = brown or grey color, no diserable features**	
1985	Bxxv	glass	annular	coiled	translucent ruby red	1.5	3.5	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-42
1985	Bxxvi	glass	annular	coiled	translucent ruby red	2	3.5	2.5	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-43

ROYAL CAPTAIN SHOAL WRECK 2

Northing Easting Location: 09º03'N 116º40'E

NM Ascension ID	Independent Bead Code	Material (preliminary)	Form (glossary of terms, van der Leen 1956 p. 32, 34, 37, 44, 46)	Glass Manufacture Type	Color	Dimensions			surface features	Notes	Report ID
		Glass; stone; shell, Bone; horn	lozenge; bicone; barrel; cylinder; oval/ellipsoid; hexagonal prism; capped; segmented; lenticular; annular; oblate; multiple	Coiled; Drawn; segmented/pressed	Blue; Red; Green; Yellow; Orange; Black; Grey; Brown	Height (parallel to bore - mm)	Width (perpendicular to bore - mm)	Bore Size	facets; polished; bevelled; dimples; straitions parallel; straitions perpendicular	crackeled/crizzeled = brown or grey color, no diserable features	
1985	Bxxvii	glass	annular	coiled	translucent ruby red	2	4	3	striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-44
1985	Bxxviii	glass	pieces/annular	coiled	translucent ruby red				striations parallel	These were found in storage packaged in little folded paper envelopes with notes descibing the number (amount) and manufacture (coiled).	Report 1985-24 - Specifically on the beads; other reports include: 1985-9, 1988-9, 1999-45

Appendix 3: LA-ICP-MS results

	PANDANAN hAl-hMg								
	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
	black	black	black	black	black	black	black	black	black
	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
	1132-Gvi	1132-Mvi	1132-Eviii	1132-Hvi	1132-Fvi	1132-Ivi	1132-Hviii	1132-Ovii	1132-Nvi
SiO2	60.56%	60.71%	61.1%	62.71%	64.55%	61.06%	66.8%	64.7%	65.51%
Na2O	0.96%	1.10%	1.2%	1.40%	1.45%	1.81%	2.1%	2.4%	1.60%
MgO	19.55%	17.17%	24.3%	13.84%	12.52%	14.01%	16.3%	16.9%	10.97%
Al2O3	10.96%	11.47%	7.2%	13.13%	12.56%	13.81%	8.2%	9.3%	12.48%
P2O5	0.13%	0.14%	0.2%	0.16%	0.11%	0.08%	0.2%	0.1%	0.10%
K2O	0.50%	0.65%	0.8%	0.82%	0.95%	0.95%	1.0%	1.1%	1.16%
CaO	1.27%	1.82%	1.0%	2.26%	2.47%	1.89%	1.3%	1.6%	3.10%
MnO	0.12%	0.14%	0.1%	0.09%	0.09%	0.09%	0.1%	0.1%	0.09%
Fe2O3	5.62%	6.46%	3.8%	5.23%	4.93%	5.84%	3.5%	3.3%	4.57%
CuO	0.11%	0.11%	0.1%	0.10%	0.09%	0.13%	0.4%	0.1%	0.10%
SnO2	0.06%	0.07%	0.0%	0.07%	0.09%	0.06%	0.0%	0.0%	0.05%
PbO	0.13%	0.12%	0.1%	0.12%	0.15%	0.23%	0.1%	0.1%	0.22%
Li	28	24	12	22	16	28	7	9	15
Be	2	2	1	2	2	2	1	2	2
B	137	95	78	86	79	60	61	66	82
Sc	8	9	5	10	10	12	7	7	11
Ti	2386	2727	1013	2920	2798	3532	1432	1552	3066
V	135	131	89	159	175	222	99	136	203
Cr	58	61	33	66	64	71	44	41	60
Ni	56	74	43	55	48	123	45	57	101
Co	52	64	29	54	55	124	19	72	127
Zn	137	173	94	207	172	170	103	119	218
As	50	66	35	42	48	54	72	53	60
Rb	3	6	3	7	7	6	5	7	10
Sr	47	112	62	160	176	130	127	183	242
Zr	178	196	115	213	226	315	169	223	276
Nb	13	15	9	16	17	18	13	12	15
Ag	1	1	1	1	1	2	3	1	1
Sb	7	8	4	4	5	3	6	4	6

Appendix 3: LA-ICP-MS results

	PANDANAN hAl-hMg								
	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
	black	black	black	black	black	black	black	black	black
	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
	1132-Gvi	1132-Mvi	1132-Eviii	1132-Hvi	1132-Fvi	1132-Ivi	1132-Hviii	1132-Ovii	1132-Nvi
Cs	0	0	0	0	0	0	0	0	0
Ba	4	24	8	22	22	5	13	13	15
La	21	44	21	35	25	35	38	37	30
Ce	51	99	52	83	63	84	89	83	71
Pr	5	10	5	8	6	8	8	8	7
Ta	1	1	1	1	1	1	1	1	1
Au	0	0	0	0	0	0	0	0	0
Y	13	16	12	17	16	17	15	15	18
Bi	0	0	0	0	0	0	0	0	0
U	108	170	52	168	203	85	235	159	163
W	0	0	0	0	0	0	0	0	0
Mo	1	3	1	4	4	0	5	1	1
Nd	16	31	18	26	21	27	27	27	24
Sm	3	5	3	5	4	5	5	5	5
Eu	1	1	1	1	1	1	1	1	1
Gd	3	4	3	4	4	4	4	4	4
Tb	0	1	0	1	1	1	1	1	1
Dy	3	3	2	3	3	4	3	3	4
Ho	1	1	0	1	1	1	1	1	1
Er	1	2	1	2	2	2	2	2	2
Tm	0	0	0	0	0	0	0	0	0
Yb	2	2	1	2	2	2	2	2	2
Lu	0	0	0	0	0	0	0	0	0
Hf	5	5	3	6	6	8	5	7	8
Th	41	44	24	50	51	42	40	36	37

Appendix 3: LA-ICP-MS results

	PANDANAN hAl-hMg								
	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
	black	black	black	black	black	black	black	black	black
	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
	1132-Gvi	1132-Mvi	1132-Eviii	1132-Hvi	1132-Fvi	1132-Ivi	1132-Hviii	1132-Ovii	1132-Nvi

Appendix 3: LA-ICP-MS results

			PANDANAN m-Na-Al Type 2								
drawn	drawn		drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
black	black		black	black	red	black	red	red	red	red	red
opaque	opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1132-Evi	1132-Qvii		1132-Gviii	1132-Cviii	1087-E	1132-Fxiv	1087-D	N.A-Z	1087-C	N.A-Y	1575-B
70.09%	70.6%	**SiO2**	60.0%	58.7%	58.50%	55.70%	57.30%	58.35%	57.87%	59.92%	55.77%
3.01%	2.4%	**Na2O**	20.4%	21.6%	19.55%	20.67%	19.71%	21.28%	20.57%	20.33%	21.56%
5.06%	10.8%	**MgO**	2.9%	2.8%	1.03%	2.47%	1.20%	1.49%	0.98%	1.62%	1.19%
12.57%	8.8%	**Al2O3**	6.7%	6.4%	8.02%	7.42%	7.93%	9.12%	7.65%	8.22%	9.14%
0.25%	0.1%	**P2O5**	0.2%	0.2%	0.13%	0.20%	0.11%	0.12%	0.12%	0.12%	0.12%
1.41%	1.6%	**K2O**	1.7%	1.7%	1.79%	1.91%	1.91%	1.92%	1.93%	1.98%	1.98%
3.40%	1.8%	**CaO**	3.5%	3.5%	5.63%	6.58%	7.46%	3.79%	6.68%	4.11%	5.49%
0.07%	0.1%	**MnO**	0.1%	0.1%	0.08%	0.15%	0.10%	0.07%	0.09%	0.07%	0.11%
3.73%	3.5%	**Fe2O3**	3.7%	3.8%	3.11%	4.58%	2.56%	2.99%	2.45%	2.77%	2.80%
0.09%	0.1%	**CuO**	0.0%	0.0%	0.38%	0.03%	0.36%	0.46%	0.24%	0.27%	0.37%
0.06%	0.0%	**SnO2**	0.0%	0.0%	0.08%	0.04%	0.07%	0.10%	0.06%	0.14%	0.08%
0.11%	0.1%	**PbO**	0.0%	0.2%	0.30%	0.15%	0.13%	0.24%	0.20%	0.37%	0.18%
5	6	**Li**	11	12	14	16	20	27	17	26	25
2	1	**Be**	1	1	1	1	1	1	1	1	1
74	58	**B**	84	87	116	116	99	147	80	143	128
10	7	**Sc**	7	7	7	12	6	7	6	6	7
2776	1509	**Ti**	1423	1403	1938	2616	1867	2279	1773	2108	2201
146	127	**V**	71	79	121	132	91	102	80	96	124
71	38	**Cr**	27	33	34	55	31	29	30	28	37
26	46	**Ni**	12	14	63	15	54	32	39	31	56
22	62	**Co**	11	12	38	21	36	14	25	15	35
131	126	**Zn**	79	106	205	126	220	176	117	229	149
38	43	**As**	12	9	18	6	11	14	10	9	18
12	10	**Rb**	33	36	39	48	37	47	42	44	59
350	235	**Sr**	155	150	211	267	254	259	236	271	235
225	215	**Zr**	149	148	146	200	138	173	135	156	178
16	12	**Nb**	9	9	9	13	9	10	8	10	10
1	1	**Ag**	0	0	4	0	4	6	3	4	3
5	5	**Sb**	2	1	6	2	5	8	4	5	8

Appendix 3: LA-ICP-MS results

PANDANAN m-Na-Al Type 2

drawn	drawn		drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
black	black		black	black	red	black	red	red	red	red	red
opaque	opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1132-Evi	1132-Qvii		1132-Gviii	1132-Cviii	1087-E	1132-Fxiv	1087-D	N.A-Z	1087-C	N.A-Y	1575-B
0	0	**Cs**	0	1	1	1	0	1	1	1	1
26	29	**Ba**	309	320	334	445	337	301	349	282	324
57	42	**La**	30	32	32	38	32	27	31	24	30
140	93	**Ce**	62	72	63	84	62	58	59	52	64
13	9	**Pr**	6	7	7	9	7	6	7	6	7
1	1	**Ta**	1	1	1	1	1	1	1	1	1
0	0	**Au**	0	0	0	0	0	0	0	0	0
23	16	**Y**	15	17	14	25	14	16	14	15	16
0	0	**Bi**	0	0	1	0	1	1	1	1	2
338	208	**U**	164	245	173	212	180	90	106	88	156
0	0	**W**	0	0	0	0	0	0	0	0	0
5	1	**Mo**	2	4	1	2	1	1	1	1	1
40	31	**Nd**	22	24	22	31	23	22	22	20	24
7	6	**Sm**	4	5	4	6	4	4	4	4	5
1	1	**Eu**	1	1	1	1	1	1	1	1	1
6	5	**Gd**	3	4	3	5	3	3	3	3	3
1	1	**Tb**	0	1	0	1	0	0	0	0	1
5	4	**Dy**	3	3	3	5	3	3	3	3	3
1	1	**Ho**	1	1	1	1	1	1	1	1	1
3	2	**Er**	2	2	1	2	1	2	1	2	2
0	0	**Tm**	0	0	0	0	0	0	0	0	0
2	2	**Yb**	1	2	1	2	1	2	1	1	2
0	0	**Lu**	0	0	0	0	0	0	0	0	0
6	7	**Hf**	4	4	4	6	4	5	4	4	5
53	36	**Th**	20	21	23	22	21	16	20	14	19

drawn	drawn
black	black
opaque	opaque
1132-Evi	1132-Qvii

PANDANAN m-Na-Al Type 2

drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
black	black	red	black	red	red	red	red	red
opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1132-Gviii	1132-Cviii	1087-E	1132-Fxiv	1087-D	N.A-Z	1087-C	N.A-Y	1575-B

Appendix 3: LA-ICP-MS results

drawn		drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
red		black	black	red	black	black	red	black	red	black	black	black
opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1575-A		1132-Oviii	1132-Qvii	N.A-Pvii	1132-Jxiv	1132-Exiv	N.A-W	1132-Ovii	N.A-X	1132-Ixiv	1132-Bviii	1132-Ivix
55.72%	**SiO2**	59.6%	60.4%	61.44%	55.52%	60.81%	58.87%	64.0%	59.47%	55.99%	59.6%	55.31%
20.64%	**Na2O**	19.6%	18.6%	20.33%	21.84%	16.38%	20.69%	19.3%	20.58%	22.69%	21.9%	20.19%
1.29%	**MgO**	2.7%	3.1%	0.91%	2.22%	2.73%	1.40%	1.7%	1.19%	2.44%	1.7%	1.41%
8.66%	**Al2O3**	6.3%	7.1%	9.10%	7.26%	8.76%	9.75%	6.2%	9.59%	7.04%	7.1%	9.78%
0.11%	**P2O5**	0.2%	0.2%	0.12%	0.19%	0.16%	0.12%	0.2%	0.13%	0.18%	0.2%	0.19%
2.01%	**K2O**	2.0%	2.0%	2.12%	2.13%	2.13%	2.13%	2.2%	2.18%	2.24%	2.3%	2.27%
6.33%	**CaO**	3.8%	3.4%	2.63%	5.33%	4.73%	3.31%	2.6%	3.23%	4.93%	3.0%	5.28%
0.12%	**MnO**	0.1%	0.1%	0.07%	0.13%	0.11%	0.07%	0.2%	0.07%	0.13%	0.1%	0.12%
2.90%	**Fe2O3**	4.7%	3.9%	2.74%	5.13%	3.84%	3.08%	2.7%	2.94%	4.08%	3.0%	3.94%
0.48%	**CuO**	0.0%	0.0%	0.31%	0.03%	0.04%	0.31%	0.1%	0.36%	0.03%	0.1%	0.03%
0.12%	**SnO2**	0.0%	0.0%	0.04%	0.02%	0.03%	0.10%	0.0%	0.06%	0.03%	0.0%	0.02%
0.22%	**PbO**	0.1%	0.0%	0.13%	0.09%	0.19%	0.10%	0.0%	0.15%	0.13%	0.1%	0.05%
27	**Li**	11	13	20	18	12	28	16	26	18	11	18
1	**Be**	1	1	1	1	1	2	1	1	1	1	2
137	**B**	89	109	109	94	85	165	95	152	93	69	118
8	**Sc**	6	7	7	9	11	7	5	7	10	6	11
2270	**Ti**	1470	1614	2196	2185	2655	2267	1126	2270	2093	1338	3356
102	**V**	75	80	109	114	127	107	63	127	113	69	118
30	**Cr**	31	31	38	47	64	34	30	40	50	33	46
33	**Ni**	13	10	29	17	20	29	15	57	19	10	14
14	**Co**	12	12	13	17	16	13	11	36	17	11	17
166	**Zn**	79	109	115	90	99	117	53	95	94	90	97
15	**As**	8	7	9	4	33	19	12	16	4	8	5
48	**Rb**	41	37	59	53	43	55	59	57	53	49	48
253	**Sr**	177	181	193	239	300	238	135	222	206	170	236
176	**Zr**	164	179	176	211	259	170	139	175	188	165	225
10	**Nb**	10	11	11	13	16	10	10	10	12	10	14
7	**Ag**	0	0	3	0	1	4	1	4	0	1	1
10	**Sb**	1	2	5	1	3	5	4	6	1	2	2

Appendix 3: LA-ICP-MS results

drawn red opaque 1575-A		drawn black opaque 1132-Oviii	drawn black opaque 1132-Qvii	drawn red opaque N.A-Pvii	drawn black opaque 1132-Jxiv	drawn black opaque 1132-Exiv	drawn red opaque N.A-W	drawn black opaque 1132-Ovii	drawn red opaque N.A-X	drawn black opaque 1132-Ixiv	drawn black opaque 1132-Bviii	drawn black opaque 1132-Ivix
1	**Cs**	1	1	1	1	1	1	1	1	1	1	1
295	**Ba**	391	407	375	448	315	314	331	313	373	404	436
27	**La**	36	39	44	41	40	27	34	28	36	34	42
59	**Ce**	74	82	94	85	96	61	72	59	84	72	91
6	**Pr**	8	8	9	9	9	6	7	6	8	8	10
1	**Ta**	1	1	1	1	1	1	1	1	1	1	2
0	**Au**	0	0	0	0	0	0	0	0	0	1	0
17	**Y**	17	19	18	22	24	15	15	16	22	17	25
1	**Bi**	0	0	1	0	0	1	0	1	0	0	0
91	**U**	193	233	622	210	291	93	214	138	274	207	228
0	**W**	0	0	0	0	0	0	0	0	0	0	1
1	**Mo**	2	1	1	2	4	1	2	1	5	1	2
22	**Nd**	27	30	30	30	32	22	25	21	29	26	32
4	**Sm**	5	6	5	6	6	4	5	4	5	5	6
1	**Eu**	1	1	1	1	1	1	1	1	1	1	2
3	**Gd**	4	5	4	4	5	3	3	3	4	4	5
0	**Tb**	1	1	1	1	1	0	1	0	1	1	1
3	**Dy**	3	4	4	4	5	3	3	3	4	3	5
1	**Ho**	1	1	1	1	1	1	1	1	1	1	1
2	**Er**	2	2	2	2	3	2	2	2	2	2	3
0	**Tm**	0	0	0	0	0	0	0	0	0	0	1
2	**Yb**	2	2	2	2	2	2	2	2	2	2	3
0	**Lu**	0	0	0	0	0	0	0	0	0	0	1
5	**Hf**	5	6	5	6	7	5	4	5	5	5	6
16	**Th**	23	28	37	26	33	16	27	17	24	22	31

Appendix 3: LA-ICP-MS results

drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
red	black	black	red	black	black	red	black	red	black	black	black
opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1575-A	1132-Oviii	1132-Qvii	N.A-Pvii	1132-Jxiv	1132-Exiv	N.A-W	1132-Ovii	N.A-X	1132-Ixiv	1132-Bviii	1132-Ivix

Appendix 3: LA-ICP-MS results

										SANTA CRUZ Pb-K		
drawn		drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	coil	coil	coil
black		black	black	red	black	black	red	red	black	turquoise	turqoise	turqoise
opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1132-Qvii		1132-Qviii	1132-Ovii	N.A-Nvii	1132-Hxiv	1132-Xv_1	N.A-Ovii	N.A-Mvii	1132-Gxiv	1171-I	1171-J	1171-K
58.2%	**SiO2**	68.1%	64.5%	59.17%	57.76%	55.01%	58.48%	65.03%	58.46%	36.7%	35.7%	36.0%
20.8%	**Na2O**	11.1%	18.0%	20.58%	21.13%	21.04%	21.08%	13.40%	20.16%	0.9%	1.9%	0.4%
2.6%	**MgO**	2.5%	1.7%	1.04%	1.70%	0.98%	1.08%	1.19%	1.68%	0.1%	0.3%	0.1%
7.0%	**Al2O3**	7.7%	4.4%	10.00%	7.87%	10.44%	9.61%	10.08%	8.13%	0.2%	0.7%	0.2%
0.2%	**P2O5**	0.3%	0.3%	0.17%	0.20%	0.15%	0.11%	0.12%	0.19%	0.0%	0.0%	0.0%
2.3%	**K2O**	2.4%	2.4%	2.39%	2.44%	2.48%	2.51%	2.75%	3.15%	10.2%	10.4%	8.6%
3.9%	**CaO**	2.8%	5.7%	2.75%	4.46%	4.83%	3.16%	3.26%	4.08%	4.1%	5.0%	3.6%
0.1%	**MnO**	0.1%	0.1%	0.07%	0.11%	0.11%	0.09%	0.10%	0.13%	0.0%	0.0%	0.0%
3.8%	**Fe2O3**	4.0%	1.7%	3.25%	4.07%	3.48%	2.92%	3.07%	3.87%	0.2%	1.0%	0.2%
0.1%	**CuO**	0.1%	0.0%	0.34%	0.08%	0.03%	0.46%	0.45%	0.03%	1.0%	0.9%	0.9%
0.0%	**SnO2**	0.0%	0.1%	0.05%	0.02%	0.02%	0.12%	0.13%	0.01%	0.1%	0.1%	0.1%
0.1%	**PbO**	0.2%	0.2%	0.11%	0.06%	0.08%	0.31%	0.35%	0.01%	46.1%	43.3%	49.2%
12	**Li**	6	14	21	16	18	23	12	27	3	7	4
1	**Be**	1	1	2	1	1	2	1	2	0	0	0
89	**B**	94	90	122	67	60	130	149	99	4	12	4
7	**Sc**	8	3	8	9	9	7	8	8	0	1	0
1614	**Ti**	1610	687	2755	2107	3078	2448	2529	1906	25	75	18
79	**V**	95	74	108	123	101	98	105	111	2	5	1
40	**Cr**	42	16	49	49	54	29	28	58	1	1	1
13	**Ni**	20	12	52	30	17	37	42	32	16	10	18
13	**Co**	15	17	25	25	14	18	20	34	1	1	1
82	**Zn**	106	154	71	74	53	233	211	50	66	1169	54
6	**As**	9	16	10	7	2	8	13	4	360	121	675
50	**Rb**	29	46	73	69	67	66	48	98	5	8	**6**
209	**Sr**	187	221	204	235	278	220	249	195	18	46	11
173	**Zr**	192	92	189	175	228	187	195	182	3	9	2
11	**Nb**	13	5	13	15	15	12	13	14	0	1	0
1	**Ag**	1	0	3	1	0	6	6	0	34	36	75
2	**Sb**	2	2	6	2	1	9	11	1	384	153	1223

Appendix 3: LA-ICP-MS results

										SANTA CRUZ Pb-K		
drawn		drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	coil	coil	coil
black		black	black	red	black	black	red	red	black	turquoise	turqoise	turqoise
opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1132-Qvii		1132-Qviii	1132-Ovii	N.A-Nvii	1132-Hxiv	1132-Xv_1	N.A-Ovii	N.A-Mvii	1132-Gxiv	1171-I	1171-J	1171-K
1	**Cs**	1	1	1	1	1	1	1	1	0	0	0
461	**Ba**	313	244	409	500	506	401	392	451	14	36	12
41	**La**	44	17	38	48	46	37	37	42	1	3	1
86	**Ce**	106	35	80	96	96	80	81	96	2	5	2
9	**Pr**	10	4	8	10	10	8	8	9	0	1	0
1	**Ta**	1	1	1	1	1	1	1	1	0	0	0
0	**Au**	0	0	0	0	0	0	0	0	0	0	0
18	**Y**	21	9	19	23	25	19	19	22	2	2	1
0	**Bi**	0	0	1	0	0	1	1	0	7	4	47
235	**U**	420	131	208	280	227	293	286	208	0	0	0
0	**W**	0	0	0	0	0	0	0	0	0	0	0
2	**Mo**	7	1	2	3	2	1	2	2	2	4	2
31	**Nd**	34	14	28	35	35	27	28	31	1	2	1
6	**Sm**	6	2	5	6	7	5	5	6	0	1	0
1	**Eu**	1	1	1	1	1	1	1	1	0	0	0
5	**Gd**	5	2	4	5	5	4	4	5	0	0	0
1	**Tb**	1	0	1	1	1	1	1	1	0	0	0
4	**Dy**	4	2	4	4	5	3	3	4	0	0	0
1	**Ho**	1	0	1	1	1	1	1	1	0	0	0
2	**Er**	2	1	2	2	3	2	2	2	0	0	0
0	**Tm**	0	0	0	0	0	0	0	0	0	0	0
2	**Yb**	2	1	2	2	3	2	2	2	0	0	0
0	**Lu**	0	0	0	0	0	0	0	0	0	0	0
6	**Hf**	6	3	5	5	7	5	6	5	0	0	0
27	**Th**	33	12	34	26	28	29	30	30	0	1	0

Appendix 3: LA-ICP-MS results

									SANTA CRUZ Pb-K		
drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	coil	coil	coil
black	black	black	red	black	black	red	red	black	turquoise	turqoise	turqoise
opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1132-Qvii	1132-Qviii	1132-Ovii	N.A-Nvii	1132-Hxiv	1132-Xv_1	N.A-Ovii	N.A-Mvii	1132-Gxiv	1171-I	1171-J	1171-K

Appendix 3: LA-ICP-MS results

		SANTA CRUZ m-Na-Al type 4									
coil		coil	coil	coil	coil	coil	coil	coil	coil	coil	coil
turqoise		yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1171-H		0211-A	0211-B	0211-D	0211-G	0211-E	0211-C	0214-F	0214-G	0211-F	0214-E
35.6%	**SiO2**	58.95%	53.42%	54.93%	60.5%	62.5%	54.26%	62.0%	62.3%	61.0%	63.4%
0.6%	**Na2O**	12.73%	14.28%	12.86%	15.0%	16.0%	13.77%	16.1%	16.3%	16.4%	14.9%
0.1%	**MgO**	0.50%	0.56%	0.55%	1.1%	1.2%	0.64%	1.2%	1.2%	1.2%	1.3%
0.3%	**Al2O3**	4.71%	5.30%	5.34%	4.2%	4.3%	6.11%	4.4%	4.5%	4.6%	4.9%
0.0%	**P2O5**	0.19%	0.17%	0.19%	0.2%	0.2%	0.16%	0.2%	0.2%	0.2%	0.2%
10.7%	**K2O**	1.56%	1.61%	1.68%	2.1%	2.0%	1.83%	1.9%	2.0%	2.1%	2.1%
3.8%	**CaO**	0.77%	0.72%	0.73%	0.8%	0.9%	0.69%	1.0%	1.0%	0.8%	0.8%
0.0%	**MnO**	0.20%	0.25%	0.18%	0.3%	0.3%	0.17%	0.3%	0.3%	0.3%	0.3%
0.2%	**Fe2O3**	1.47%	1.60%	1.60%	1.7%	1.7%	1.80%	1.8%	1.8%	1.8%	1.9%
1.0%	**CuO**	0.00%	0.00%	0.00%	0.0%	0.0%	0.00%	0.0%	0.0%	0.0%	0.0%
0.1%	**SnO2**	1.71%	1.77%	2.00%	1.0%	0.8%	1.73%	0.9%	0.7%	0.8%	0.7%
47.5%	**PbO**	17.18%	20.27%	19.89%	12.8%	10.0%	18.78%	10.2%	9.7%	10.6%	9.3%
4	**Li**	16	13	16	14	11	16	11	13	13	14
0	**Be**	1	1	1	1	1	2	1	1	1	1
4	**B**	78	71	71	71	72	68	83	86	72	86
0	**Sc**	4	4	5	4	4	5	4	4	4	9
26	**Ti**	1259	1450	1432	870	874	1627	907	921	919	940
1	**V**	27	39	36	39	35	53	35	36	43	42
1	**Cr**	16	23	20	19	19	30	21	22	21	22
25	**Ni**	8	11	9	10	9	11	9	11	10	10
1	**Co**	5	15	6	6	5	9	12	13	6	18
27	**Zn**	28	32	28	27	29	32	30	30	27	32
89	**As**	12	4	5	18	18	10	15	15	20	15
6	**Rb**	63	62	70	64	63	72	62	63	65	66
15	**Sr**	33	52	48	48	42	67	56	58	52	61
5	**Zr**	176	231	1093	189	183	201	236	240	197	2468
0	**Nb**	7	8	8	8	8	9	9	9	9	9
87	**Ag**	2	4	3	5	5	4	5	4	4	7
87	**Sb**	2	2	1	2	2	2	1	1	2	1

coil turqoise opaque 1171-H		SANTA CRUZ m-Na-Al type 4 coil yellow opaque 0211-A	coil yellow opaque 0211-B	coil yellow opaque 0211-D	coil yellow opaque 0211-G	coil yellow opaque 0211-E	coil yellow opaque 0211-C	coil yellow opaque 0214-F	coil yellow opaque 0214-G	coil yellow opaque 0211-F	coil yellow opaque 0214-E
0	**Cs**	3	3	3	3	3	3	3	3	3	4
14	**Ba**	280	415	346	418	363	433	450	476	416	635
2	**La**	25	32	30	34	33	35	38	39	36	38
3	**Ce**	57	75	67	74	69	79	86	88	76	90
0	**Pr**	6	8	7	8	8	8	9	10	9	9
0	**Ta**	1	1	1	1	1	1	1	1	1	1
0	**Au**	0	0	0	0	0	0	0	0	0	0
1	**Y**	18	22	22	19	19	24	21	22	20	59
6	**Bi**	0	1	1	3	3	1	1	1	2	1
0	**U**	31	53	43	39	35	59	55	58	40	81
0	**W**	1	2	2	2	2	2	2	2	2	2
1	**Mo**	1	3	3	4	4	3	4	4	6	3
1	**Nd**	22	27	25	28	27	30	32	33	30	33
0	**Sm**	5	5	5	6	5	6	6	7	6	8
0	**Eu**	1	1	1	1	1	1	1	1	1	9
0	**Gd**	4	5	4	5	5	5	5	5	5	9
0	**Tb**	1	1	1	1	1	1	1	1	1	2
0	**Dy**	4	4	4	4	4	5	5	5	4	11
0	**Ho**	1	1	1	1	1	1	1	1	1	3
0	**Er**	2	2	2	2	2	3	3	3	2	8
0	**Tm**	0	0	0	0	0	0	0	0	0	1
0	**Yb**	2	2	3	2	2	2	3	3	2	11
0	**Lu**	0	0	0	0	0	0	0	0	0	2
0	**Hf**	6	7	38	7	6	6	9	9	7	166
0	**Th**	12	15	14	15	15	16	18	18	17	25

Appendix 3: LA-ICP-MS results

	SANTA CRUZ m-Na-Al type 4									
coil	coil	coil	coil	coil	coil	coil	coil	coil	coil	coil
turqoise	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
1171-H	0211-A	0211-B	0211-D	0211-G	0211-E	0211-C	0214-F	0214-G	0211-F	0214-E

Appendix 3: LA-ICP-MS results

SANTA CRUZ m-Na-Al type 2												
drawn black opaque N.A-M		drawn black opaque N.A-L	drawn black opaque N.A-Gi, Hi	drawn black opaque N.A-Di, Ei, Fi	drawn black opaque N.A-Ii, Ji, Ki	drawn black opaque N.A-O	drawn black opaque N.A-J	drawn black opaque N.A-Ci	drawn black opaque N.A-P	drawn black opaque N.A-I	drawn black opaque N.A-K	drawn black opaque N.A-N
58.6%	**SiO2**	56.92%	58.3%	58.1%	61.2%	63.2%	57.76%	66.8%	61.2%	56.60%	57.76%	61.4%
21.7%	**Na2O**	22.54%	21.0%	20.9%	19.7%	19.4%	20.94%	15.5%	19.0%	21.31%	20.81%	18.9%
1.6%	**MgO**	1.55%	2.8%	2.8%	1.7%	1.8%	1.06%	1.5%	1.8%	1.06%	1.06%	1.8%
5.9%	**Al2O3**	8.79%	6.2%	6.4%	6.6%	6.2%	10.33%	5.9%	7.0%	11.15%	10.33%	6.9%
0.7%	**P2O5**	0.18%	0.2%	0.2%	0.2%	0.2%	0.20%	0.2%	0.2%	0.16%	0.20%	0.2%
3.7%	**K2O**	2.15%	2.2%	2.3%	2.6%	2.4%	2.39%	3.2%	2.3%	2.46%	2.49%	2.4%
3.1%	**CaO**	3.22%	3.8%	3.9%	3.0%	2.8%	2.79%	3.1%	3.3%	3.13%	2.86%	3.2%
0.1%	**MnO**	0.08%	0.1%	0.1%	0.3%	0.3%	0.06%	0.1%	0.1%	0.08%	0.06%	0.1%
3.4%	**Fe2O3**	4.27%	4.2%	4.1%	3.1%	2.9%	4.19%	2.3%	3.9%	3.84%	4.18%	4.1%
0.1%	**CuO**	0.02%	0.1%	0.0%	0.5%	0.1%	0.08%	0.1%	0.1%	0.03%	0.06%	0.1%
0.0%	**SnO2**	0.04%	0.0%	0.0%	0.0%	0.0%	0.03%	0.0%	0.0%	0.02%	0.03%	0.0%
0.1%	**PbO**	0.19%	0.2%	0.2%	0.1%	0.0%	0.11%	0.1%	0.1%	0.08%	0.09%	0.1%
88	**Li**	19	13	14	18	17	18	11	12	19	18	12
10	**Be**	1	1	1	1	1	1	1	1	2	2	1
463	**B**	93	86	89	97	104	67	104	65	63	70	66
6	**Sc**	9	7	8	6	5	9	4	6	10	9	6
1265	**Ti**	2826	1545	1613	1309	1208	2944	1004	1482	3355	2951	1479
75	**V**	112	83	84	72	65	126	85	86	110	126	84
33	**Cr**	51	36	38	35	33	50	27	35	58	49	35
113	**Ni**	17	19	15	34	14	28	19	18	16	25	22
18	**Co**	16	13	13	12	11	24	15	19	15	25	19
72	**Zn**	90	84	90	52	50	80	71	67	59	76	69
864	**As**	2	3	7	6	10	3	7	9	1	2	10
53	**Rb**	56	46	45	74	67	69	52	57	70	70	59
188	**Sr**	206	174	177	167	158	228	162	202	306	233	194
147	**Zr**	192	163	176	163	154	183	123	146	249	183	150
12	**Nb**	12	11	13	12	11	15	8	13	16	15	13
2	**Ag**	0	1	0	3	1	1	1	2	0	1	1
34	**Sb**	2	2	2	5	4	2	4	2	1	2	2

Appendix 3: LA-ICP-MS results

SANTA CRUZ m-Na-Al type 2												
drawn black opaque N.A-M		drawn black opaque N.A-L	drawn black opaque N.A-Gi, Hi	drawn black opaque N.A-Di, Ei, Fi	drawn black opaque N.A-Ii, Ji, Ki	drawn black opaque N.A-O	drawn black opaque N.A-J	drawn black opaque N.A-Ci	drawn black opaque N.A-P	drawn black opaque N.A-I	drawn black opaque N.A-K	drawn black opaque N.A-N
2	**Cs**	1	1	1	1	1	1	1	1	1	1	1
469	**Ba**	386	382	387	411	400	499	323	518	561	499	498
44	**La**	37	37	38	39	39	49	26	48	48	49	49
90	**Ce**	84	85	87	82	83	98	53	98	102	97	98
10	**Pr**	8	8	9	8	8	10	6	11	11	10	11
1	**Ta**	1	1	1	1	1	1	1	1	1	1	1
0	**Au**	0	0	0	0	0	0	0	0	0	0	0
17	**Y**	21	18	19	17	16	23	11	19	26	23	19
0	**Bi**	0	0	0	1	0	0	0	0	0	0	0
312	**U**	297	301	310	248	246	304	171	334	240	298	324
0	**W**	0	0	0	0	0	0	0	0	0	0	0
3	**Mo**	5	5	4	2	2	2	2	2	2	2	2
33	**Nd**	29	29	30	29	29	36	20	36	37	35	36
6	**Sm**	6	6	6	5	5	7	4	7	7	7	6
1	**Eu**	1	1	1	1	1	1	1	1	1	1	1
5	**Gd**	5	5	5	4	4	5	3	5	6	5	5
1	**Tb**	1	1	1	1	1	1	0	1	1	1	1
4	**Dy**	4	4	4	3	4	4	2	4	5	4	4
1	**Ho**	1	1	1	1	1	1	0	1	1	1	1
2	**Er**	2	2	2	2	2	2	1	2	3	2	2
0	**Tm**	0	0	0	0	0	0	0	0	0	0	0
2	**Yb**	2	2	2	2	2	2	1	2	3	2	2
0	**Lu**	0	0	0	0	0	0	0	0	0	0	0
5	**Hf**	6	5	6	5	5	5	4	5	7	5	5
27	**Th**	25	25	28	31	31	28	17	29	30	27	28

Appendix 3: LA-ICP-MS results

	SANTA CRUZ m-Na-Al type 2											
drawn		drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn	drawn
black		black	black	black	black	black	black	black	black	black	black	black
opaque		opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque	opaque
N.A-M		N.A-L	N.A-Gi, Hi	N.A-Di, Ei, Fi	N.A-Ii, Ji, Ki	N.A-O	N.A-J	N.A-Ci	N.A-P	N.A-I	N.A-K	N.A-N

Appendix 3: LA-ICP-MS results

		Royal Captain Shoal wreck 2 Pb-K									
		coil	coil	coil	coil	coil	coil	coil	coil	coil	coil
		red	red	red	red	red	red	red	red	red	yellow
		translucent	translucent	translucent	translucent	translucent	translucent	translucent	translucent	translucent	opaque
		Bvii	Bii	Bi	Bviii	Biii	Biv	Bvi	Bv	A	Civ
SiO2	**SiO2**	29.6%	33.0%	29.6%	28.4%	29.3%	31.0%	30.4%	33.9%	35.22%	34.87%
Na2O	**Na2O**	0.1%	0.8%	0.2%	0.2%	0.1%	0.1%	0.2%	0.9%	0.12%	0.42%
MgO	**MgO**	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.09%	0.07%
Al2O3	**Al2O3**	0.2%	0.2%	0.5%	0.2%	0.3%	0.3%	0.2%	0.2%	0.58%	0.26%
P2O5	**P2O5**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.01%	0.00%
K2O	**K2O**	5.2%	5.3%	5.3%	5.4%	5.7%	5.7%	6.3%	5.2%	5.77%	5.98%
CaO	**CaO**	0.3%	0.4%	0.5%	0.4%	0.2%	0.8%	0.4%	0.4%	0.79%	0.26%
MnO	**MnO**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.01%	0.01%
Fe2O3	**Fe2O3**	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.20%	0.24%
CuO	**CuO**	0.4%	0.3%	0.4%	0.4%	0.4%	0.4%	0.6%	0.6%	0.29%	0.01%
SnO2	**SnO2**	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%	0.12%	0.60%
PbO	**PbO**	63.6%	59.4%	62.7%	64.4%	63.4%	61.0%	60.7%	58.1%	56.63%	57.23%
Li	**Li**	3	2	3	3	8	8	4	3	4	4
Be	**Be**	0	0	0	0	0	0	0	0	0	0
B	**B**	2	2	2	2	1	2	2	3	4	2
Sc	**Sc**	0	0	0	0	0	0	0	0	0	0
Ti	**Ti**	18	15	42	20	15	14	10	20	74	29
V	**V**	0	1	2	1	1	1	0	1	3	2
Cr	**Cr**	0	1	0	0	0	0	0	0	0	1
Ni	**Ni**	4	6	6	2	5	6	4	4	8	4
Co	**Co**	0	0	0	1	1	0	0	1	1	2
Zn	**Zn**	770	683	738	988	981	766	1492	570	1007	85
As	**As**	82	22	68	2	3	172	148	176	92	222
Rb	**Rb**	22	21	25	35	23	43	42	**20**	33	33
Sr	**Sr**	2	3	11	2	2	3	3	5	15	5
Zr	**Zr**	3	1	4	2	3	2	1	3	7	3
Nb	**Nb**	1	0	1	1	1	0	0	0	1	1
Ag	**Ag**	22	24	11	6	9	35	26	8	13	151
Sb	**Sb**	374	115	213	17	35	251	1659	218	250	158

Appendix 3: LA-ICP-MS results

		Royal Captain Shoal wreck 2 Pb-K									
		coil	coil	coil	coil	coil	coil	coil	coil	coil	coil
		red	red	red	red	red	red	red	red	red	yellow
		translucent	translucent	translucent	translucent	translucent	translucent	translucent	translucent	translucent	opaque
		Bvii	Bii	Bi	Bviii	Biii	Biv	Bvi	Bv	A	Civ
Cs	**Cs**	0	0	0	0	0	0	0	0	0	0
Ba	**Ba**	4	5	17	5	6	9	5	18	19	8
La	**La**	1	0	1	1	1	1	0	1	1	1
Ce	**Ce**	3	1	3	2	1	2	1	2	4	2
Pr	**Pr**	0	0	0	0	0	0	0	0	0	0
Ta	**Ta**	0	0	0	0	0	0	0	0	0	0
Au	**Au**	0	0	0	0	0	0	0	0	0	0
Y	**Y**	1	0	1	1	2	3	0	0	1	1
Bi	**Bi**	19.27	1.58	3.05	2.25	0.41	3.03	40.30	11.21	4	34
U	**U**	0.30	0.15	0.25	0.29	0.33	0.40	0.22	0.17	0	0
W	**W**	0.05	0.04	0.06	0.07	0.72	0.65	0.04	0.07	0	16
Mo	**Mo**	0.16	0.04	1.10	0.15	0.22	0.10	0.17	0.07	1	0
Nd	**Nd**	0.53	0.35	0.99	0.69	0.65	0.85	0.37	0.54	1	1
Sm	**Sm**	0.12	0.09	0.20	0.14	0.20	0.34	0.08	0.11	0	0
Eu	**Eu**	0.02	0.01	0.03	0.02	0.02	0.02	0.01	0.03	0	0
Gd	**Gd**	0.11	0.09	0.18	0.14	0.26	0.42	0.07	0.10	0	0
Tb	**Tb**	0.02	0.01	0.03	0.02	0.05	0.09	0.02	0.02	0	0
Dy	**Dy**	0.13	0.09	0.18	0.16	0.39	0.61	0.08	0.08	0	0
Ho	**Ho**	0.03	0.02	0.03	0.03	0.08	0.14	0.02	0.02	0	0
Er	**Er**	0.08	0.05	0.09	0.10	0.25	0.42	0.05	0.05	0	0
Tm	**Tm**	0.01	0.01	0.01	0.02	0.04	0.06	0.01	0.01	0	0
Yb	**Yb**	0.09	0.04	0.10	0.09	0.26	0.45	0.05	0.06	0	0
Lu	**Lu**	0.01	0.01	0.02	0.02	0.04	0.07	0.01	0.01	0	0
Hf	**Hf**	0.17	0.08	0.18	0.13	0.17	0.10	0.07	0.12	0	0
Th	**Th**	0.94	0.44	1.26	0.90	0.78	0.77	0.45	0.53	1	1

Royal Captain Shoal wreck 2 Pb-K

coil	coil	coil	coil	coil	coil	coil	coil	coil	coil
red	red	red	red	red	red	red	red	red	yellow
translucent	translucent	translucent	translucent	translucent	translucent	translucent	translucent	translucent	opaque
Bvii	Bii	Bi	Bviii	Biii	Biv	Bvi	Bv	A	Civ

Appendix 3: LA-ICP-MS results

coil		coil	coil	coil	coil	coil	coil	coil
yellow		dark	orange	orange	white	white	white	white
opaque		translucent	translucent	opaque	opaque	opaque	opaque	opaque
Ciii_2		D_2	Fii	Fi	Eiii	Eii	Ei	Eiv
37.56%	**SiO2**	37.50%	34.64%	31.87%	31.7%	34.4%	35.3%	34.4%
0.07%	**Na2O**	0.19%	0.11%	0.40%	0.2%	0.5%	0.8%	0.2%
0.02%	**MgO**	0.12%	0.03%	0.43%	0.0%	0.0%	0.0%	0.0%
0.33%	**Al2O3**	1.43%	0.38%	1.95%	0.4%	0.4%	0.4%	0.4%
0.00%	**P2O5**	0.02%	0.00%	0.09%	0.0%	0.0%	0.0%	0.0%
7.92%	**K2O**	7.94%	6.86%	11.91%	7.0%	7.3%	7.9%	8.4%
0.11%	**CaO**	1.98%	0.05%	3.72%	2.8%	4.0%	3.4%	3.3%
0.01%	**MnO**	0.49%	0.02%	0.14%	0.0%	0.0%	0.0%	0.0%
0.10%	**Fe2O3**	0.70%	0.19%	3.25%	0.1%	0.1%	0.2%	0.1%
0.03%	**CuO**	0.18%	0.30%	4.94%	0.1%	0.0%	0.0%	0.0%
0.21%	**SnO2**	0.04%	0.09%	0.16%	0.0%	0.0%	0.0%	0.0%
53.41%	**PbO**	49.30%	57.03%	37.51%	57.5%	52.9%	51.8%	52.9%
16	**Li**	23	4	10	12	11	5	13
0	**Be**	0	0	0	0	0	0	0
3	**B**	3	1	21	2	3	4	2
0	**Sc**	2	0	2	0	0	0	0
25	**Ti**	355	31	843	19	25	41	20
1	**V**	9	1	112	2	2	3	1
0	**Cr**	4	0	6	2	1	2	1
10	**Ni**	49	3	147	3	6	2	1
1	**Co**	293	1	12	1	0	1	0
76	**Zn**	154	2112	27826	91	53	33	13
45	**As**	69	3	198	222	6	86	3
18	**Rb**	21	45	51	9	7	10	9
3	**Sr**	28	3	73	7	10	10	10
3	**Zr**	184	3	153	2	2	4	2
1	**Nb**	4	1	8	1	1	1	1
144	**Ag**	163	69	64	106	117	26	162
1006	**Sb**	60	102	145	314	12	2	5

coil		coil	coil	coil	coil	coil	coil	coil
yellow		dark	orange	orange	white	white	white	white
opaque		translucent	translucent	opaque	opaque	opaque	opaque	opaque
Ciii_2		D_2	Fii	Fi	Eiii	Eii	Ei	Eiv
0	**Cs**	0	0	1	0	0	0	0
11	**Ba**	219	12	132	9	7	10	5
1	**La**	7	1	12	1	2	2	1
2	**Ce**	58	3	23	2	3	4	2
0	**Pr**	2	0	2	0	0	0	0
0	**Ta**	0	0	1	0	0	0	0
0	**Au**	0	0	0	0	0	0	0
4	**Y**	11	1	8	4	4	2	3
33	**Bi**	29	3	54	9	0	6	62
0	**U**	1	0	3	0	0	1	0
1	**W**	2	0	1	1	1	0	1
0	**Mo**	1	1	1	1	0	0	0
1	**Nd**	6	1	8	1	1	1	1
0	**Sm**	2	0	2	0	0	0	0
0	**Eu**	0	0	0	0	0	0	0
0	**Gd**	2	0	1	0	0	0	0
0	**Tb**	0	0	0	0	0	0	0
1	**Dy**	2	0	1	1	1	0	1
0	**Ho**	0	0	0	0	0	0	0
0	**Er**	1	0	1	0	0	0	0
0	**Tm**	0	0	0	0	0	0	0
0	**Yb**	1	0	1	0	0	0	0
0	**Lu**	0	0	0	0	0	0	0
0	**Hf**	6	0	5	0	0	0	0
1	**Th**	5	1	7	1	1	1	1

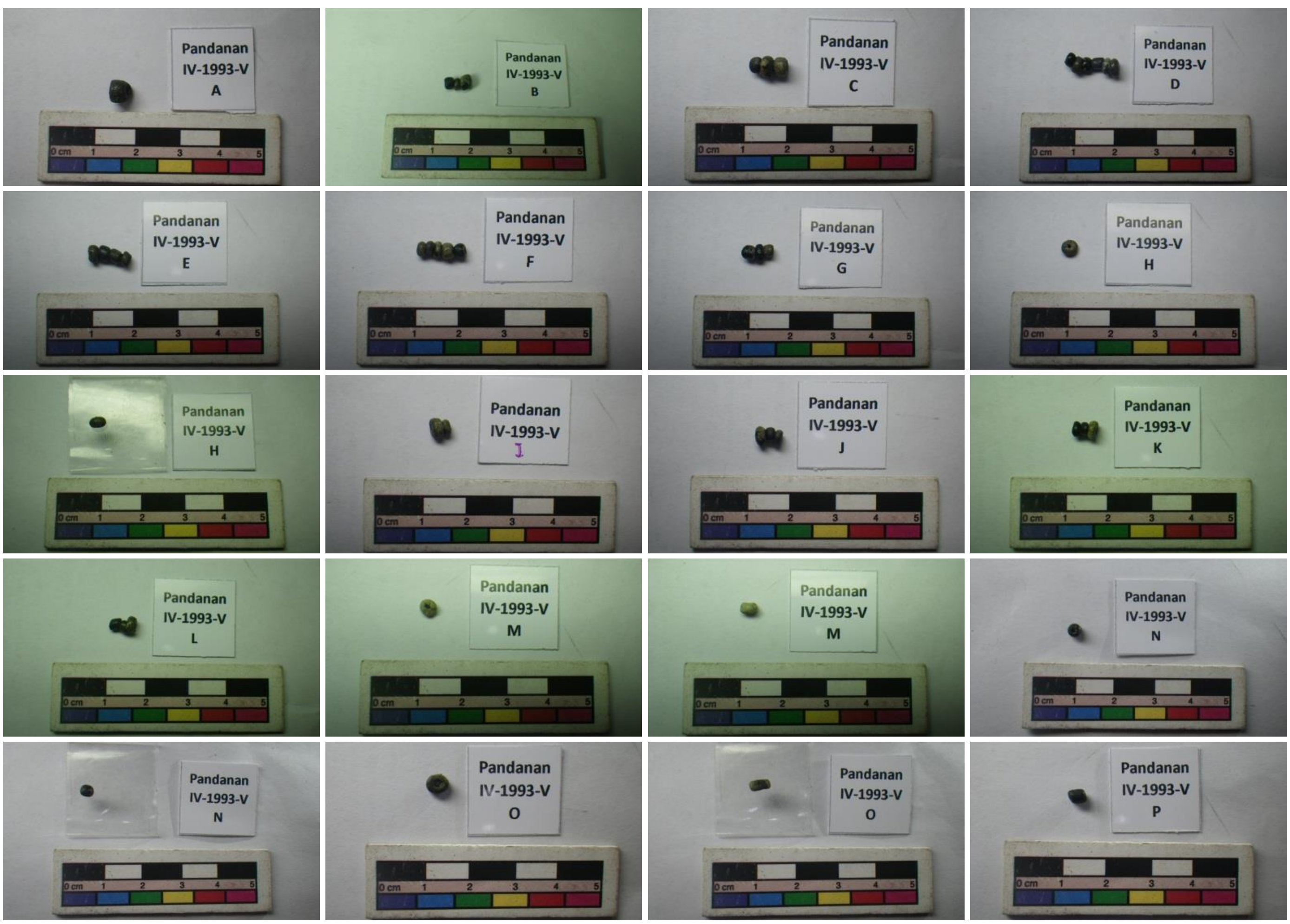
Appendix 3: LA-ICP-MS results

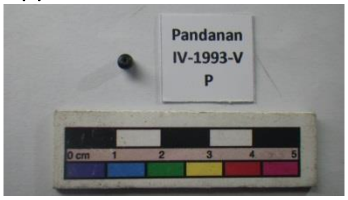
coil	coil	coil	coil	coil	coil	coil	coil
yellow	dark	orange	orange	white	white	white	white
opaque	translucent	translucent	opaque	opaque	opaque	opaque	opaque
Ciii_2	D_2	Fii	Fi	Eiii	Eii	Ei	Eiv

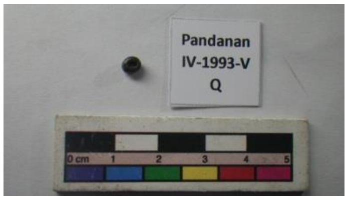
1087

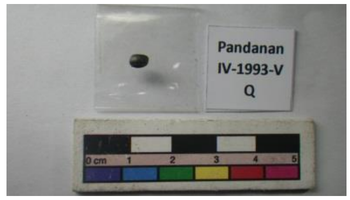

Pandanan
IV-1993-V
1087
A[redacted]
Pandanan
IV-1993-V
1087
A[redacted]
Pandanan
IV-1993-V
1087
B[redacted]
Pandanan
IV-1993-V
1087
B[redacted]
Pandanan
IV-1993-V
1087
C[redacted]
Pandanan
IV-1993-V
1087
C[redacted]
Pandanan
IV-1993-V
1087
D[redacted]
Pandanan
IV-1993-V
1087
D[redacted]
Pandanan
IV-1993-V
1087
E[redacted]

1132

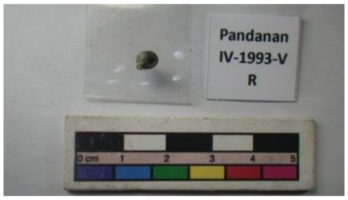

Pandanan
IV-1993-V
A
Pandanan
IV-1993-V
B
Pandanan
IV-1993-V
C
Pandanan
IV-1993-V
D
Pandanan
IV-1993-V
E
Pandanan
IV-1993-V
F
Pandanan
IV-1993-V
G
Pandanan
IV-1993-V
H
Pandanan
IV-1993-V
H
Pandanan
IV-1993-V
I
Pandanan
IV-1993-V
J
Pandanan
IV-1993-V
K
Pandanan
IV-1993-V
L
Pandanan
IV-1993-V
M
Pandanan
IV-1993-V
M
Pandanan
IV-1993-V
N
Pandanan
IV-1993-V
N
Pandanan
IV-1993-V
O
Pandanan
IV-1993-V
O
Pandanan
IV-1993-V
P

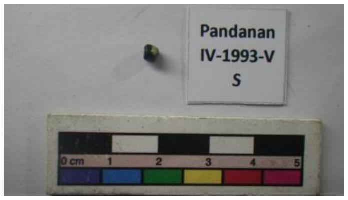

Pandanan
IV-1993-V
P

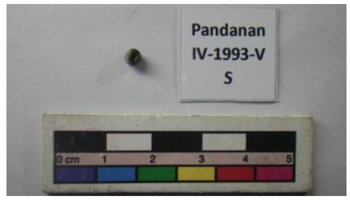

Pandanan
IV-1993-V
Q

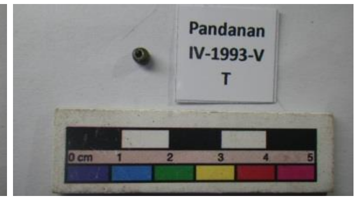

Pandanan
IV-1993-V
Q

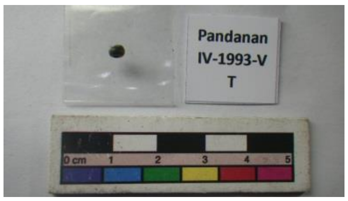

Pandanan
IV-1993-V
R


Pandanan
IV-1993-V
R


Pandanan
IV-1993-V
S


Pandanan
IV-1993-V
S

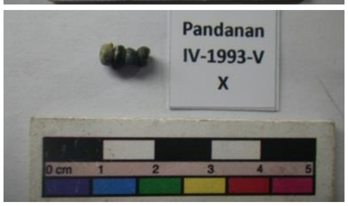

Pandanan
IV-1993-V
T

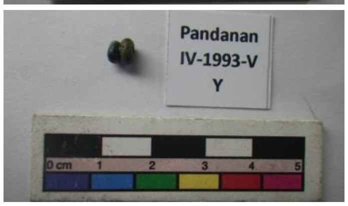

Pandanan
IV-1993-V
T

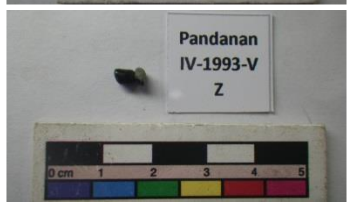

Pandanan
IV-1993-V
U

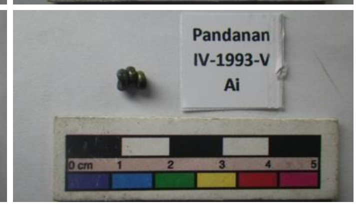

Pandanan
IV-1993-V
V


Pandanan
IV-1993-V
W


Pandanan
IV-1993-V
X


Pandanan
IV-1993-V
Y


Pandanan
IV-1993-V
Z

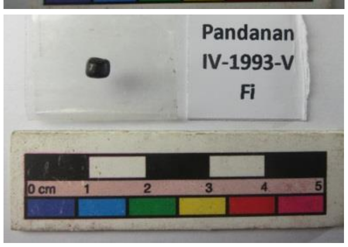

Pandanan
IV-1993-V
Ai

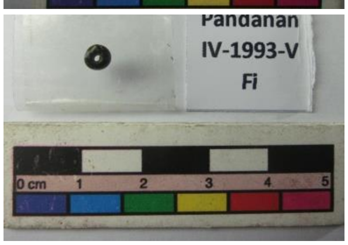

Pandanan
IV-1993-V
Bi


Pandanan
IV-1993-V
Ci

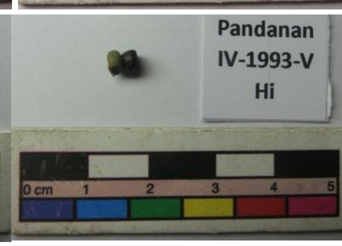

Pandanan
IV-1993-V
Di

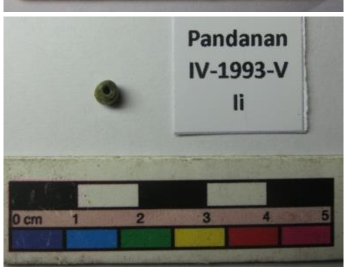

Pandanan
IV-1993-V
Ei

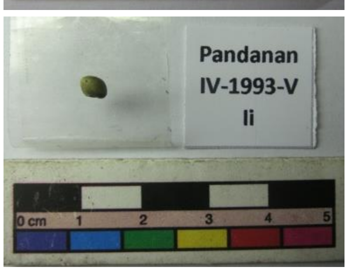

Pandanan
IV-1993-V
Fi

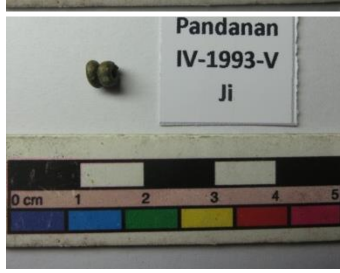

Pandanan
IV-1993-V
Fi


Pandanan
IV-1993-V
Gi


Pandanan
IV-1993-V
Hi


Pandanan
IV-1993-V
Ii

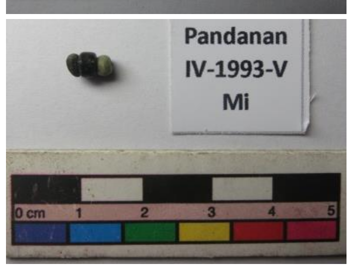

Pandanan
IV-1993-V
Ii


Pandanan
IV-1993-V
Ji

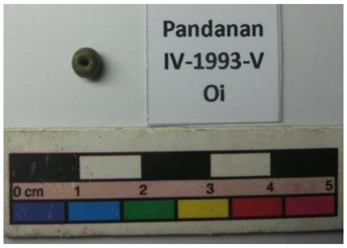
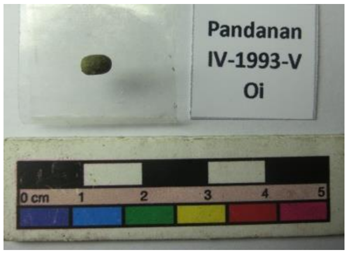
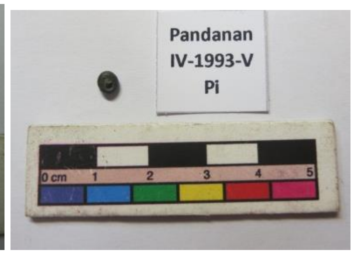
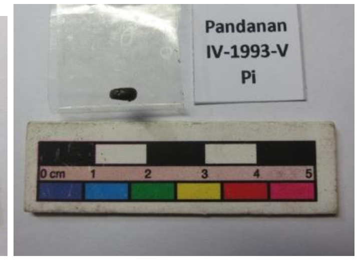
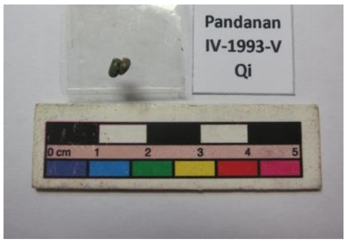
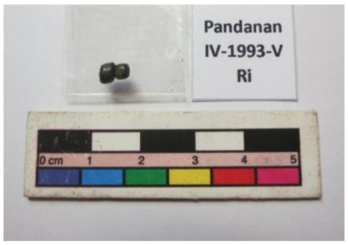
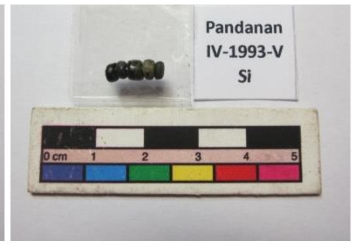
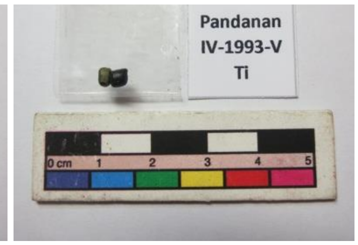
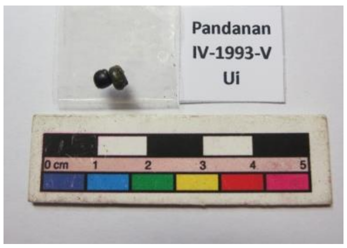
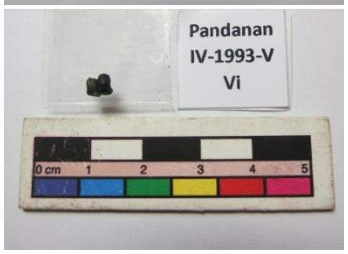
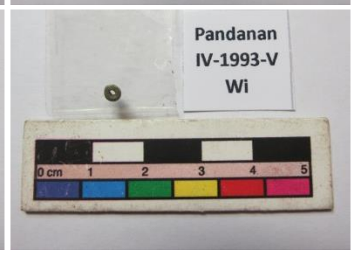

Pandanan
IV-1993-V
Ki

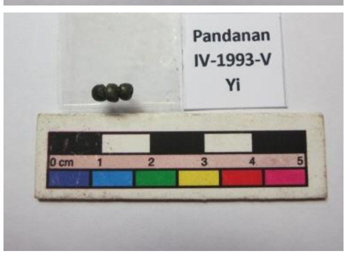

Pandanan
IV-1993-V
Lii


Pandanan
IV-1993-V
Lii

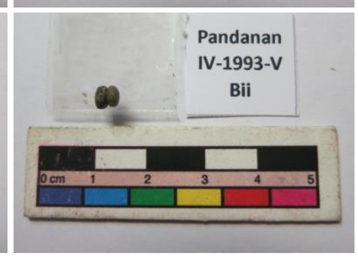
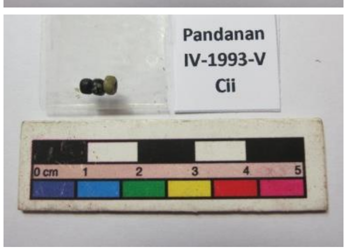

Pandanan
IV-1993-V
Mi

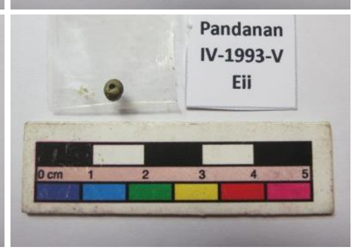
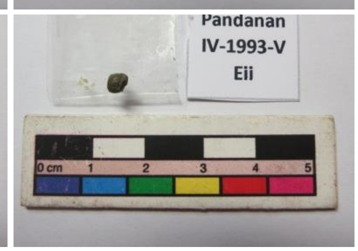

Pandanan
IV-1993-V
Ni

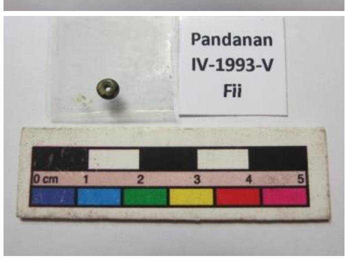
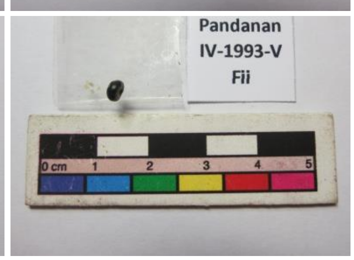
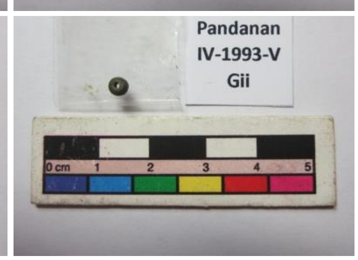
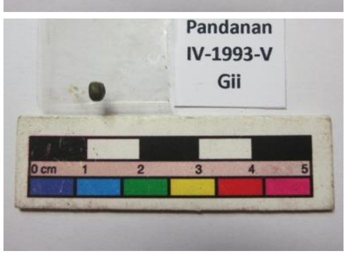
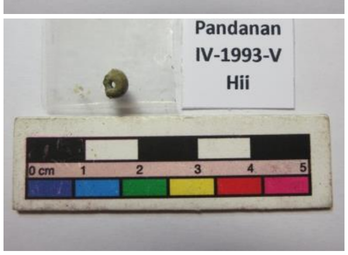
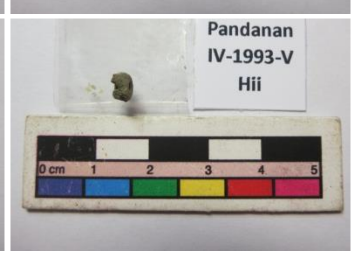
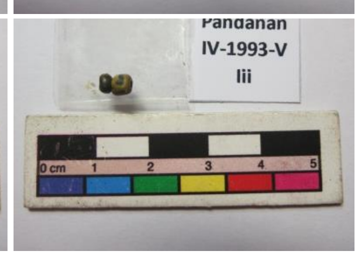

Pandanan
IV-1993-V
Oi

Pandanan
IV-1993-V
Oi

Pandanan
IV-1993-V
Pi

Pandanan
IV-1993-V
Pi

Pandanan
IV-1993-V
Qi

Pandanan
IV-1993-V
Ri

Pandanan
IV-1993-V
Si

Pandanan
IV-1993-V
Ti

Pandanan
IV-1993-V
Ui

Pandanan
IV-1993-V
Vi

Pandanan
IV-1993-V
Wi

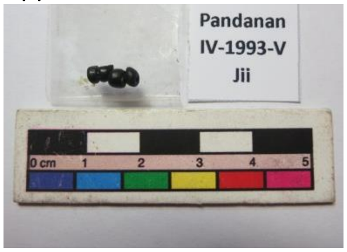
Pandanan
IV-1993-V
Xi

Pandanan
IV-1993-V
Yi

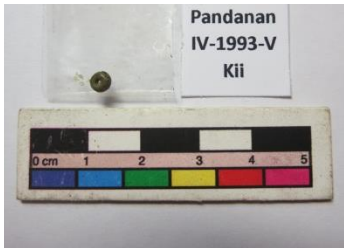
Pandanan
IV-1993-V
Zi

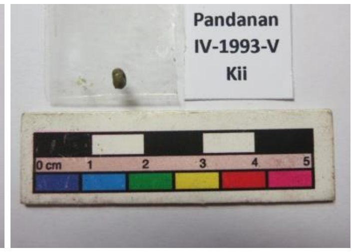
Pandanan
IV-1993-V
Aii

Pandanan
IV-1993-V
Bii

Pandanan
IV-1993-V
Cii

IV-1993-V
Dii

Pandanan
IV-1993-V
Eii

Pandanan
IV-1993-V
Eii

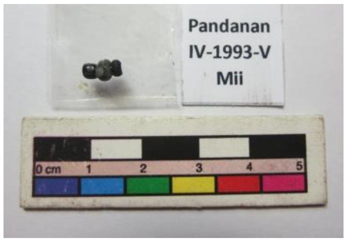
Pandanan
IV-1993-V
Fii

Pandanan
IV-1993-V
Fii

Pandanan
IV-1993-V
Fii

Pandanan
IV-1993-V
Gii

Pandanan
IV-1993-V
Gii

Pandanan
IV-1993-V
Hii

Pandanan
IV-1993-V
Hii

IV-1993-V
Iii

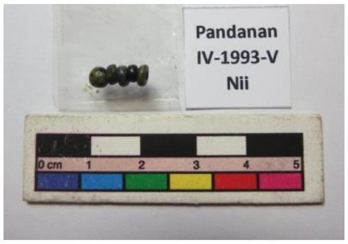

Pandanan
IV-1993-V
Jii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Kii
0 cm 1 2 3 4 5

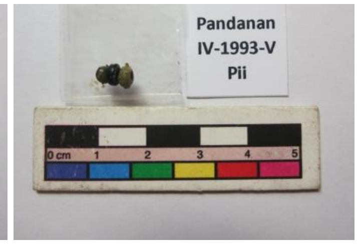

Pandanan
IV-1993-V
Kii
0 cm 1 2 3 4 5

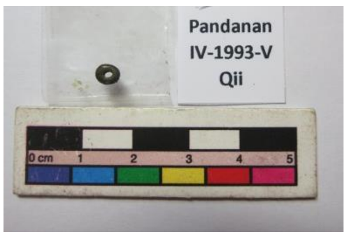

Pandanan
IV-1993-V
Lii
0 cm 1 2 3 4 5

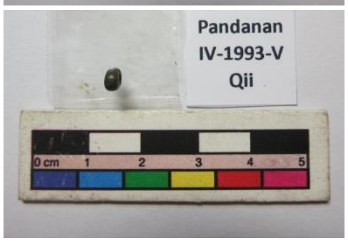

Pandanan
IV-1993-V
Mii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Nii
0 cm 1 2 3 4 5

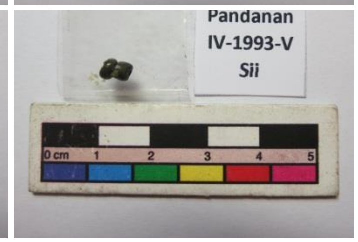

Pandanan
IV-1993-V
Oii
0 cm 1 2 3 4 5

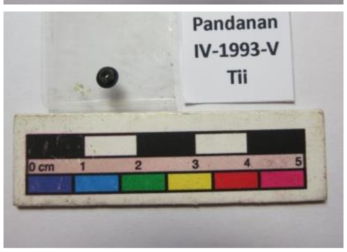

Pandanan
IV-1993-V
Pii
0 cm 1 2 3 4 5

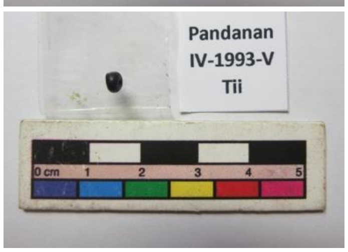

Pandanan
IV-1993-V
Qii
0 cm 1 2 3 4 5

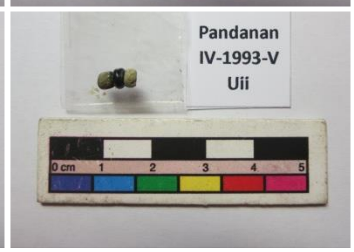

Pandanan
IV-1993-V
Qii
0 cm 1 2 3 4 5

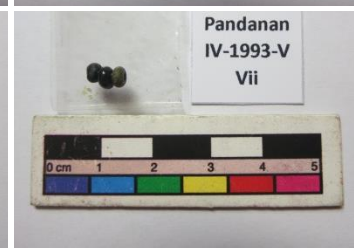

Pandanan
IV-1993-V
Rii
0 cm 1 2 3 4 5

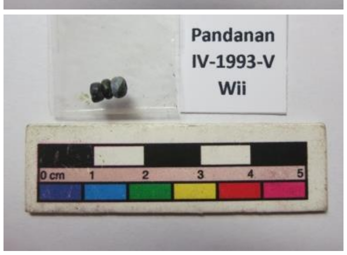

Pandanan
IV-1993-V
Sii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Tii
0 cm 1 2 3 4 5

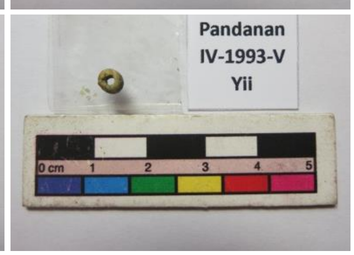

Pandanan
IV-1993-V
Tii
0 cm 1 2 3 4 5

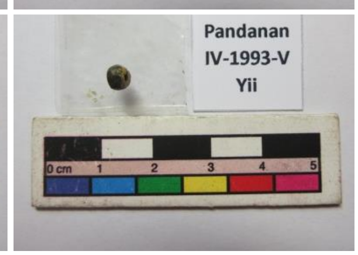

Pandanan
IV-1993-V
Uii
0 cm 1 2 3 4 5

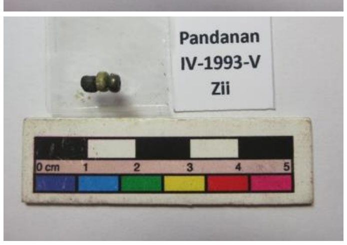

Pandanan
IV-1993-V
Vii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Wii
0 cm 1 2 3 4 5

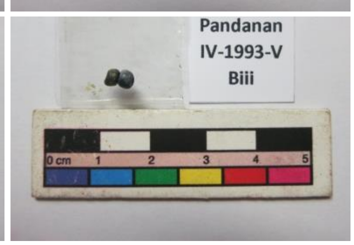

Pandanan
IV-1993-V
Xii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Yii
0 cm 1 2 3 4 5

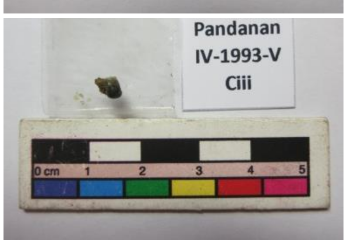

Pandanan
IV-1993-V
Yii
0 cm 1 2 3 4 5

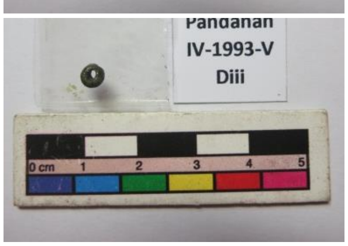

Pandanan
IV-1993-V
Zii
0 cm 1 2 3 4 5

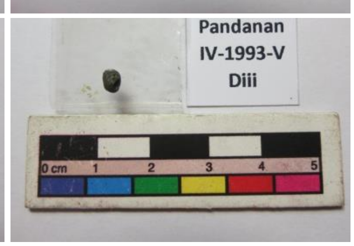

IV-1993-V
Aiii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Biii
0 cm 1 2 3 4 5

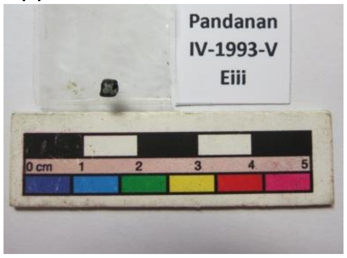

IV-1993-V
Ciii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Ciii
0 cm 1 2 3 4 5

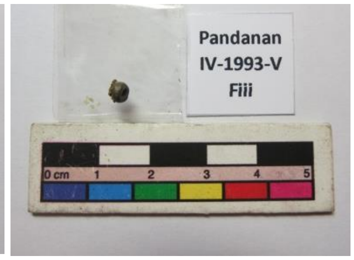

IV-1993-V
Diii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Diii
0 cm 1 2 3 4 5

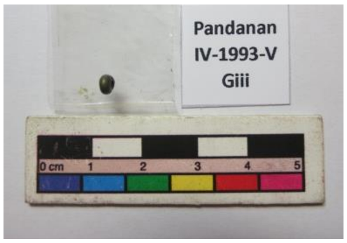

IV-1993-V
Eiii
0 cm 1 2 3 4 5

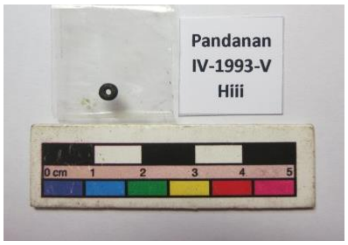

Pandanan
IV-1993-V
Eiii

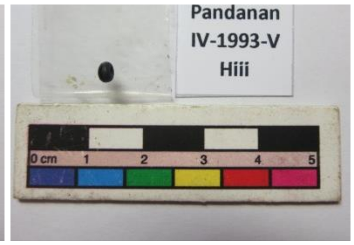

Pandanan
IV-1993-V
Fiii

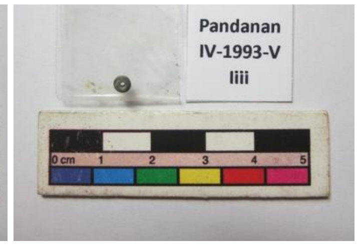

Pandanan
IV-1993-V
Fiii

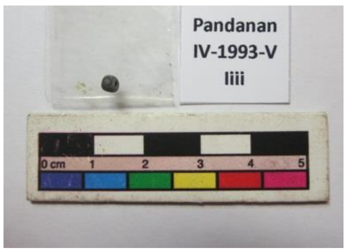

Pandanan
IV-1993-V
Giii

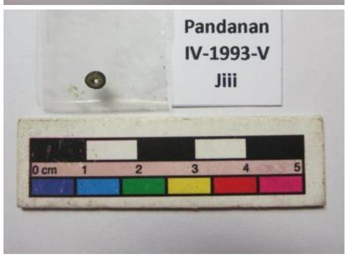

Pandanan
IV-1993-V
Giii

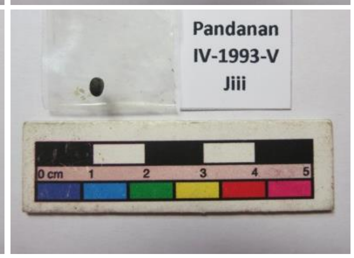

Pandanan
IV-1993-V
Hiii

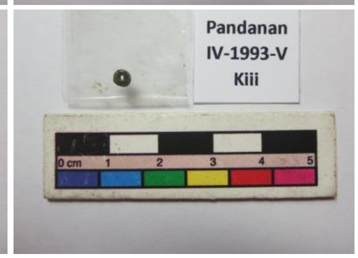

Pandanan
IV-1993-V
Hiii

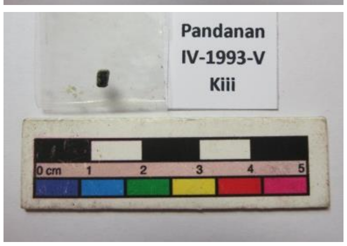

Pandanan
IV-1993-V
Iiii

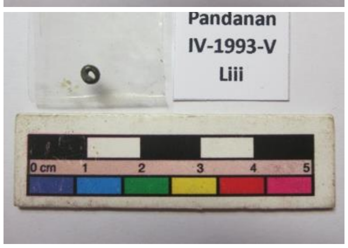

Pandanan
IV-1993-V
Iiii

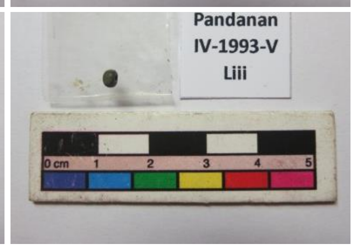

Pandanan
IV-1993-V
Jiii

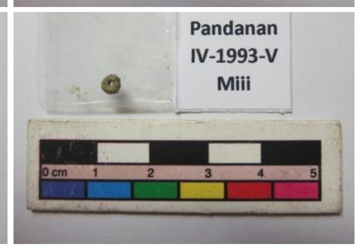

Pandanan
IV-1993-V
Jiii

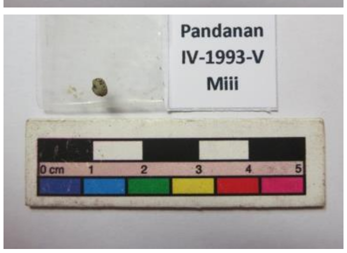

Pandanan
IV-1993-V
Kiii


Pandanan
IV-1993-V
Kiii


Pandanan
IV-1993-V
Liii

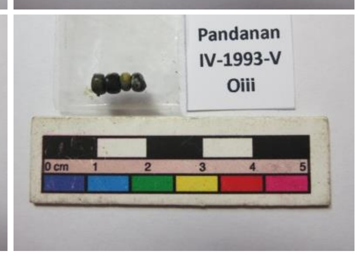

Pandanan
IV-1993-V
Liii


Pandanan
IV-1993-V
Miii


Pandanan
IV-1993-V
Miii


Pandanan
IV-1993-V
Niii


Pandanan
IV-1993-V
Niii

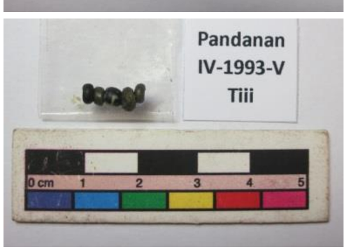

Pandanan
IV-1993-V
Oiii


Pandanan
IV-1993-V
Piii

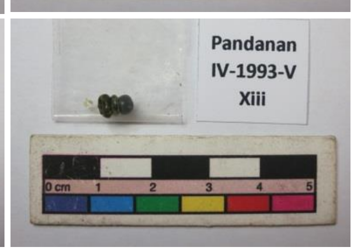

Pandanan
IV-1993-V
Qiii

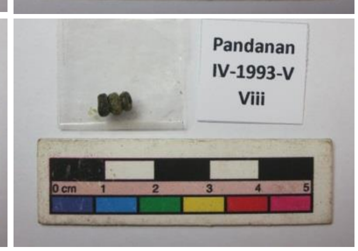

Pandanan
IV-1993-V
Riii

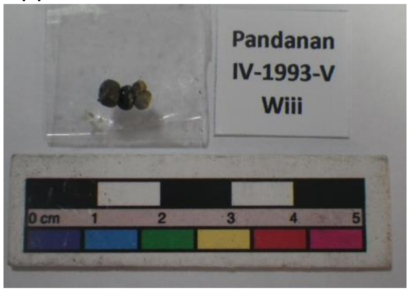

Pandanan
IV-1993-V
Siii

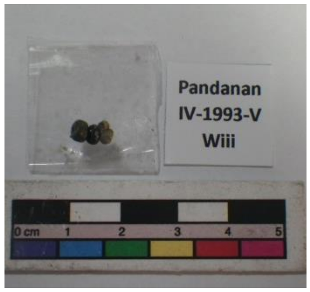

Pandanan
IV-1993-V
Tiii


Pandanan
IV-1993-V
Uiii


Pandanan
IV-1993-V
Xiii


Pandanan
IV-1993-V
Viii


Pandanan
IV-1993-V
Wiii
0 cm 1 2 3 4 5

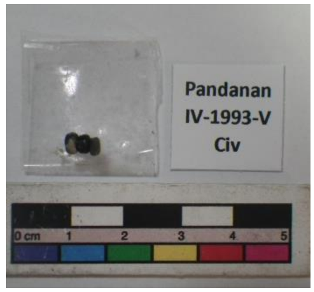

Pandanan
IV-1993-V
Wiii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Yiii
0 cm 1 2 3 4 5

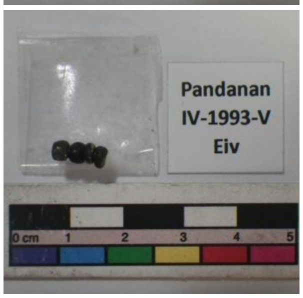

Pandanan
IV-1993-V
Ziii
0 cm 1 2 3 4 5

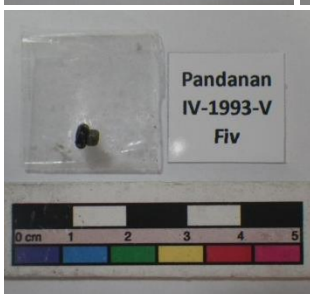

Pandanan
IV-1993-V
Aiv
0 cm 1 2 3 4 5

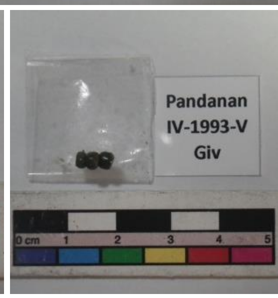

Pandanan
IV-1993-V
Biv
0 cm 1 2 3 4 5

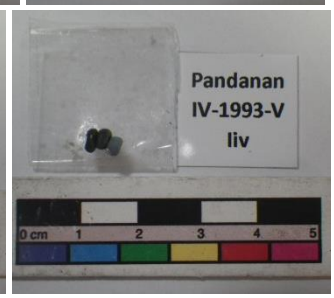

Pandanan
IV-1993-V
Civ
0 cm 1 2 3 4 5

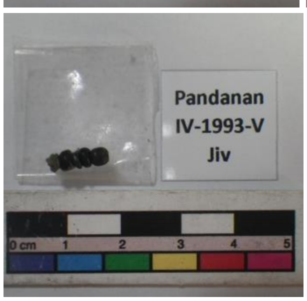

Pandanan
IV-1993-V
Div
0 cm 1 2 3 4 5

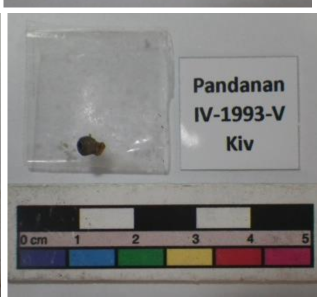

Pandanan
IV-1993-V
Eiv
0 cm 1 2 3 4 5

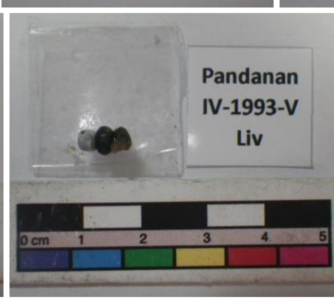

Pandanan
IV-1993-V
Fiv
0 cm 1 2 3 4 5

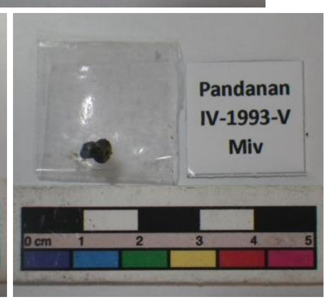

Pandanan
IV-1993-V
Giv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Iiv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Jiv
0 cm 1 2 3 4 5

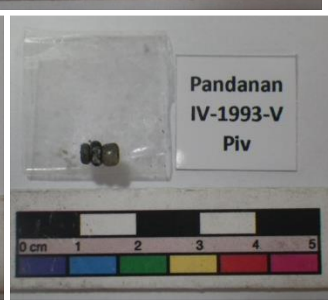

Pandanan
IV-1993-V
Kiv
0 cm 1 2 3 4 5

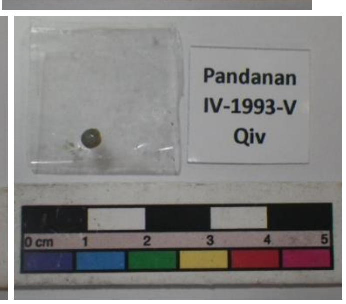

Pandanan
IV-1993-V
Liv
0 cm 1 2 3 4 5

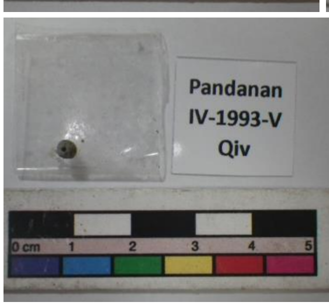

Pandanan
IV-1993-V
Miv
0 cm 1 2 3 4 5

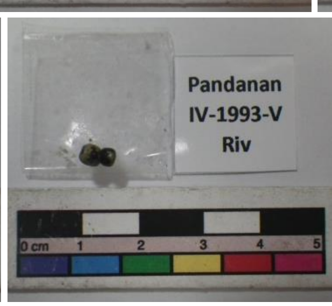

Pandanan
IV-1993-V
Niv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Oiv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Piv
0 cm 1 2 3 4 5

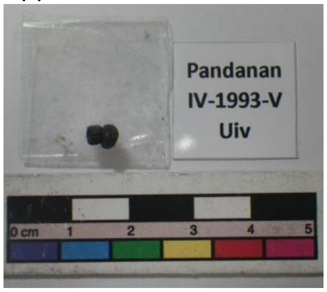

Pandanan
IV-1993-V
Qiv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Qiv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Riv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Siv
0 cm 1 2 3 4 5

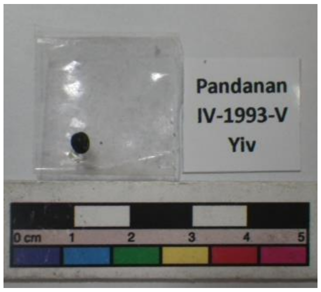

Pandanan
IV-1993-V
Tiv
0 cm 1 2 3 4 5

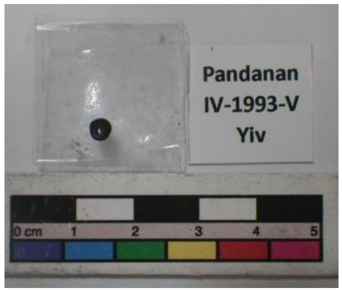

Pandanan
IV-1993-V
Uiv


Pandanan
IV-1993-V
Viv

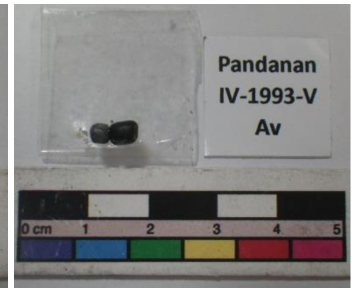

Pandanan
IV-1993-V
Wiv

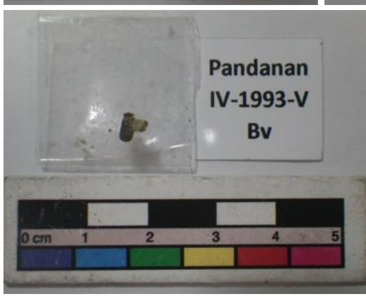

Pandanan
IV-1993-V
Xiv

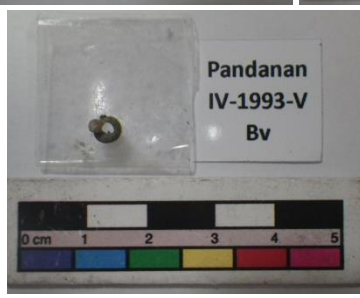

Pandanan
IV-1993-V
Yiv

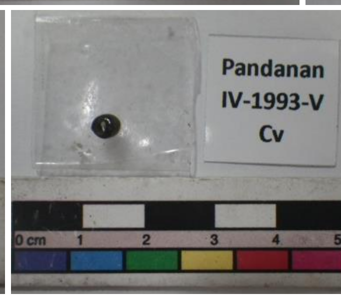

Pandanan
IV-1993-V
Yiv

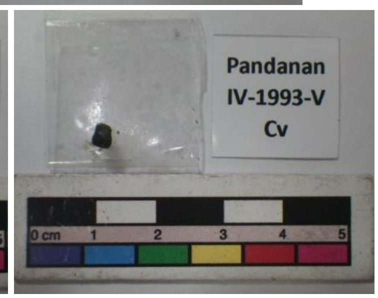

Pandanan
IV-1993-V
Ziv

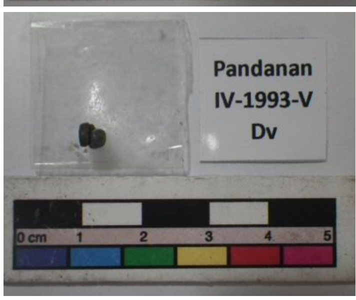

Pandanan
IV-1993-V
Av

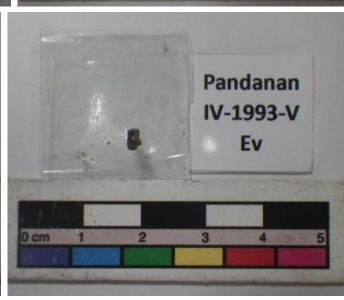

Pandanan
IV-1993-V
Bv

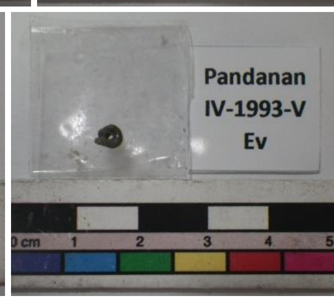

Pandanan
IV-1993-V
Bv

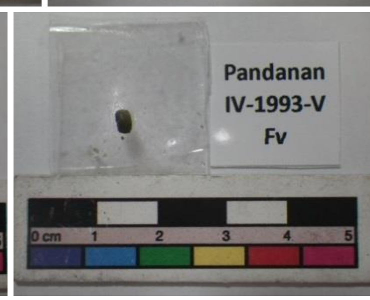

Pandanan
IV-1993-V
Cv

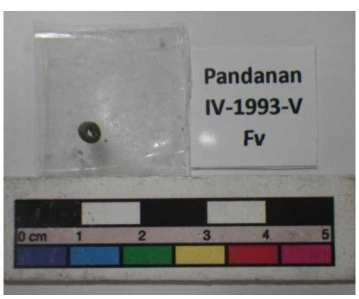

Pandanan
IV-1993-V
Cv

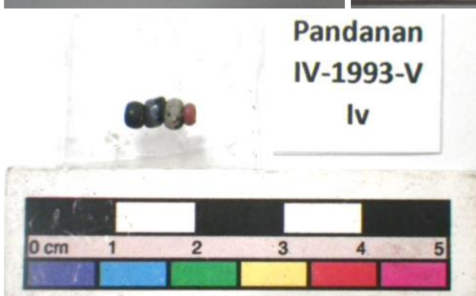

Pandanan
IV-1993-V
Dv

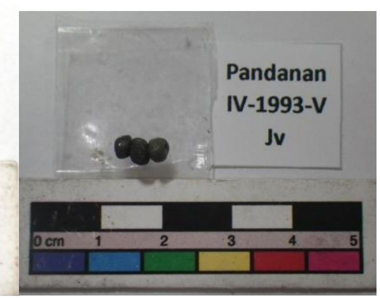

Pandanan
IV-1993-V
Ev

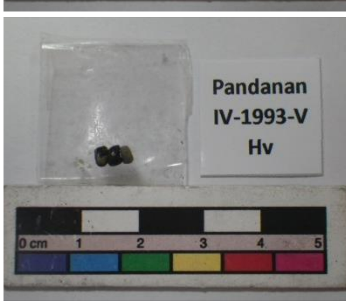

Pandanan
IV-1993-V
Ev


Pandanan
IV-1993-V
Fv

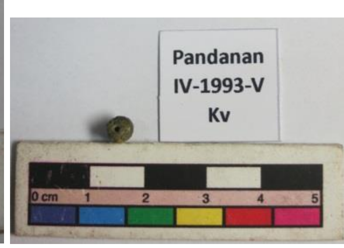

Pandanan
IV-1993-V
Fv

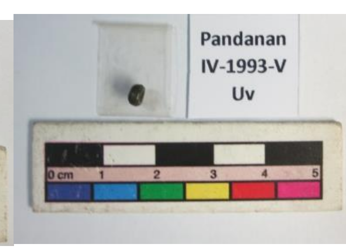

Pandanan
IV-1993-V
Iv

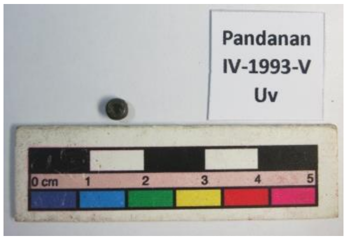

Pandanan
IV-1993-V
Jv

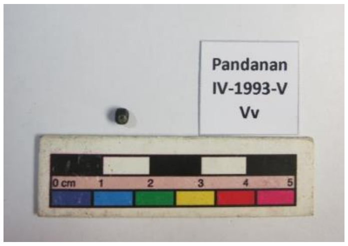

Pandanan
IV-1993-V
Hv

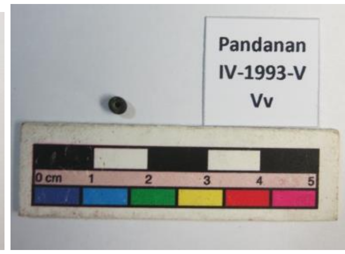

Pandanan
IV-1993-V
Gv

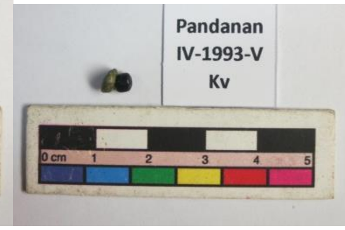

Pandanan
IV-1993-V
Kv

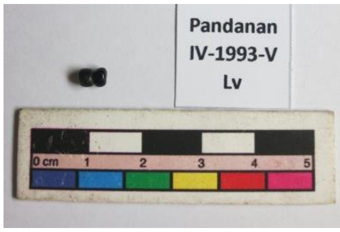

Pandanan
IV-1993-V
Uv

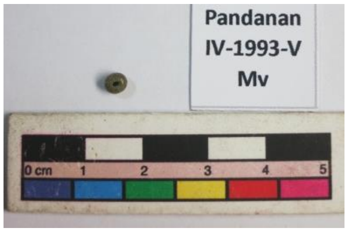

Pandanan
IV-1993-V
Uv

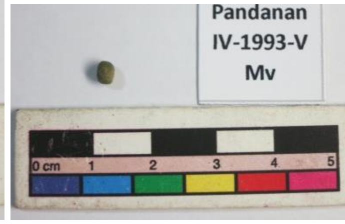

Pandanan
IV-1993-V
Vv

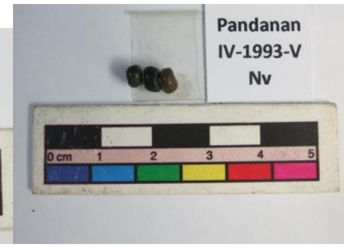

Pandanan
IV-1993-V
Vv

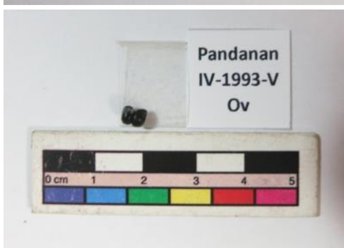

Pandanan
IV-1993-V
Kv

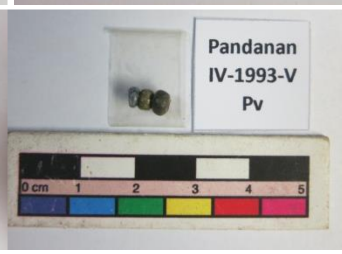

Pandanan
IV-1993-V
Lv


Pandanan
IV-1993-V
Mv

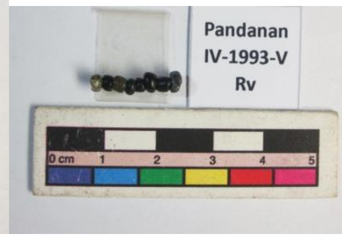

Pandanan
IV-1993-V
Mv

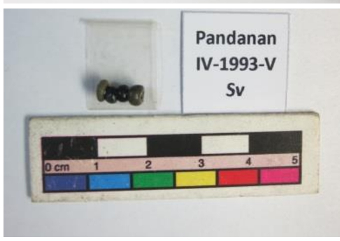

Pandanan
IV-1993-V
Nv

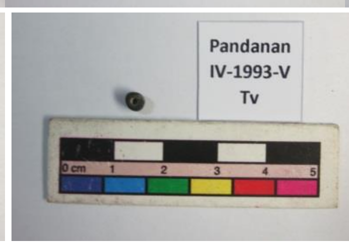

Pandanan
IV-1993-V
Ov

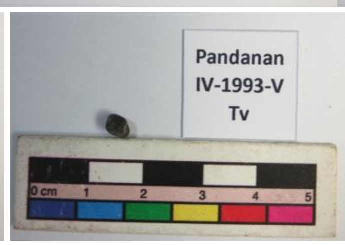

Pandanan
IV-1993-V
Pv

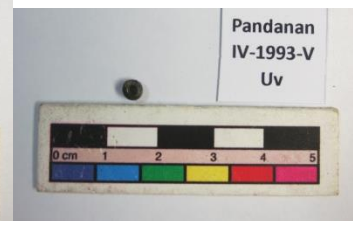

Pandanan
IV-1993-V
Qv

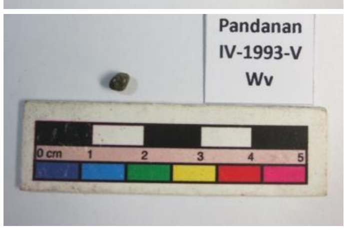

Pandanan
IV-1993-V
Rv

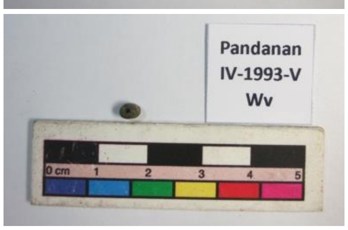

Pandanan
IV-1993-V
Sv

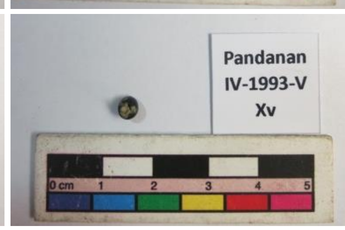

Pandanan
IV-1993-V
Tv

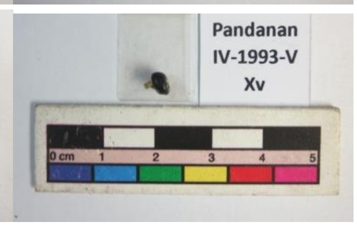

Pandanan
IV-1993-V
Tv

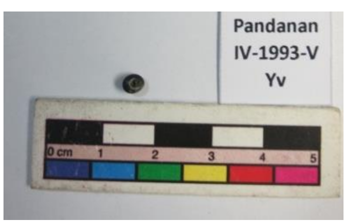

Pandanan
IV-1993-V
Uv

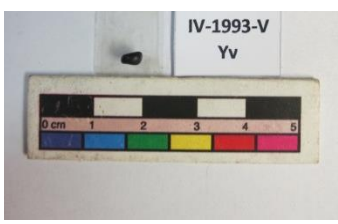

Pandanan
IV-1993-V
Wv

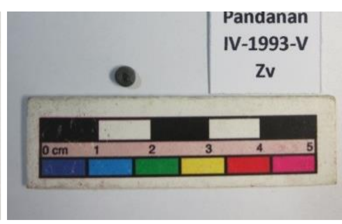

Pandanan
IV-1993-V
Wv

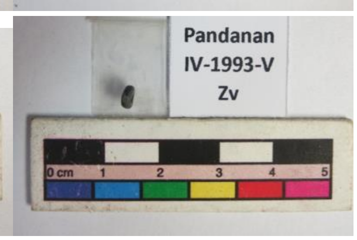

Pandanan
IV-1993-V
Xv

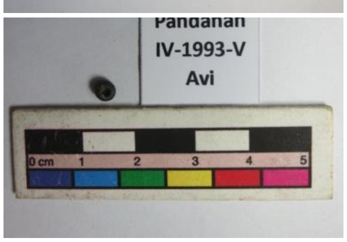

Pandanan
IV-1993-V
Xv

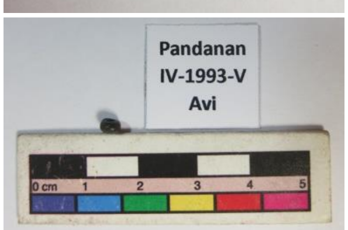

Pandanan
IV-1993-V
Yv

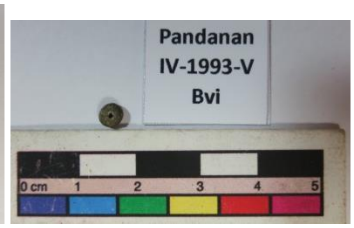

IV-1993-V
Yv

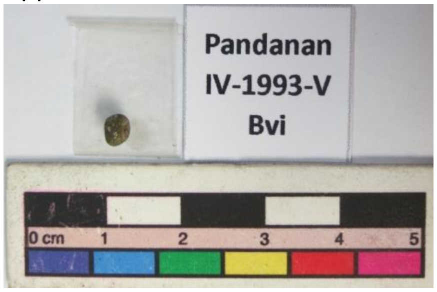

IV-1993-V
Zv

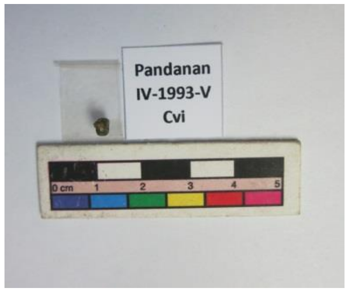

Pandanan
IV-1993-V
Zv

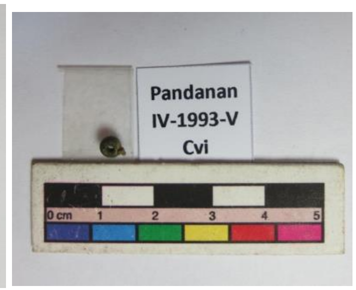

IV-1993-V
Avi

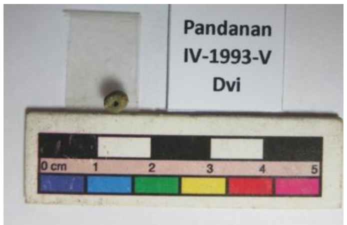

Pandanan
IV-1993-V
Avi

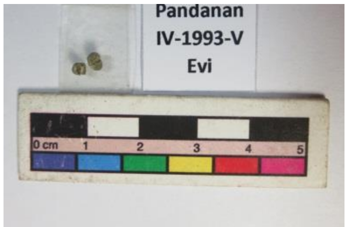

Pandanan
IV-1993-V
Bvi

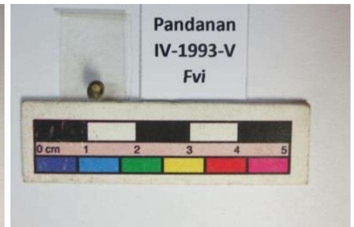

Pandanan
IV-1993-V
Bvi

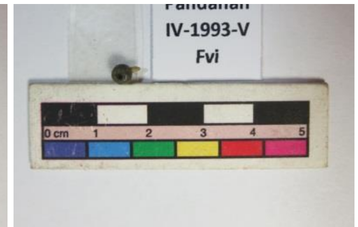

Pandanan
IV-1993-V
Cvi

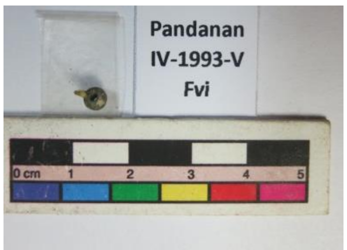

Pandanan
IV-1993-V
Cvi

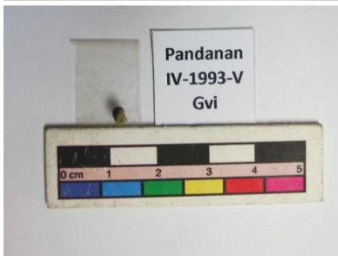

Pandanan
IV-1993-V
Dvi

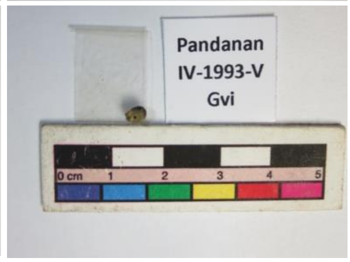

Pandanan
IV-1993-V
Evi

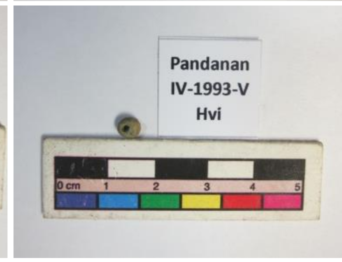

Pandanan
IV-1993-V
Fvi

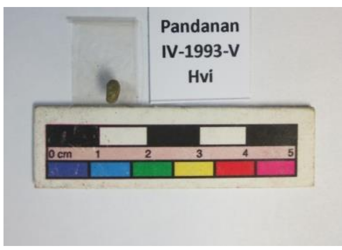

IV-1993-V
Fvi

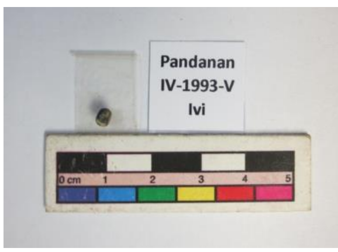

Pandanan
IV-1993-V
Fvi

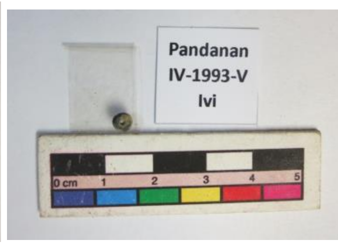

Pandanan
IV-1993-V
Gvi

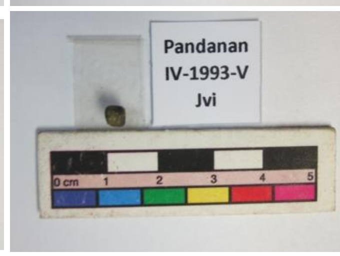

Pandanan
IV-1993-V
Gvi

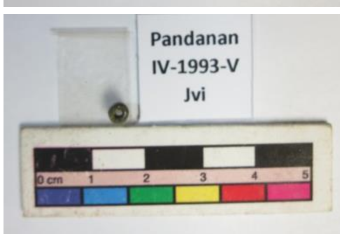

Pandanan
IV-1993-V
Hvi

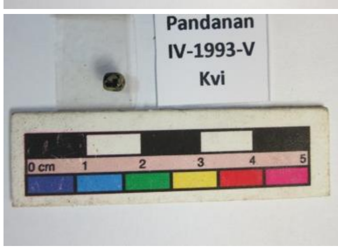

Pandanan
IV-1993-V
Hvi

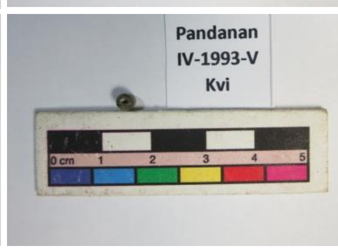

Pandanan
IV-1993-V
Ivi

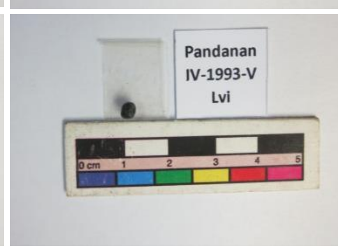

Pandanan
IV-1993-V
Ivi

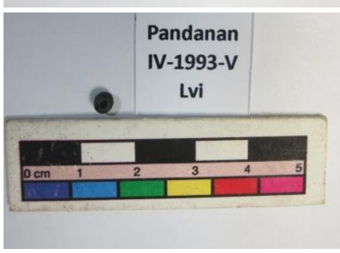

Pandanan
IV-1993-V
Jvi

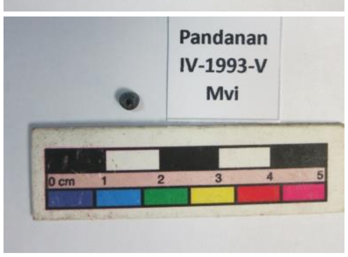

Pandanan
IV-1993-V
Jvi

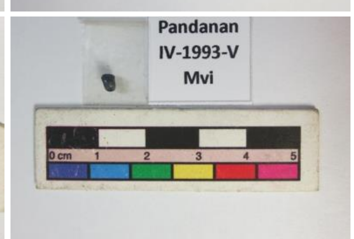

Pandanan
IV-1993-V
Kvi

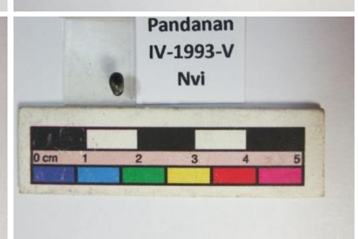

Pandanan
IV-1993-V
Kvi


Pandanan
IV-1993-V
Lvi

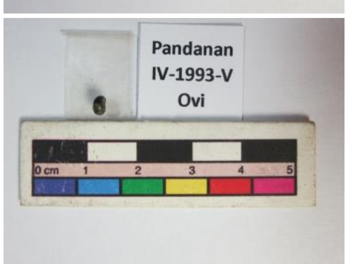

Pandanan
IV-1993-V
Lvi


Pandanan
IV-1993-V
Mvi


Pandanan
IV-1993-V
Mvi


Pandanan
IV-1993-V
Nvi

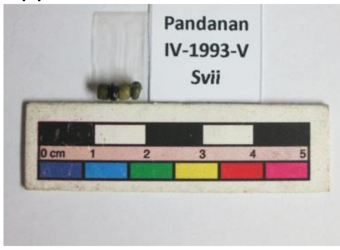

Pandanan
IV-1993-V
Nvi

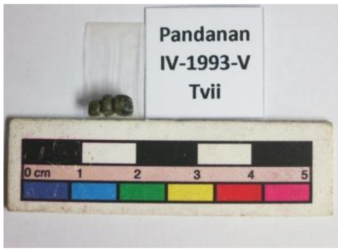

Pandanan
IV-1993-V
Ovi

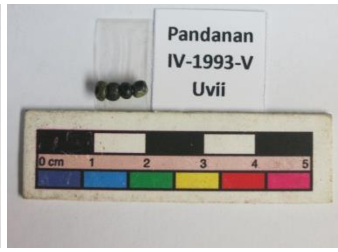

Pandanan
IV-1993-V
Ovi

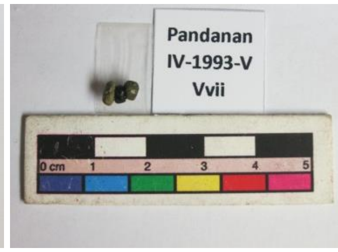

Pandanan
IV-1993-V
Pvi

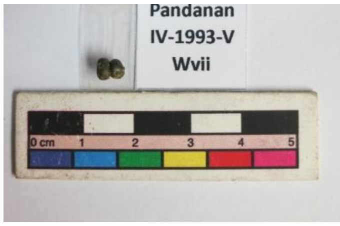

Pandanan IV-1993-V Qvi
Pandanan IV-1993-V Rvi
Pandanan IV-1993-V Svi
Pandanan IV-1993-V Tvi
Pandanan IV-1993-V Uvi
Pandanan IV-1993-V Vvi
Pandanan IV-1993-V Wvi
Pandanan IV-1993-V Xvi
Pandanan IV-1993-V Yvi
Pandanan IV-1993-V Avii
Pandanan IV-1993-V Bvii
Pandanan IV-1993-V Cvii
Pandanan IV-1993-V Dvii
Pandanan IV-1993-V Evii
Pandanan IV-1993-V Fvii
Pandanan IV-1993-V Gvii
Pandanan IV-1993-V Hvii
Pandanan IV-1993-V Ivii
Pandanan IV-1993-V Jvii
Pandanan IV-1993-V Kvii
Pandanan IV-1993-V Kvii
Pandanan IV-1993-V Lvii
Pandanan IV-1993-V Mvii
Pandanan IV-1993-V Nvii
Pandanan IV-1993-V Ovii
Pandanan IV-1993-V Pvii
Pandanan IV-1993-V Qvii
Pandanan IV-1993-V Rvii

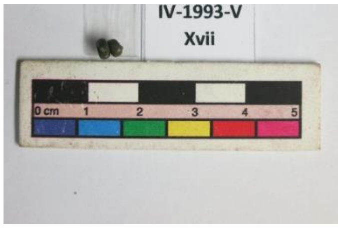

Pandanan
IV-1993-V
Svii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Tvii
0 cm 1 2 3 4 5

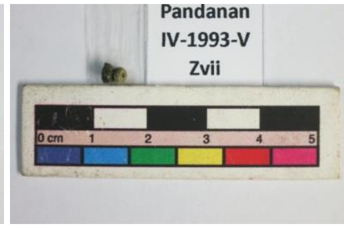

Pandanan
IV-1993-V
Uvii
0 cm 1 2 3 4 5

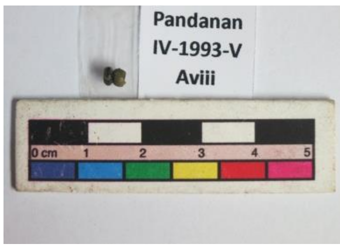

Pandanan
IV-1993-V
Vvii
0 cm 1 2 3 4 5

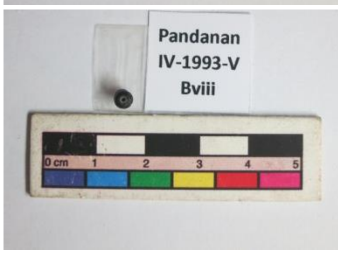

Pandanan
IV-1993-V
Wvii
0 cm 1 2 3 4 5


IV-1993-V
Xvii
0 cm 1 2 3 4 5

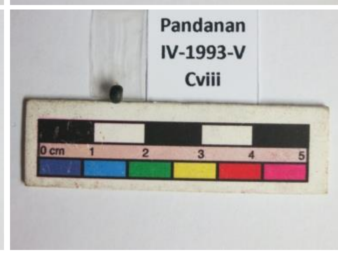

IV-1993-V
Yvii
0 cm 1 2 3 4 5

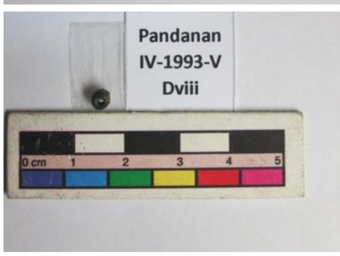

Pandanan
IV-1993-V
Zvii
0 cm 1 2 3 4 5

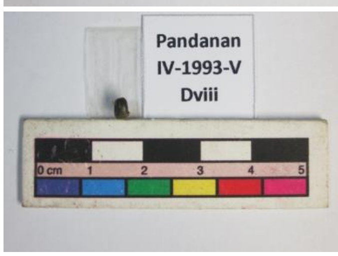

Pandanan
IV-1993-V
Aviii
0 cm 1 2 3 4 5

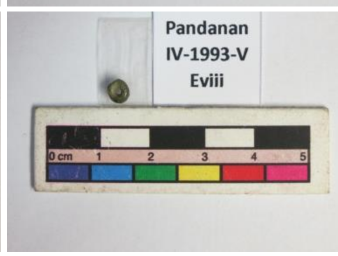

Pandanan
IV-1993-V
Bviii
0 cm 1 2 3 4 5

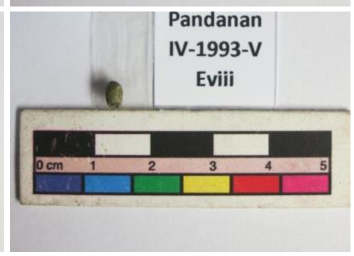

Pandanan
IV-1993-V
Cviii
0 cm 1 2 3 4 5

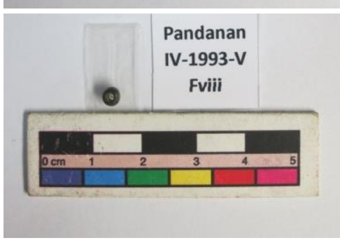

Pandanan
IV-1993-V
Cviii
0 cm 1 2 3 4 5

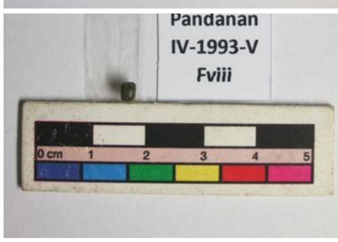

Pandanan
IV-1993-V
Dviii
0 cm 1 2 3 4 5

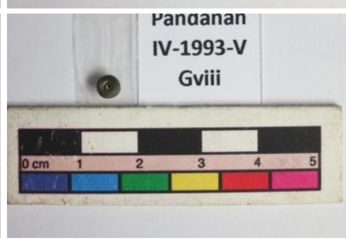

Pandanan
IV-1993-V
Dviii
0 cm 1 2 3 4 5

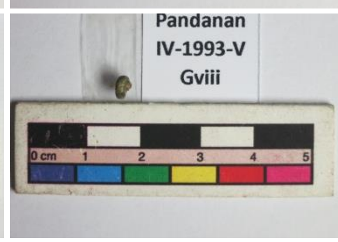

Pandanan
IV-1993-V
Eviii
0 cm 1 2 3 4 5

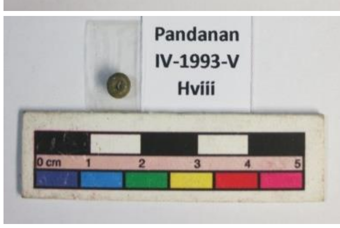

Pandanan
IV-1993-V
Eviii
0 cm 1 2 3 4 5

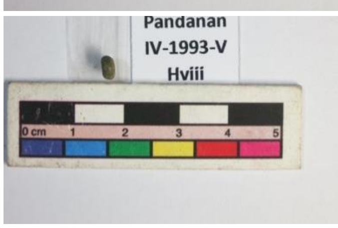

Pandanan
IV-1993-V
Fviii
0 cm 1 2 3 4 5

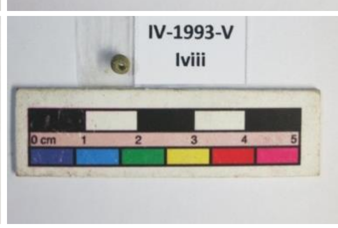

Pandanan
IV-1993-V
Fviii
0 cm 1 2 3 4 5

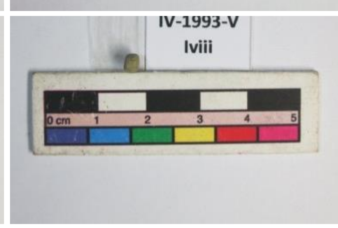

Pandanan
IV-1993-V
Gviii
0 cm 1 2 3 4 5

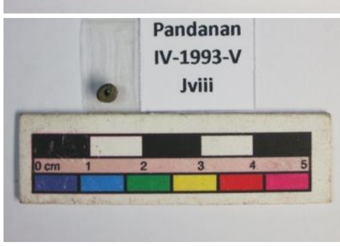

Pandanan
IV-1993-V
Gviii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Hviii
0 cm 1 2 3 4 5

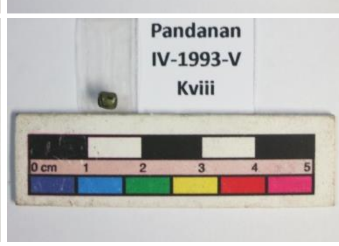

Pandanan
IV-1993-V
Hviii
0 cm 1 2 3 4 5

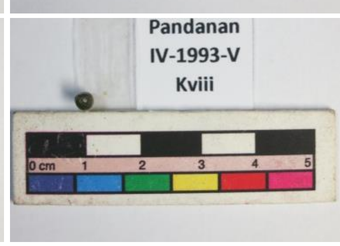

IV-1993-V
Iviii
0 cm 1 2 3 4 5

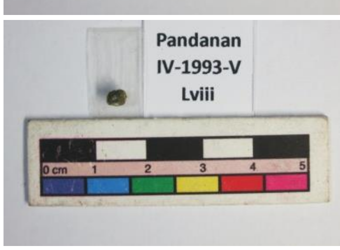

IV-1993-V
Iviii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Jviii
0 cm 1 2 3 4 5

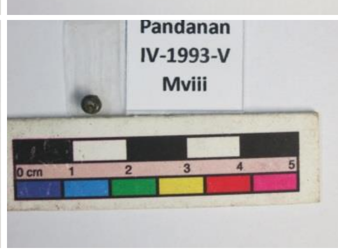

IV-1993-V
Jviii
0 cm 1 2 3 4 5

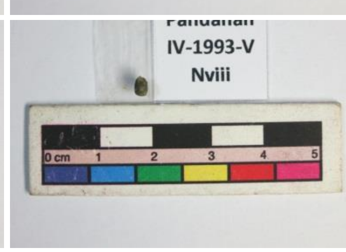

Pandanan
IV-1993-V
Kviii
0 cm 1 2 3 4 5

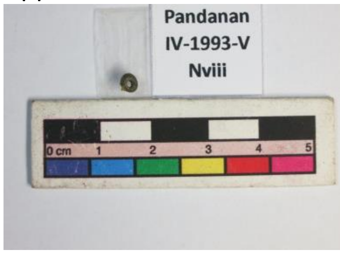

Pandanan
IV-1993-V
Kviii
0 cm 1 2 3 4 5

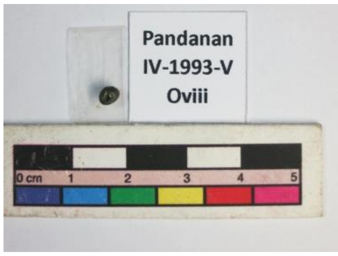

Pandanan
IV-1993-V
Lviii
0 cm 1 2 3 4 5

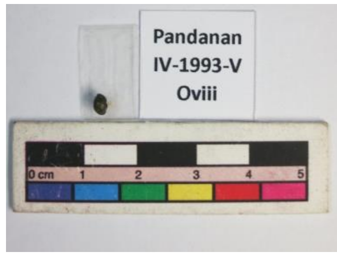

IV-1993-V
Mviii
0 cm 1 2 3 4 5

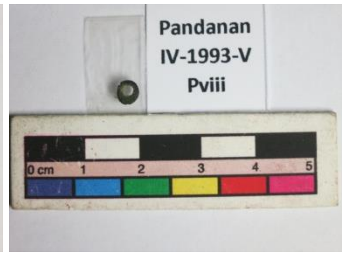

Pandanan
IV-1993-V
Mviii
0 cm 1 2 3 4 5

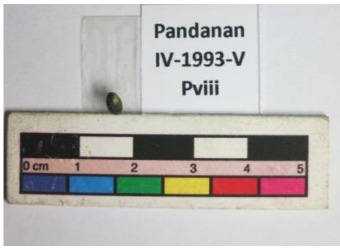

IV-1993-V
Nviii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Nviii
0 cm 1 2 3 4 5

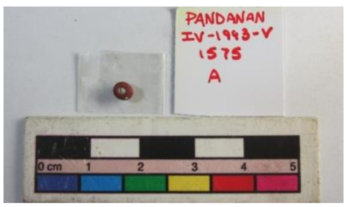

Pandanan
IV-1993-V
Oviii
0 cm 1 2 3 4 5

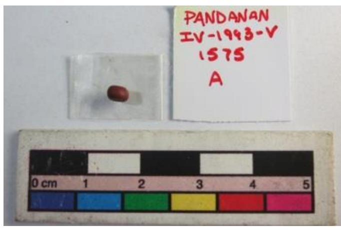

Pandanan
IV-1993-V
Oviii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Pviii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Pviii
0 cm 1 2 3 4 5

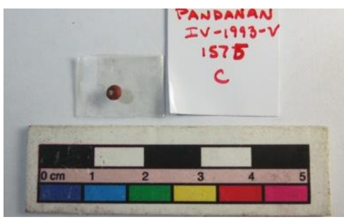
1575

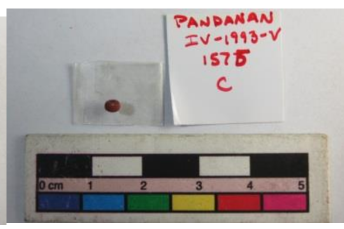

PANDANAN
IV-1993-V
1575
A
0 cm 1 2 3 4 5

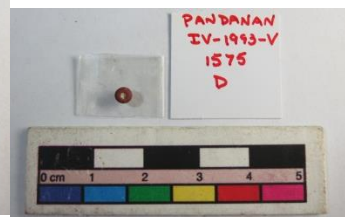

PANDANAN
IV-1993-V
1575
A
0 cm 1 2 3 4 5

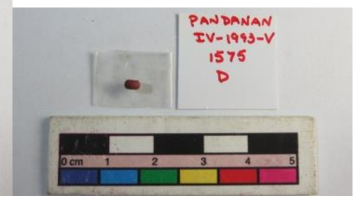

PANDANAN
IV-1993-V
1575
B
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
B
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
C
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
C
0 cm 1 2 3 4 5

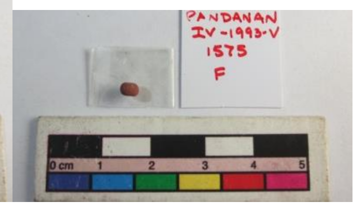

PANDANAN
IV-1993-V
1575
D
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
D
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
E
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
E
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
F
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
F
0 cm 1 2 3 4 5

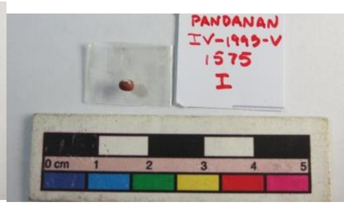

PANDANAN
IV-1993-V
1575
G
0 cm 1 2 3 4 5

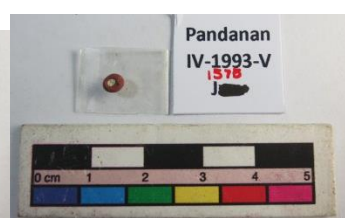

PANDANAN
IV-1993-V
1575
G
0 cm 1 2 3 4 5

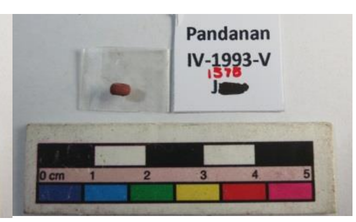

PANDANAN
IV-1993-V
1575
H
0 cm 1 2 3 4 5


PANDANAN
IV-1993-V
1575
H
0 cm 1 2 3 4 5

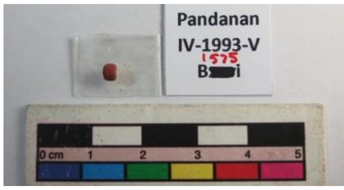

PANDANAN
IV-1993-V
1575
I
0 cm 1 2 3 4 5

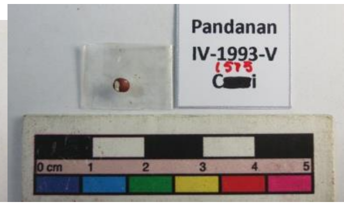

PANDANAN
IV-1993-V
1575
I
0 cm 1 2 3 4 5

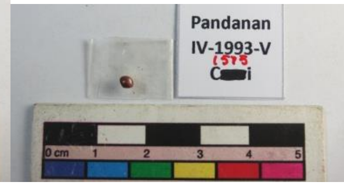

Pandanan
IV-1993-V
1578
J[redacted]
0 cm 1 2 3 4 5

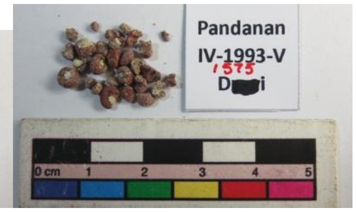

Pandanan
IV-1993-V
1578
J[redacted]
0 cm 1 2 3 4 5

Appendix 4 Pandanan


Pandanan
IV-1993-V
1575
B[redacted]i

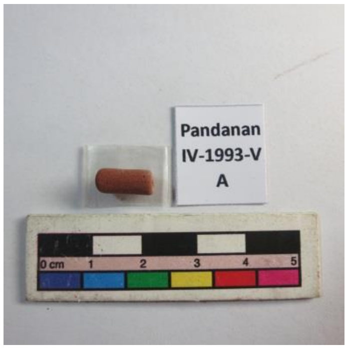

Pandanan
IV-1993-V
1575
C[redacted]i

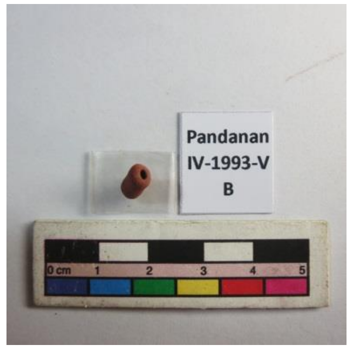

Pandanan
IV-1993-V
1575
C[redacted]i

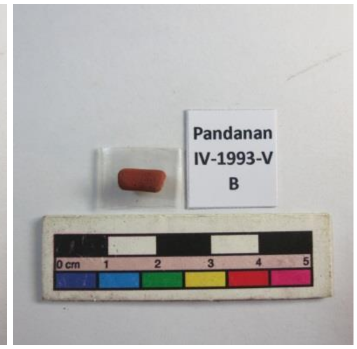

Pandanan
IV-1993-V
1575
D[redacted]i

N.A.


Pandanan
IV-1993-V
A

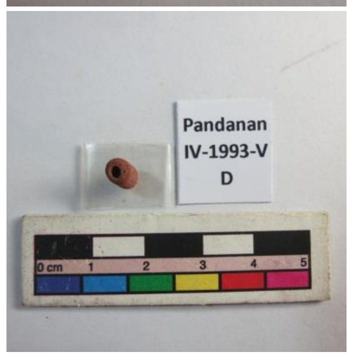

Pandanan
IV-1993-V
A

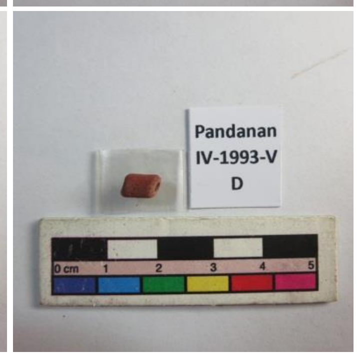

Pandanan
IV-1993-V
B


Pandanan
IV-1993-V
B

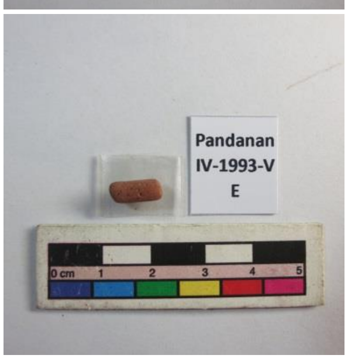

Pandanan
IV-1993-V
C

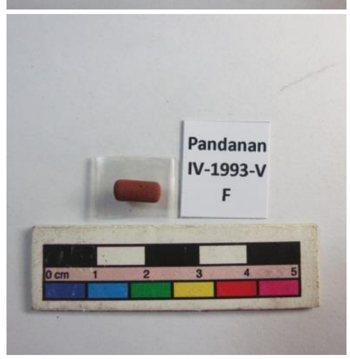

Pandanan
IV-1993-V
C

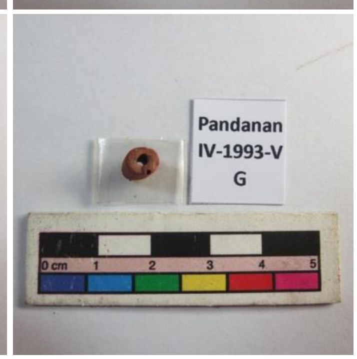

Pandanan
IV-1993-V
D


Pandanan
IV-1993-V
D

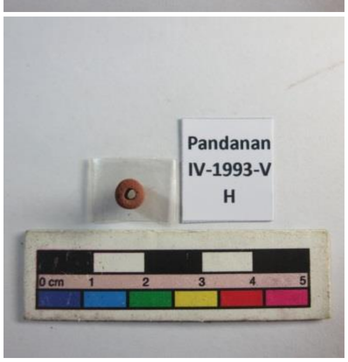

Pandanan
IV-1993-V
E


Pandanan
IV-1993-V
E

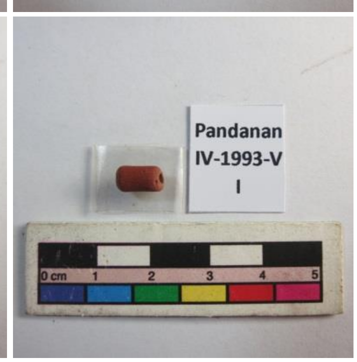

Pandanan
IV-1993-V
F


Pandanan
IV-1993-V
G

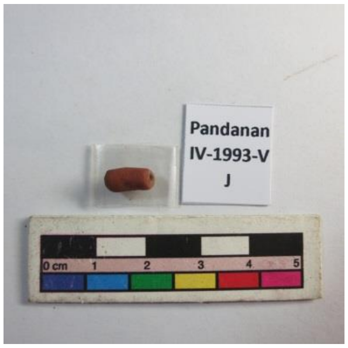

Pandanan
IV-1993-V
G


Pandanan
IV-1993-V
H

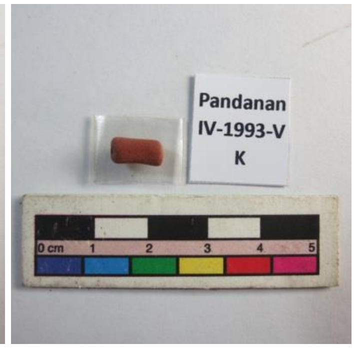

Pandanan
IV-1993-V
I


Pandanan
IV-1993-V
I


Pandanan
IV-1993-V
J
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
J
0 cm 1 2 3 4 5

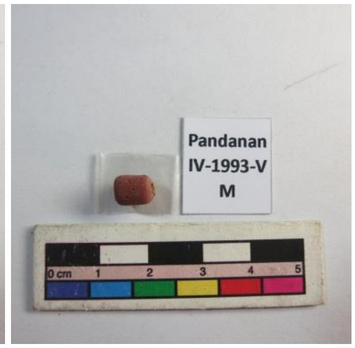

Pandanan
IV-1993-V
K
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
K
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
L
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
L
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
M
0 cm 1 2 3 4 5

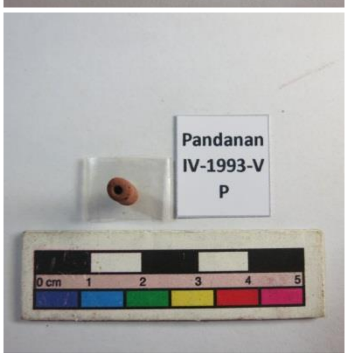

Pandanan
IV-1993-V
M
0 cm 1 2 3 4 5

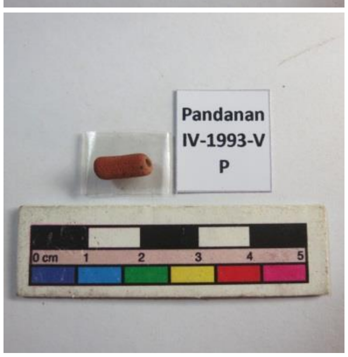

Pandanan
IV-1993-V
N
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
N
0 cm 1 2 3 4 5

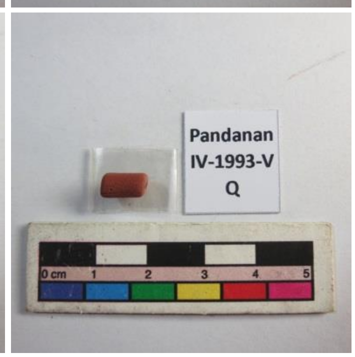

Pandanan
IV-1993-V
O
0 cm 1 2 3 4 5

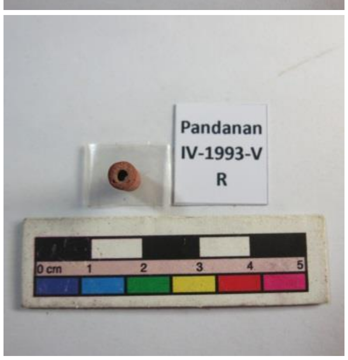

Pandanan
IV-1993-V
O
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
P
0 cm 1 2 3 4 5

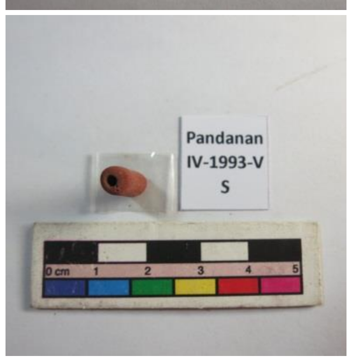

Pandanan
IV-1993-V
P
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Q
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Q
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
R
0 cm 1 2 3 4 5

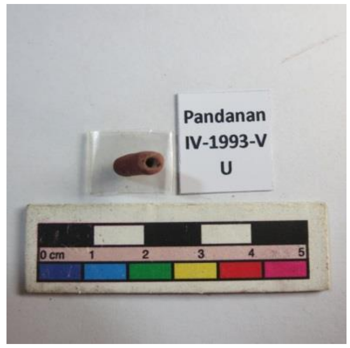

Pandanan
IV-1993-V
R
0 cm 1 2 3 4 5

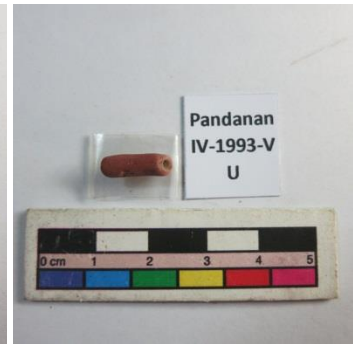

Pandanan
IV-1993-V
S
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
S
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
T


Pandanan
IV-1993-V
T

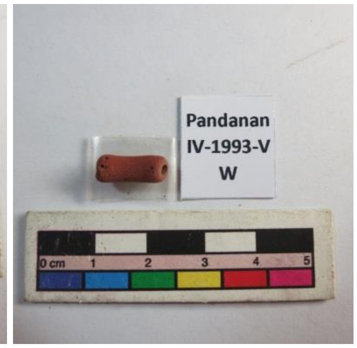

Pandanan
IV-1993-V
U


Pandanan
IV-1993-V
U

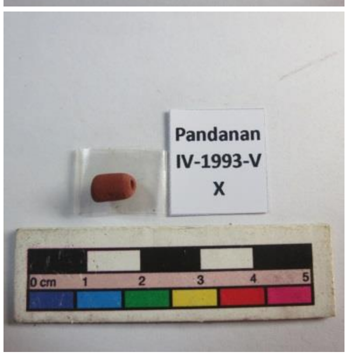

Pandanan
IV-1993-V
V


Pandanan
IV-1993-V
V

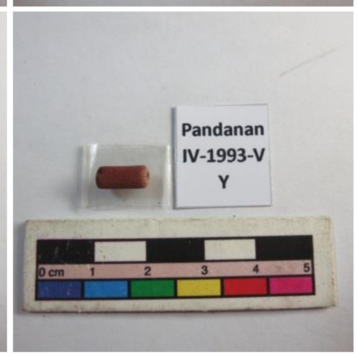

Pandanan
IV-1993-V
W

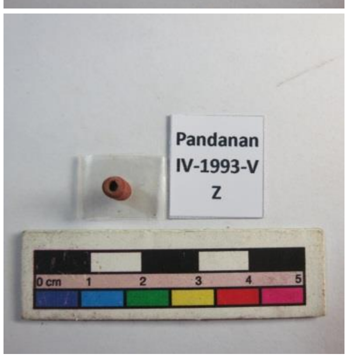

Pandanan
IV-1993-V
W

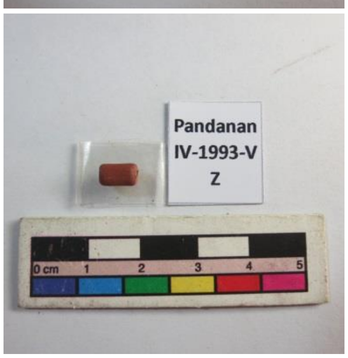

Pandanan
IV-1993-V
X

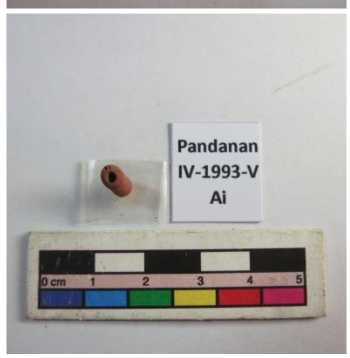

Pandanan
IV-1993-V
X

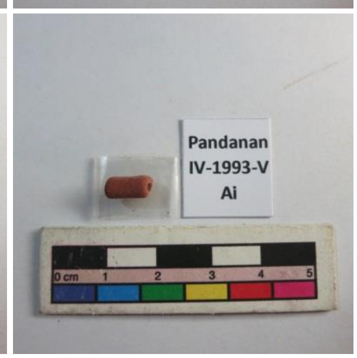

Pandanan
IV-1993-V
Y


Pandanan
IV-1993-V
Y

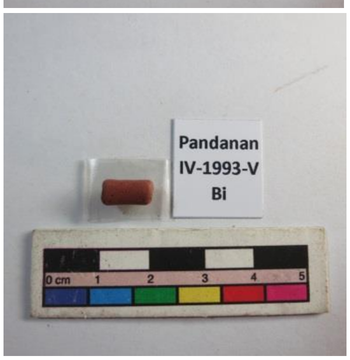

Pandanan
IV-1993-V
Z


Pandanan
IV-1993-V
Z

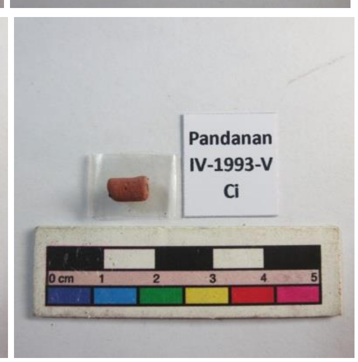

Pandanan
IV-1993-V
Ai


Pandanan
IV-1993-V
Ai

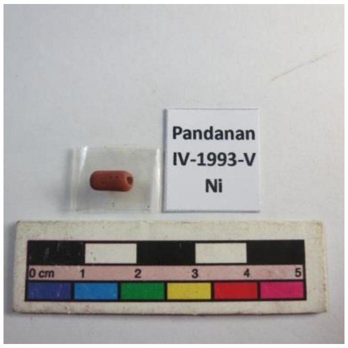

Pandanan
IV-1993-V
Bi

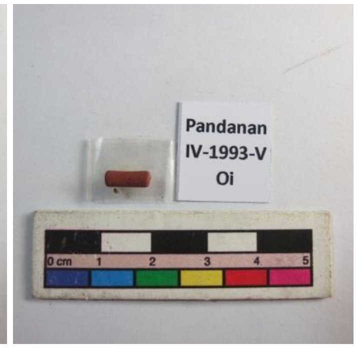

Pandanan
IV-1993-V
Bi

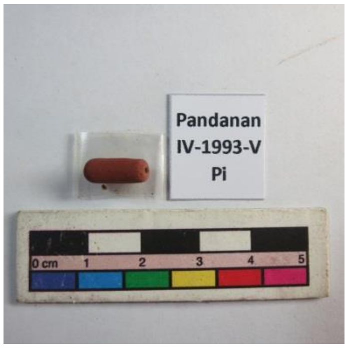

Pandanan
IV-1993-V
Ci

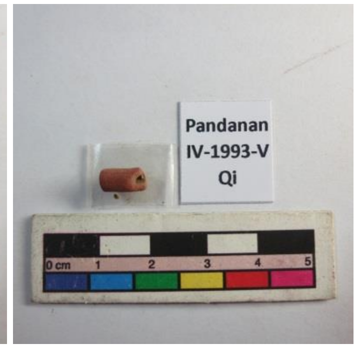
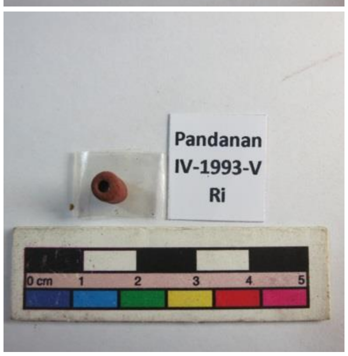

Pandanan
IV-1993-V
Ci

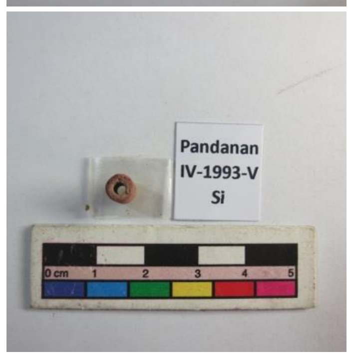
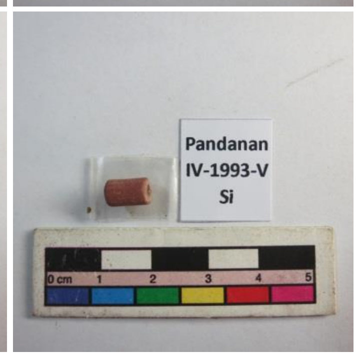
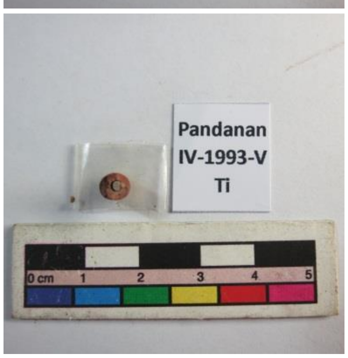
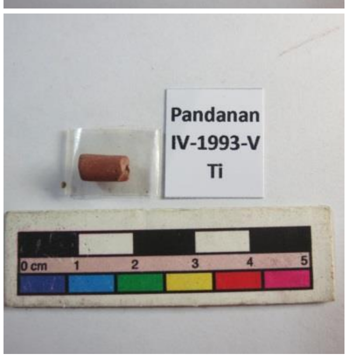
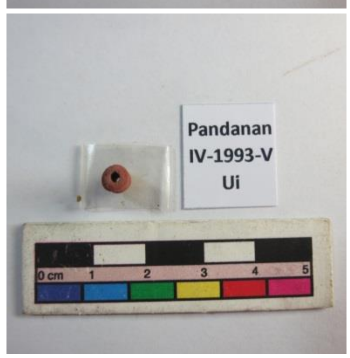
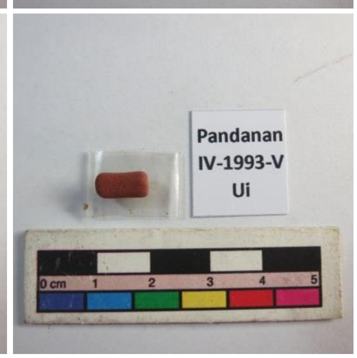

Pandanan
IV-1993-V
Di
Pandanan
IV-1993-V
Di
Pandanan
IV-1993-V
Ei
Pandanan
IV-1993-V
Ei
Pandanan
IV-1993-V
Fi
Pandanan
IV-1993-V
Fi
Pandanan
IV-1993-V
Gi
Pandanan
IV-1993-V
Gi
Pandanan
IV-1993-V
Hi
Pandanan
IV-1993-V
Hi
Pandanan
IV-1993-V
Ii
Pandanan
IV-1993-V
Ii
Pandanan
IV-1993-V
Ji
Pandanan
IV-1993-V
Ji
Pandanan
IV-1993-V
Ki
Pandanan
IV-1993-V
Ki
Pandanan
IV-1993-V
Li
Pandanan
IV-1993-V
Li
Pandanan
IV-1993-V
Mi
Pandanan
IV-1993-V
Mi

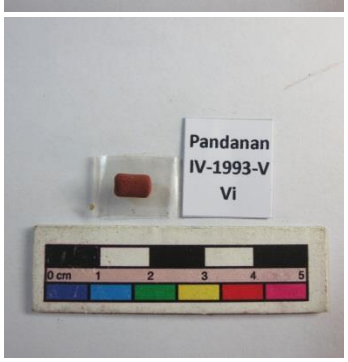
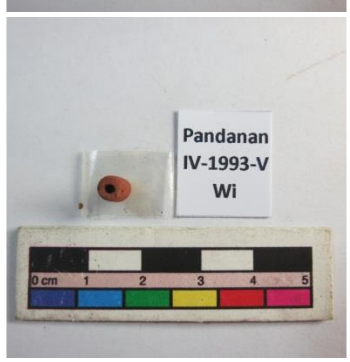
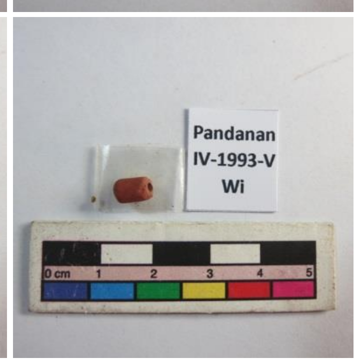

Pandanan
IV-1993-V
Ni

Pandanan
IV-1993-V
Ni

Pandanan
IV-1993-V
Oi

Pandanan
IV-1993-V
Oi

Pandanan
IV-1993-V
Pi

Pandanan
IV-1993-V
Pi

Pandanan
IV-1993-V
Qi

Pandanan
IV-1993-V
Qi

Pandanan
IV-1993-V
Ri

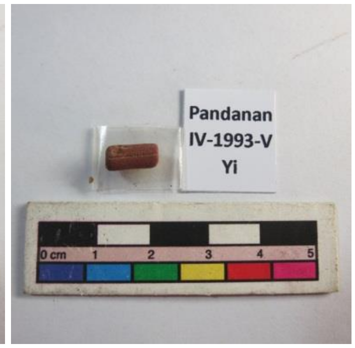
Pandanan
IV-1993-V
Ri

Pandanan
IV-1993-V
Si

Pandanan
IV-1993-V
Si

Pandanan
IV-1993-V
Ti

Pandanan
IV-1993-V
Ti

Pandanan
IV-1993-V
Ui

Pandanan
IV-1993-V
Ui

Pandanan
IV-1993-V
Vi

Pandanan
IV-1993-V
Vi

Pandanan
IV-1993-V
Wi

Pandanan
IV-1993-V
Wi


Pandanan
IV-1993-V
Xi


Pandanan
IV-1993-V
Xi

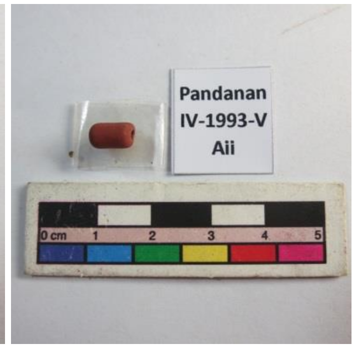

Pandanan
IV-1993-V
Yi


Pandanan
IV-1993-V
Yi

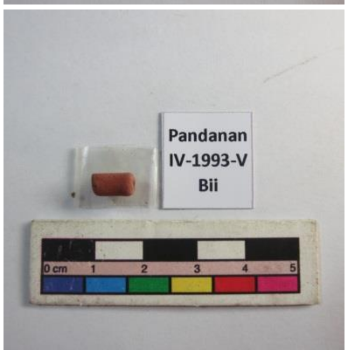

Pandanan
IV-1993-V
Zi


Pandanan
IV-1993-V
Zi


Pandanan
IV-1993-V
Aii

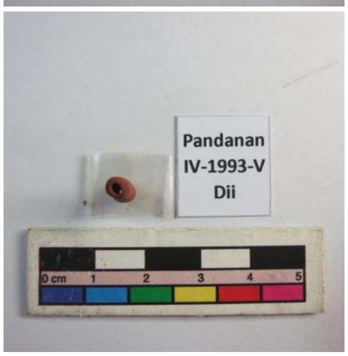

Pandanan
IV-1993-V
Aii

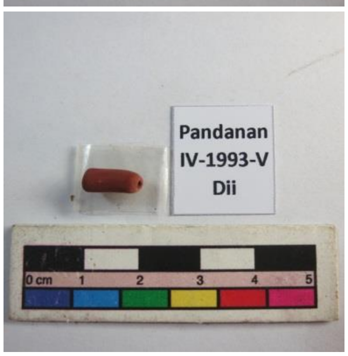

Pandanan
IV-1993-V
Bii

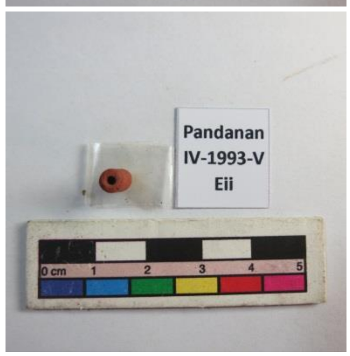

Pandanan
IV-1993-V
Bii

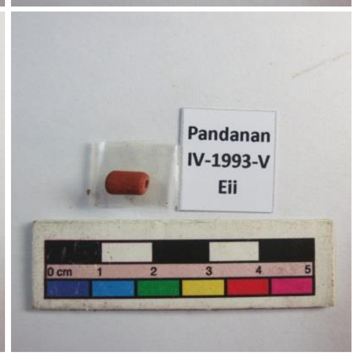

Pandanan
IV-1993-V
Cii


Pandanan
IV-1993-V
Cii


Pandanan
IV-1993-V
Dii


Pandanan
IV-1993-V
Dii


Pandanan
IV-1993-V
Eii

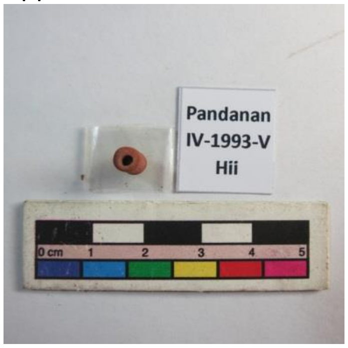

Pandanan
IV-1993-V
Eii


Pandanan
IV-1993-V
Fii

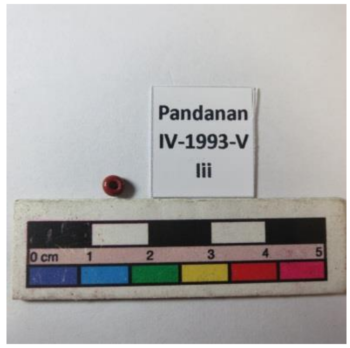

Pandanan
IV-1993-V
Fii

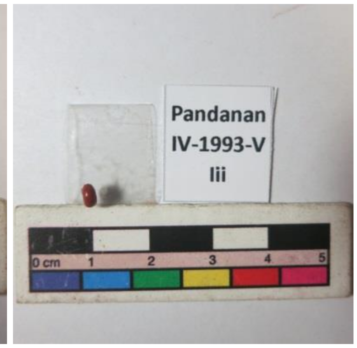

Pandanan
IV-1993-V
Gii


Pandanan
IV-1993-V
Gii

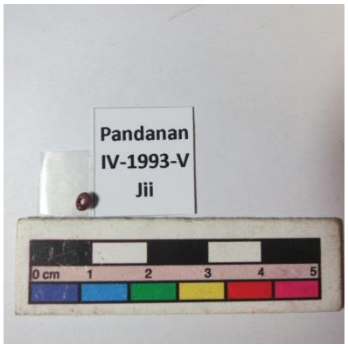

Pandanan
IV-1993-V
Hii
0 cm 1 2 3 4 5

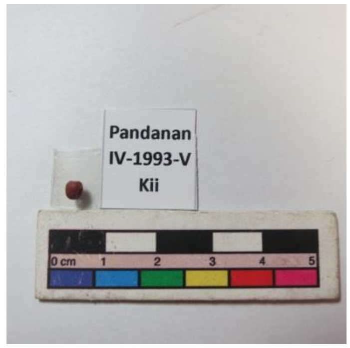

Pandanan
IV-1993-V
Hii
0 cm 1 2 3 4 5

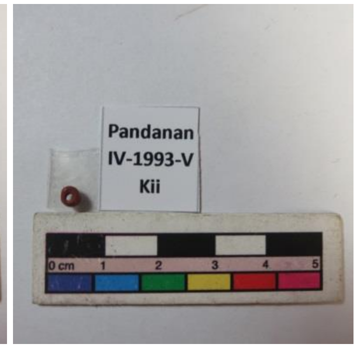

Pandanan
IV-1993-V
Iii
0 cm 1 2 3 4 5

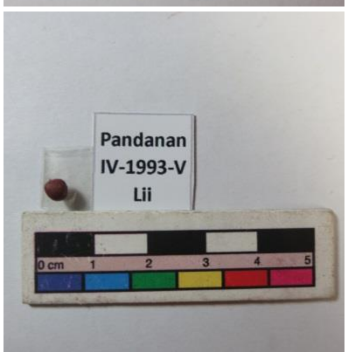

Pandanan
IV-1993-V
Iii
0 cm 1 2 3 4 5

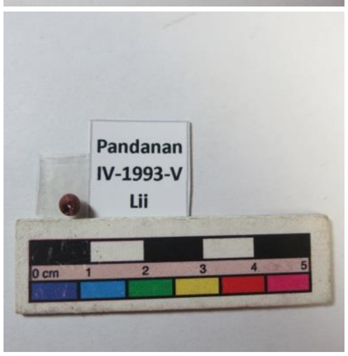

Pandanan
IV-1993-V
Jii
0 cm 1 2 3 4 5

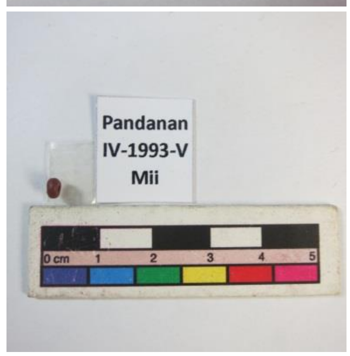

Pandanan
IV-1993-V
Jii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Kii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Kii
0 cm 1 2 3 4 5

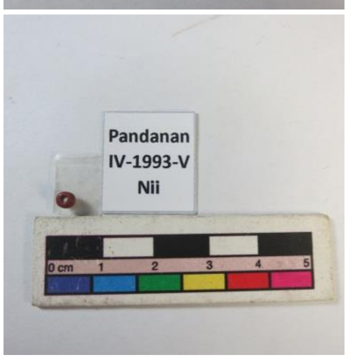

Pandanan
IV-1993-V
Lii
0 cm 1 2 3 4 5

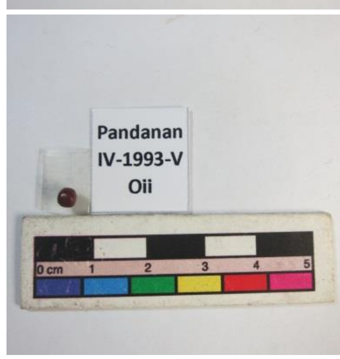

Pandanan
IV-1993-V
Lii
0 cm 1 2 3 4 5

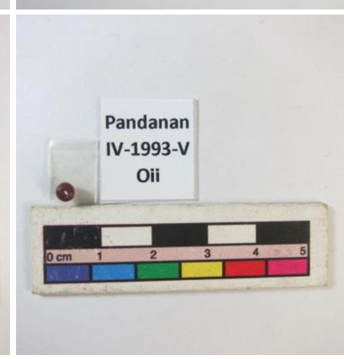

Pandanan
IV-1993-V
Mii
0 cm 1 2 3 4 5

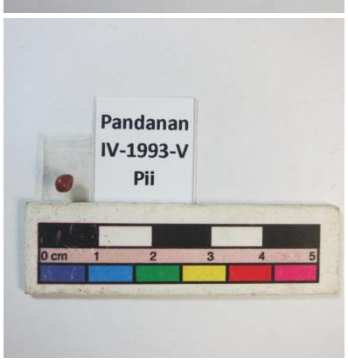

Pandanan
IV-1993-V
Mii
0 cm 1 2 3 4 5

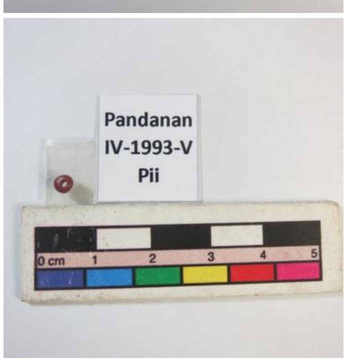

Pandanan
IV-1993-V
Nii
0 cm 1 2 3 4 5

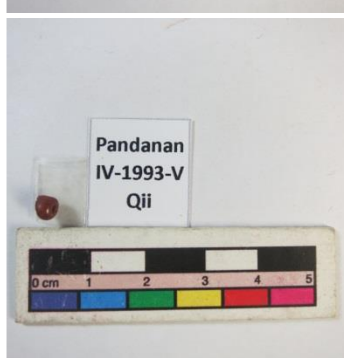

Pandanan
IV-1993-V
Nii
0 cm 1 2 3 4 5

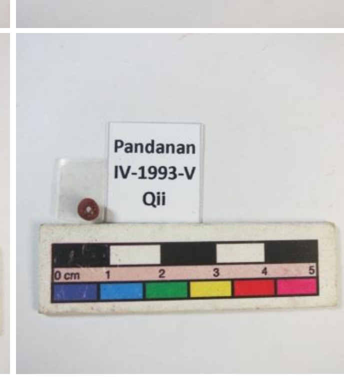

Pandanan
IV-1993-V
Oii
0 cm 1 2 3 4 5

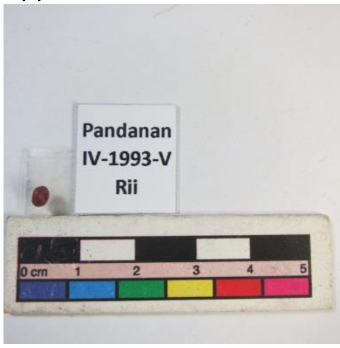

Pandanan
IV-1993-V
Oii
0 cm 1 2 3 4 5

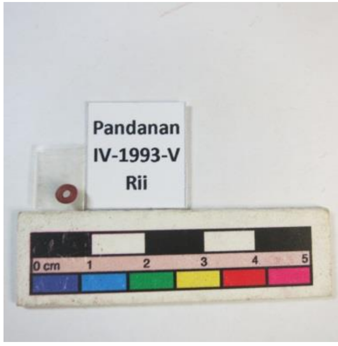

Pandanan
IV-1993-V
Pii
0 cm 1 2 3 4 5

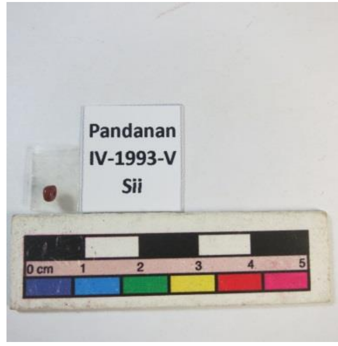

Pandanan
IV-1993-V
Pii
0 cm 1 2 3 4 5

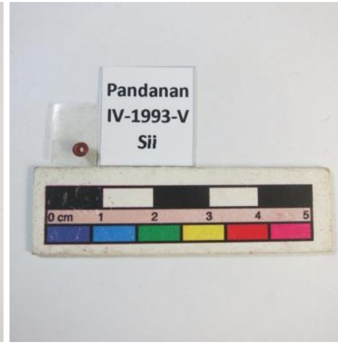

Pandanan
IV-1993-V
Qii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Qii
0 cm 1 2 3 4 5

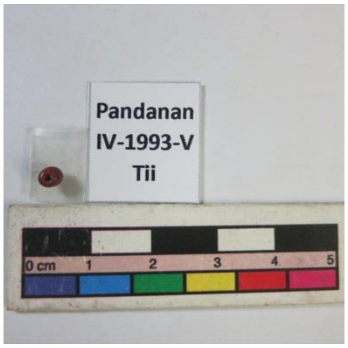

Pandanan
IV-1993-V
Rii
0 cm 1 2 3 4 5

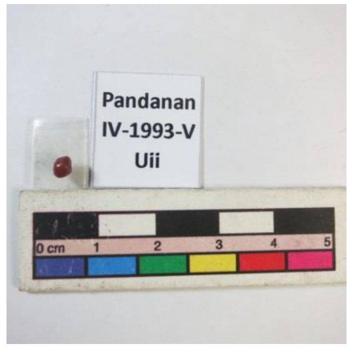

Pandanan
IV-1993-V
Rii
0 cm 1 2 3 4 5

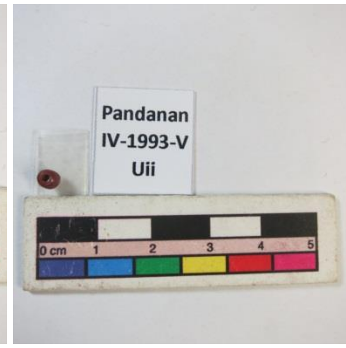

Pandanan
IV-1993-V
Sii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Sii
0 cm 1 2 3 4 5

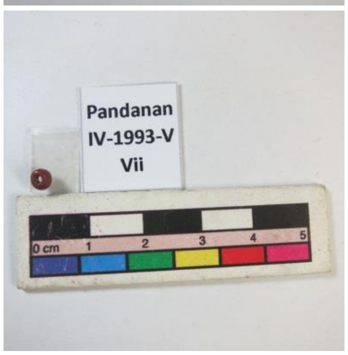

Pandanan
IV-1993-V
Tii
0 cm 1 2 3 4 5

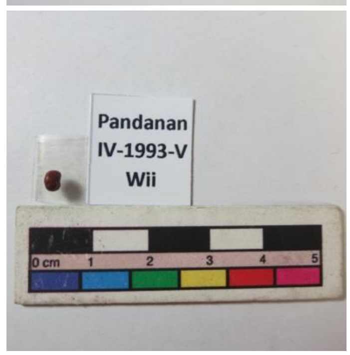

Pandanan
IV-1993-V
Tii
0 cm 1 2 3 4 5

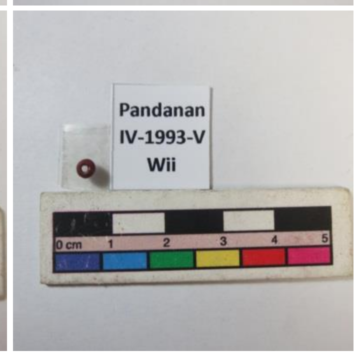

Pandanan
IV-1993-V
Uii
0 cm 1 2 3 4 5

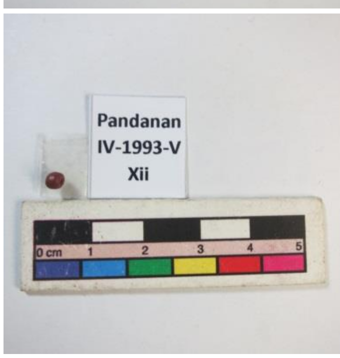

Pandanan
IV-1993-V
Uii
0 cm 1 2 3 4 5

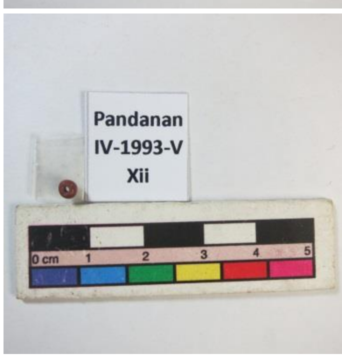

Pandanan
IV-1993-V
Vii
0 cm 1 2 3 4 5

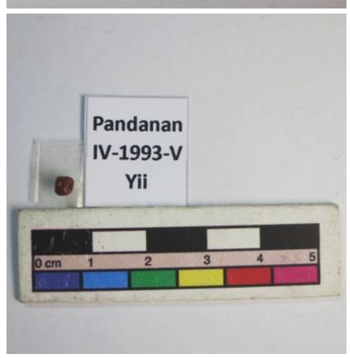

Pandanan
IV-1993-V
Vii
0 cm 1 2 3 4 5

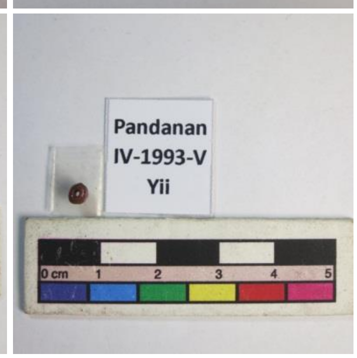

Pandanan
IV-1993-V
Wii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Wii
0 cm 1 2 3 4 5

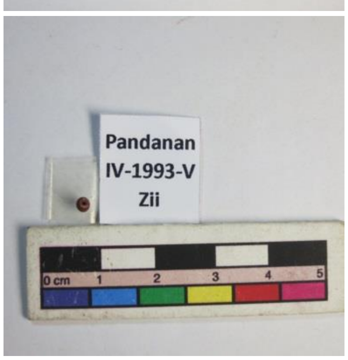

Pandanan
IV-1993-V
Xii
0 cm 1 2 3 4 5

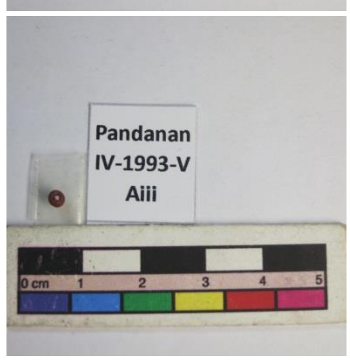

Pandanan
IV-1993-V
Xii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Yii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Yii
0 cm 1 2 3 4 5

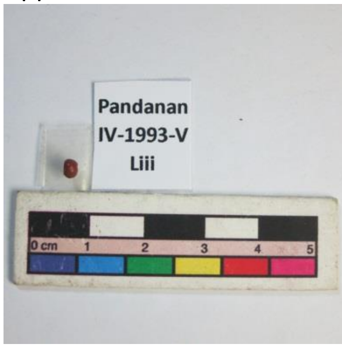

Pandanan
IV-1993-V
Zii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Zii
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Aiii
0 cm 1 2 3 4 5

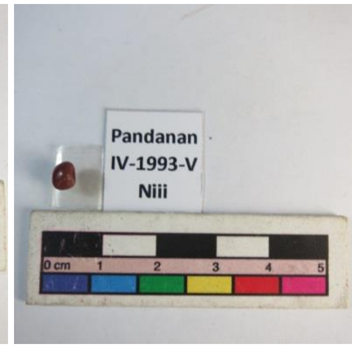

Pandanan
IV-1993-V
Aiii
0 cm 1 2 3 4 5

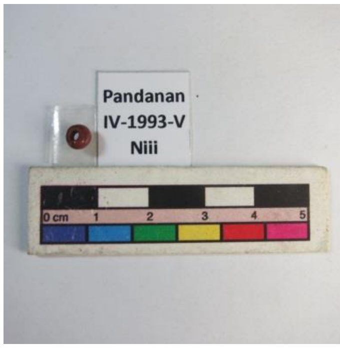

Pandanan IV-1993-V Biii
Pandanan IV-1993-V Biii
Pandanan IV-1993-V Ciii
Pandanan IV-1993-V Ciii
Pandanan IV-1993-V Diii
Pandanan IV-1993-V Diii
Pandanan IV-1993-V Eiii
Pandanan IV-1993-V Eiii
Pandanan IV-1993-V Fiii
Pandanan IV-1993-V Fiii
Pandanan IV-1993-V Giii
Pandanan IV-1993-V Hiii
Pandanan IV-1993-V Hiii
Pandanan IV-1993-V Iiii
Pandanan IV-1993-V Iiii
Pandanan IV-1993-V Jiii
Pandanan IV-1993-V Jiii
Pandanan IV-1993-V Kiii
Pandanan IV-1993-V Kiii
Pandanan IV-1993-V Liii

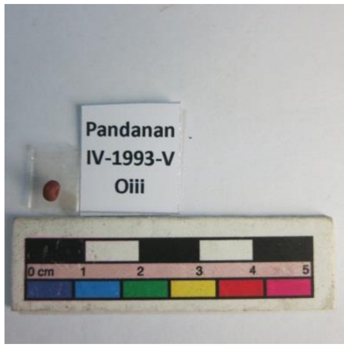

Pandanan
IV-1993-V
Liii

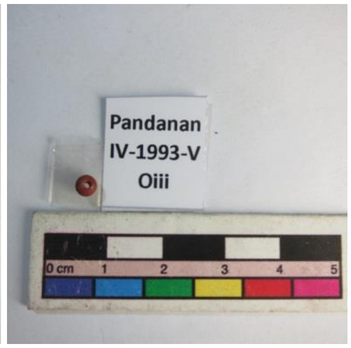

Pandanan
IV-1993-V
Miii

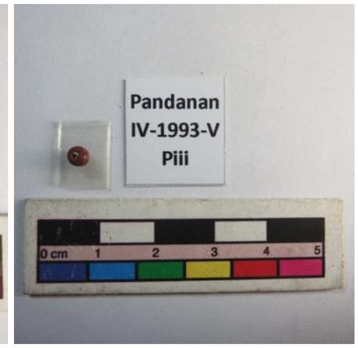

Pandanan
IV-1993-V
Miii

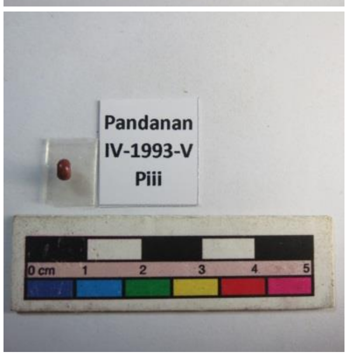

Pandanan
IV-1993-V
Niii

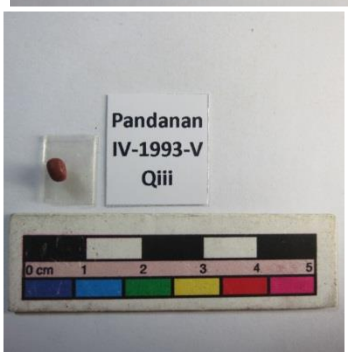

Pandanan
IV-1993-V
Niii

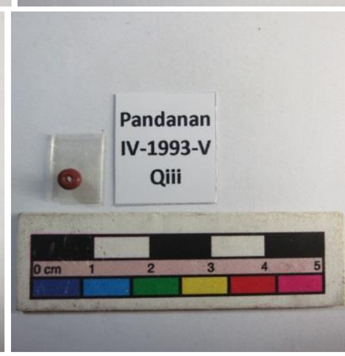

Pandanan
IV-1993-V
Oiii

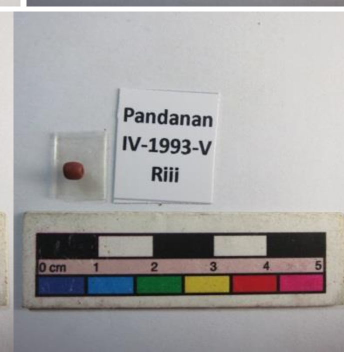

Pandanan
IV-1993-V
Oiii

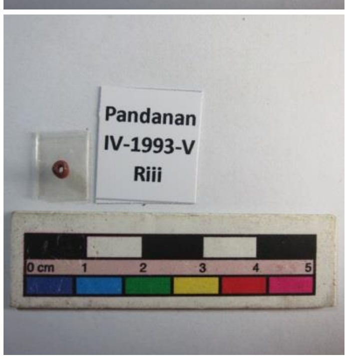

Pandanan
IV-1993-V
Piii


Pandanan
IV-1993-V
Piii


Pandanan
IV-1993-V
Qiii

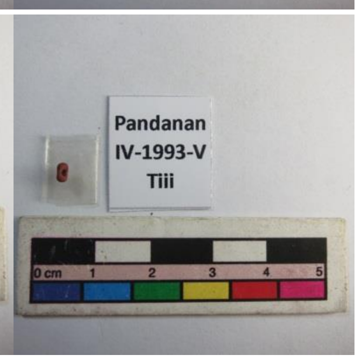

Pandanan
IV-1993-V
Qiii

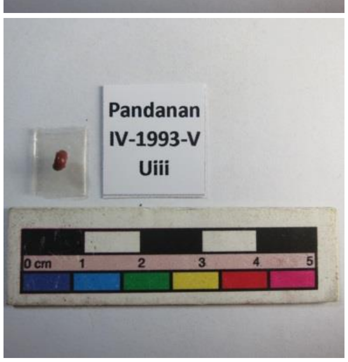

Pandanan
IV-1993-V
Riii

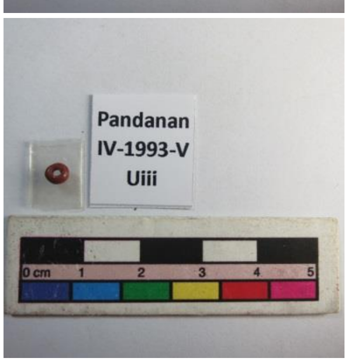

Pandanan
IV-1993-V
Riii

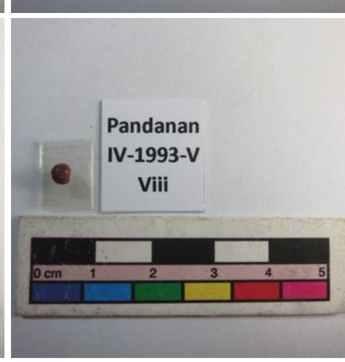

Pandanan
IV-1993-V
Siii

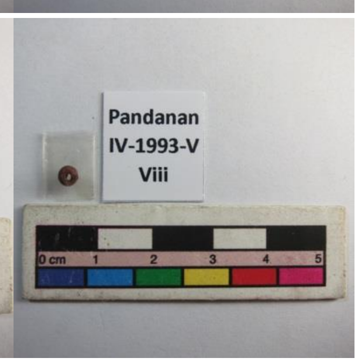

Pandanan
IV-1993-V
Siii

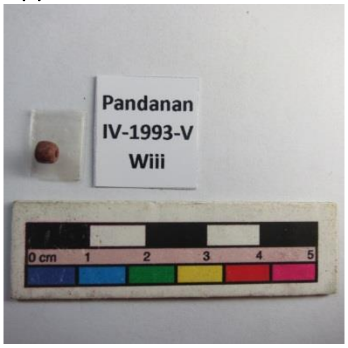

Pandanan
IV-1993-V
Tiii


Pandanan
IV-1993-V
Uiii


Pandanan
IV-1993-V
Uiii

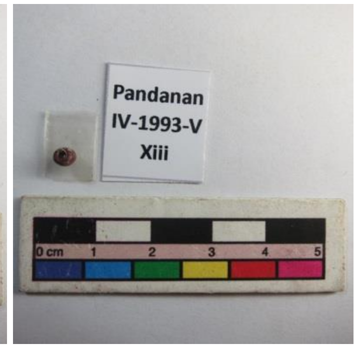

Pandanan
IV-1993-V
Viii

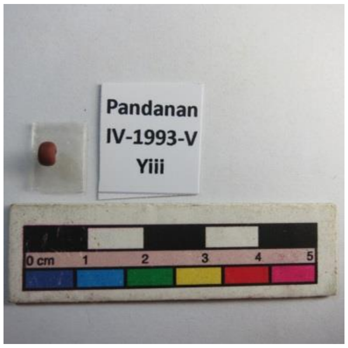

Pandanan
IV-1993-V
Viii

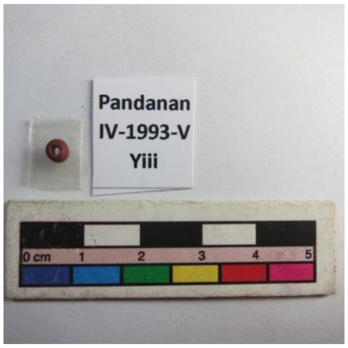

Pandanan
IV-1993-V
Wiii


Pandanan
IV-1993-V
Wiii


Pandanan
IV-1993-V
Xiii

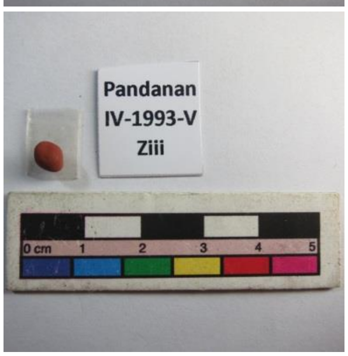

Pandanan
IV-1993-V
Xiii

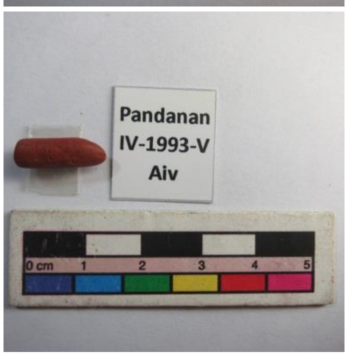

Pandanan
IV-1993-V
Yiii

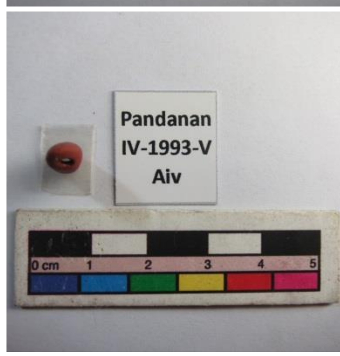

Pandanan
IV-1993-V
Yiii

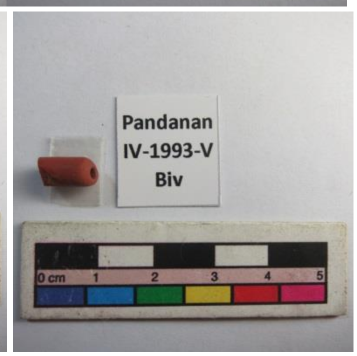

Pandanan
IV-1993-V
Ziii

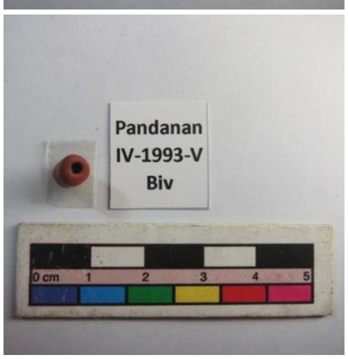

Pandanan
IV-1993-V
Ziii

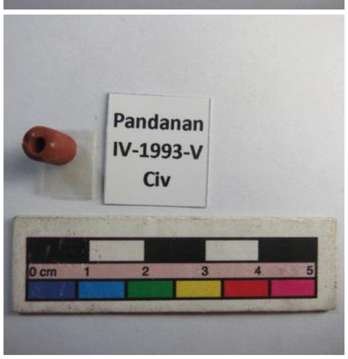

Pandanan
IV-1993-V
Ziii

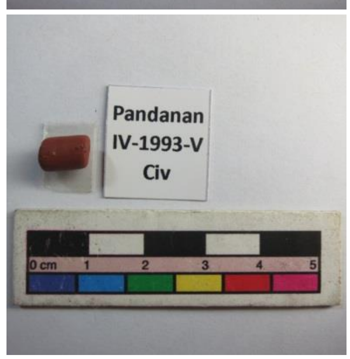

Pandanan
IV-1993-V
Aiv

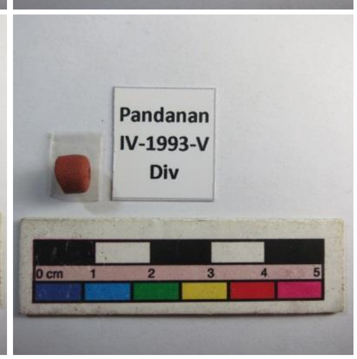

Pandanan
IV-1993-V
Aiv

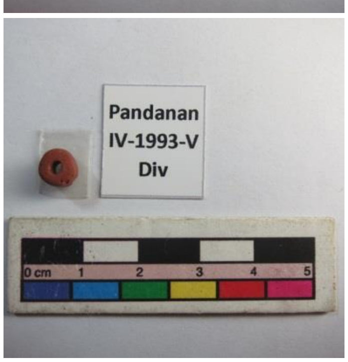

Pandanan
IV-1993-V
Biv

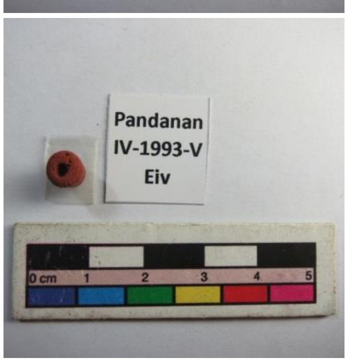

Pandanan
IV-1993-V
Biv

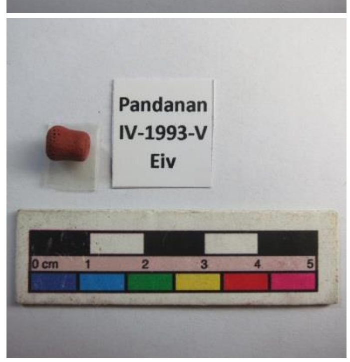

Pandanan
IV-1993-V
Civ


Pandanan
IV-1993-V
Civ

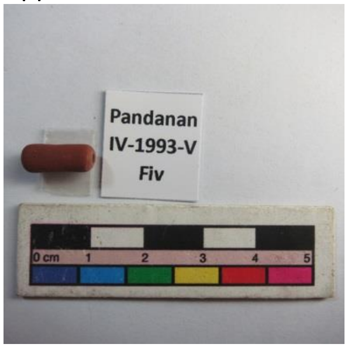

Pandanan
IV-1993-V
Div


Pandanan
IV-1993-V
Div

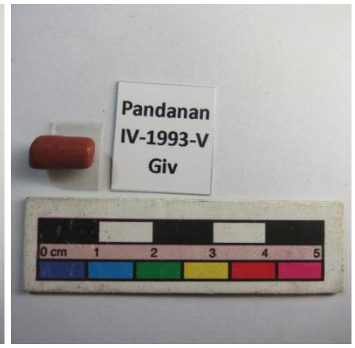

Pandanan
IV-1993-V
Eiv

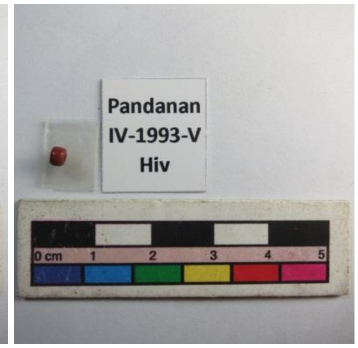

Pandanan
IV-1993-V
Eiv

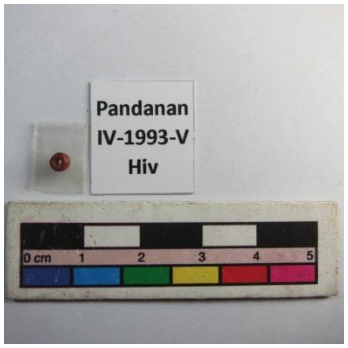

Pandanan
IV-1993-V
Fiv

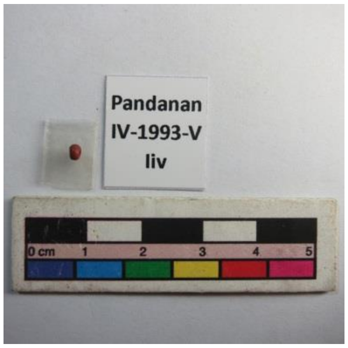

Pandanan
IV-1993-V
Fiv
0 cm 1 2 3 4 5

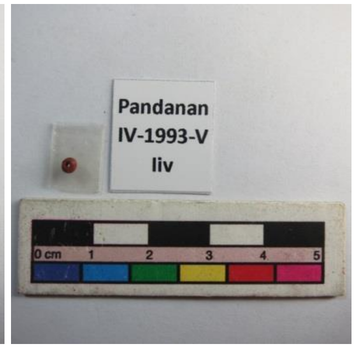

Pandanan
IV-1993-V
Giv
0 cm 1 2 3 4 5

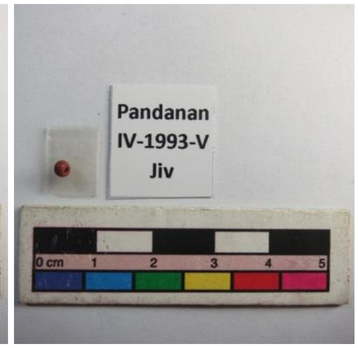

Pandanan
IV-1993-V
Giv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Hiv
0 cm 1 2 3 4 5

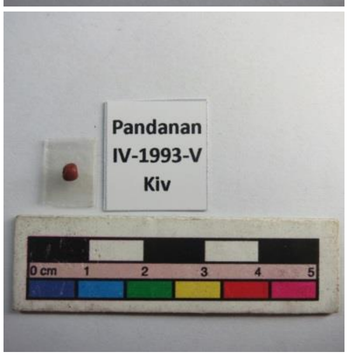

Pandanan
IV-1993-V
Hiv
0 cm 1 2 3 4 5

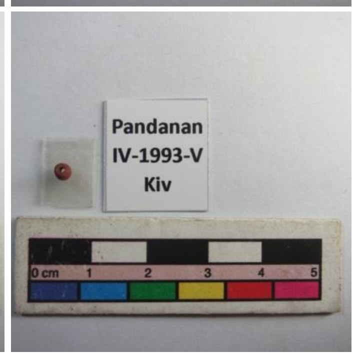

Pandanan
IV-1993-V
Iiv
0 cm 1 2 3 4 5

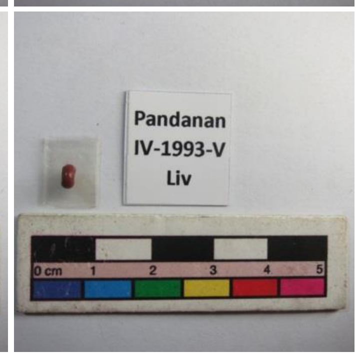

Pandanan
IV-1993-V
Iiv
0 cm 1 2 3 4 5

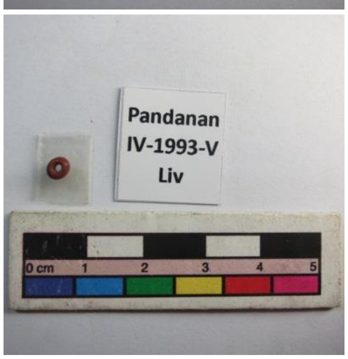

Pandanan
IV-1993-V
Jiv
0 cm 1 2 3 4 5

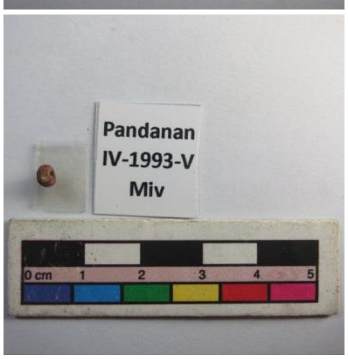

Pandanan
IV-1993-V
Jiv
0 cm 1 2 3 4 5

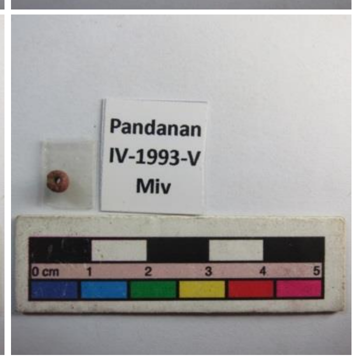

Pandanan
IV-1993-V
Kiv
0 cm 1 2 3 4 5

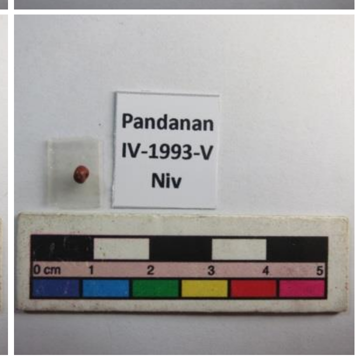

Pandanan
IV-1993-V
Kiv
0 cm 1 2 3 4 5

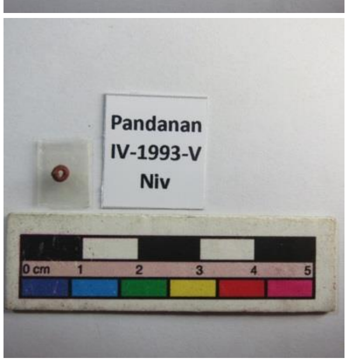

Pandanan
IV-1993-V
Liv
0 cm 1 2 3 4 5

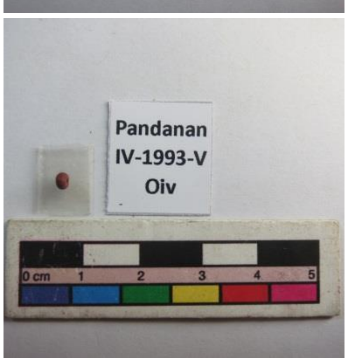

Pandanan
IV-1993-V
Liv
0 cm 1 2 3 4 5

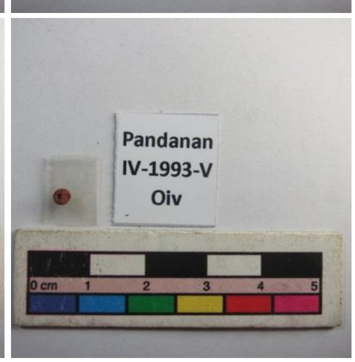

Pandanan
IV-1993-V
Miv
0 cm 1 2 3 4 5

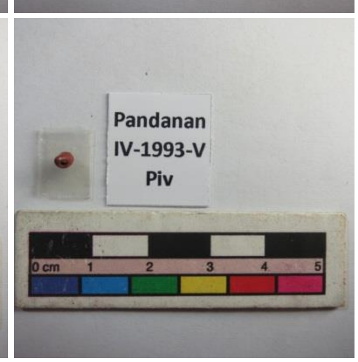

Pandanan
IV-1993-V
Miv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Niv
0 cm 1 2 3 4 5


Pandanan
IV-1993-V
Niv
0 cm 1 2 3 4 5

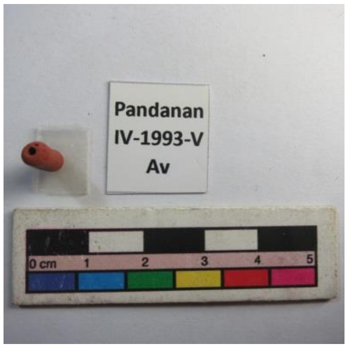

Pandanan
IV-1993-V
Oiv
0 cm 1 2 3 4 5

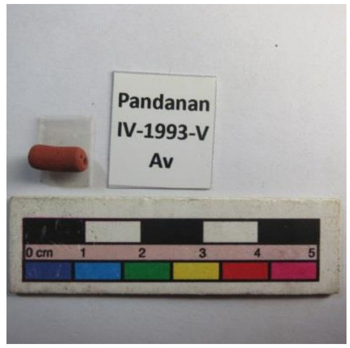

Pandanan
IV-1993-V
Oiv
0 cm 1 2 3 4 5

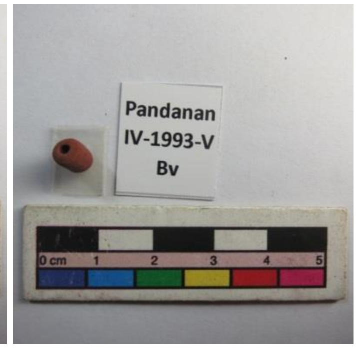

Pandanan
IV-1993-V
Piv
0 cm 1 2 3 4 5

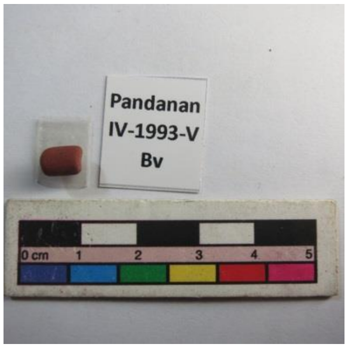

Pandanan IV-1993-V Piv
Pandanan IV-1993-V Qiv
Pandanan IV-1993-V Qiv
Pandanan IV-1993-V Riv
Pandanan IV-1993-V Riv
Pandanan IV-1993-V Siv
Pandanan IV-1993-V Siv
Pandanan IV-1993-V Tiv
Pandanan IV-1993-V Tiv
Pandanan IV-1993-V Uiv
Pandanan IV-1993-V Uiv
Pandanan IV-1993-V Viv
Pandanan IV-1993-V Viv
Pandanan IV-1993-V Wiv
Pandanan IV-1993-V Wiv
Pandanan IV-1993-V Xiv
Pandanan IV-1993-V Xiv
Pandanan IV-1993-V Yiv
Pandanan IV-1993-V Yiv
Pandanan IV-1993-V Ziv

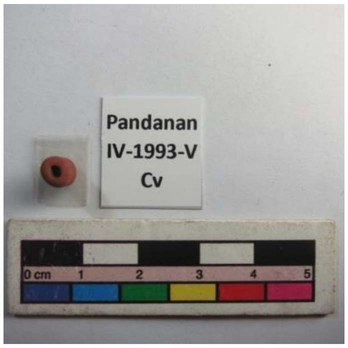

Pandanan
IV-1993-V
Ziv


Pandanan
IV-1993-V
Av

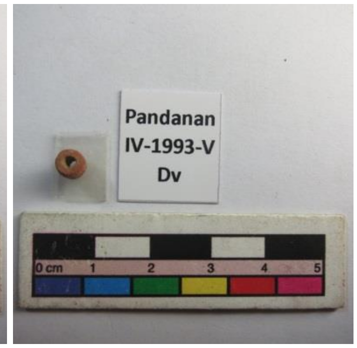

Pandanan
IV-1993-V
Av

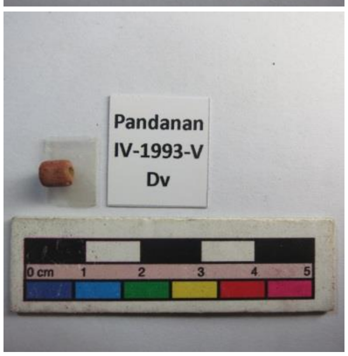

Pandanan
IV-1993-V
Bv

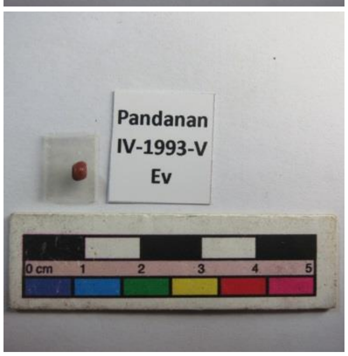

Pandanan
IV-1993-V
Bv

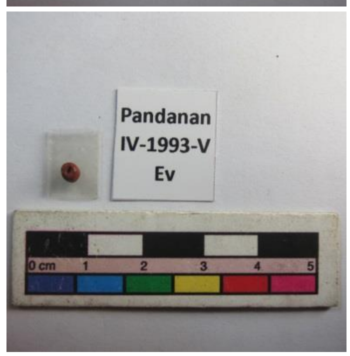

Pandanan
IV-1993-V
Cv

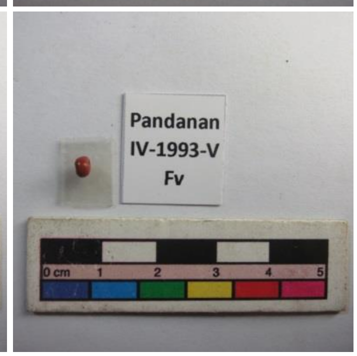

Pandanan
IV-1993-V
Cv

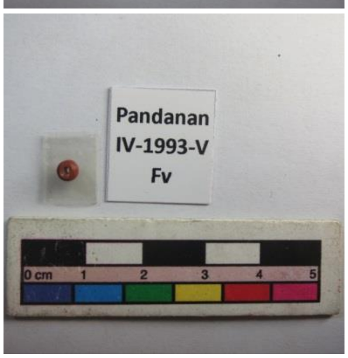

Pandanan
IV-1993-V
Dv

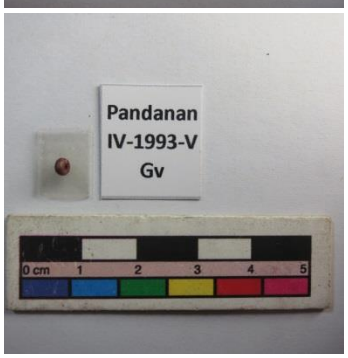

Pandanan
IV-1993-V
Dv

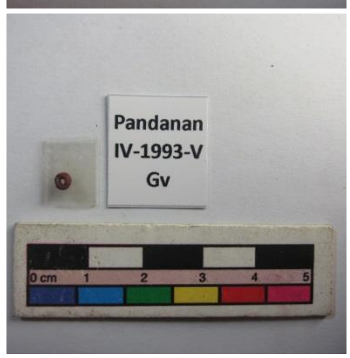

Pandanan
IV-1993-V
Ev

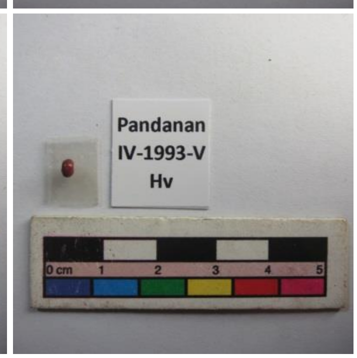

Pandanan
IV-1993-V
Ev

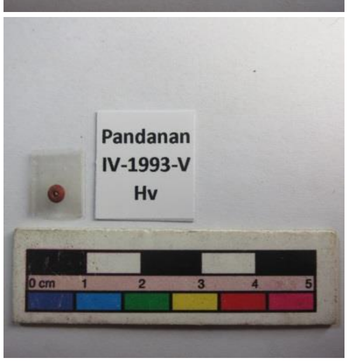

Pandanan
IV-1993-V
Fv

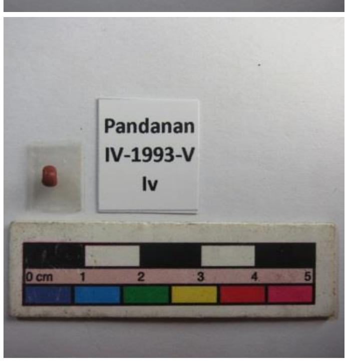

Pandanan
IV-1993-V
Fv

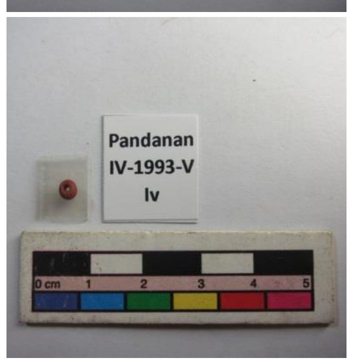

Pandanan
IV-1993-V
Gv

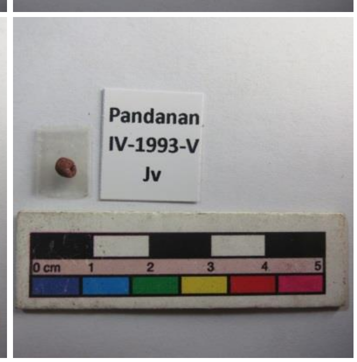

Pandanan
IV-1993-V
Gv

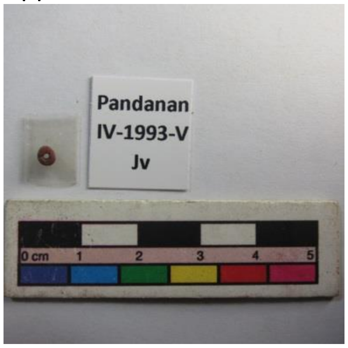

Pandanan
IV-1993-V
Hv


Pandanan
IV-1993-V
Hv

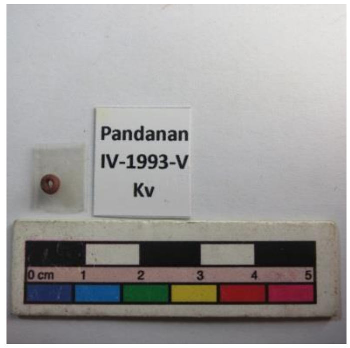

Pandanan
IV-1993-V
Iv

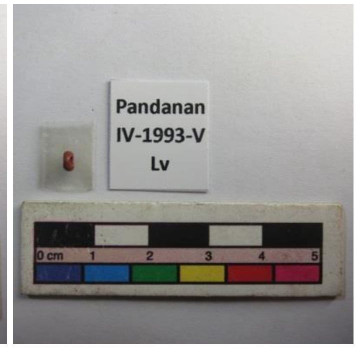

Pandanan
IV-1993-V
Iv

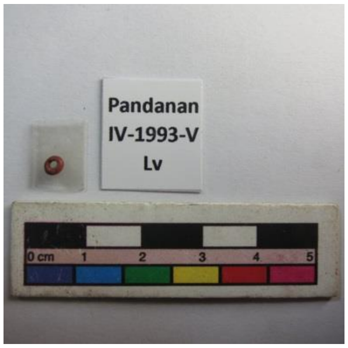

Pandanan
IV-1993-V
Jv

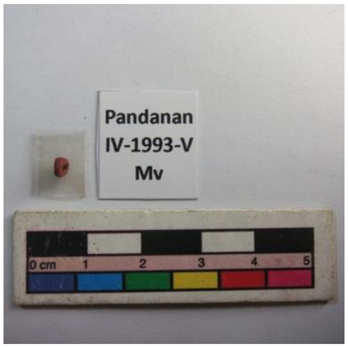

Pandanan
IV-1993-V
Jv


Pandanan
IV-1993-V
Kv

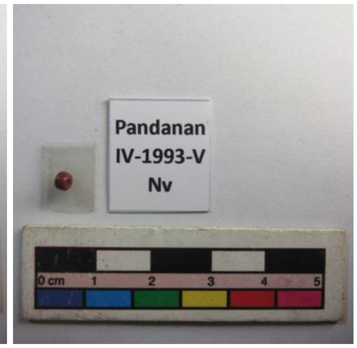

Pandanan
IV-1993-V
Kv

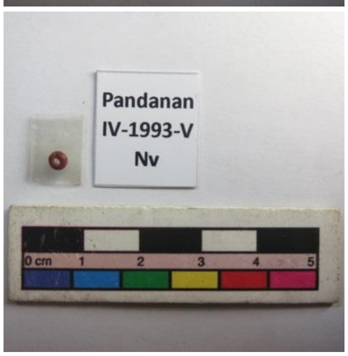

Pandanan
IV-1993-V
Lv

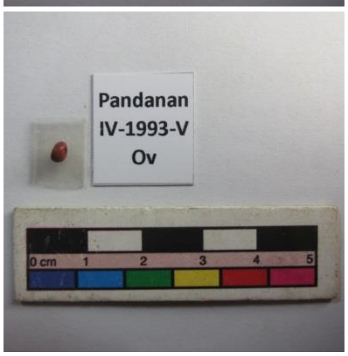

Pandanan
IV-1993-V
Lv

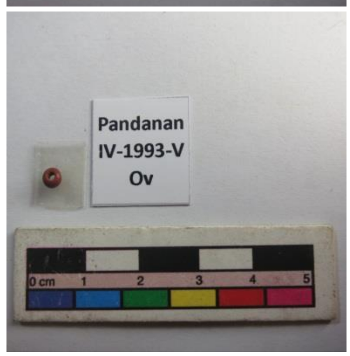

Pandanan
IV-1993-V
Mv

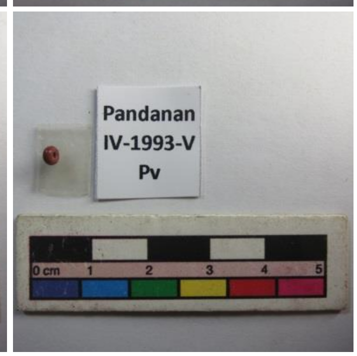

Pandanan
IV-1993-V
Mv

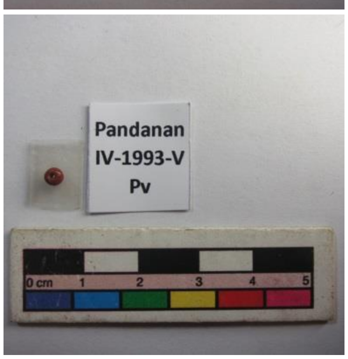

Pandanan
IV-1993-V
Nv

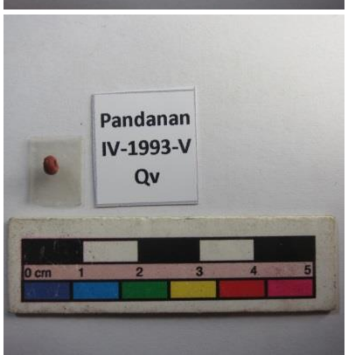

Pandanan
IV-1993-V
Nv

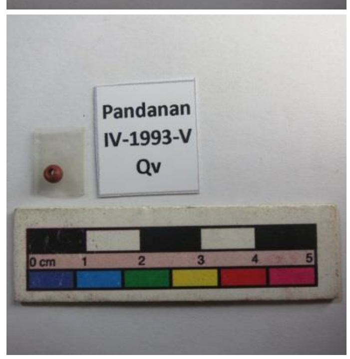

Pandanan
IV-1993-V
Ov


Pandanan
IV-1993-V
Ov

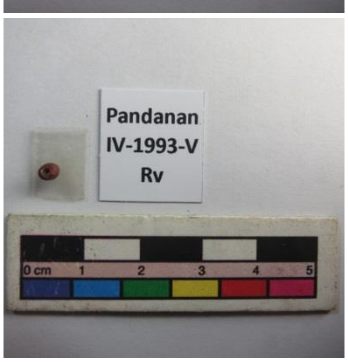

Pandanan
IV-1993-V
Pv

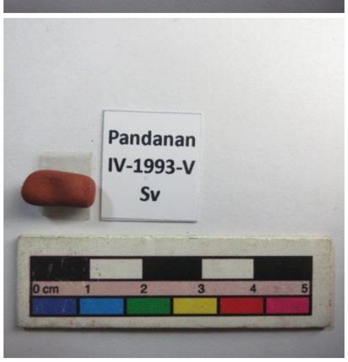

Pandanan
IV-1993-V
Pv

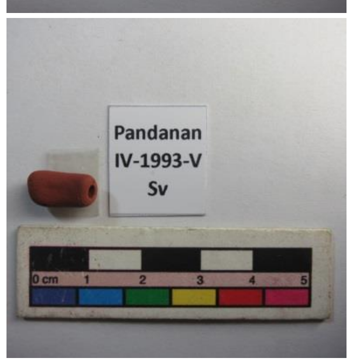

Pandanan
IV-1993-V
Qv


Pandanan
IV-1993-V
Qv

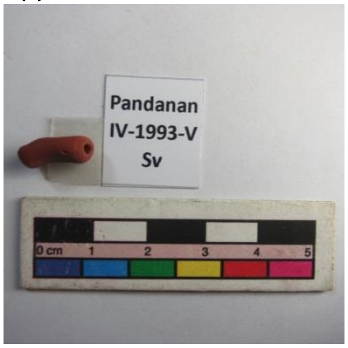

Pandanan
IV-1993-V
Rv


Pandanan
IV-1993-V
Rv

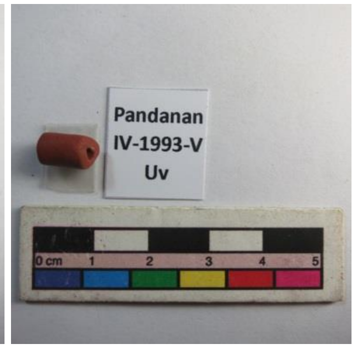

Pandanan
IV-1993-V
Sv

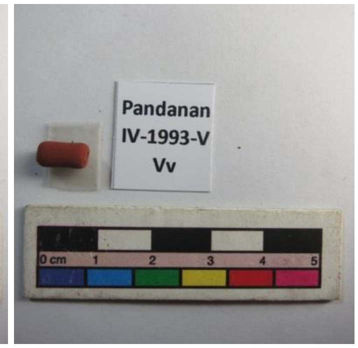

Pandanan
IV-1993-V
Sv

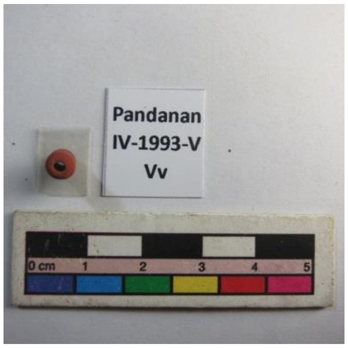

Pandanan
IV-1993-V
Sv

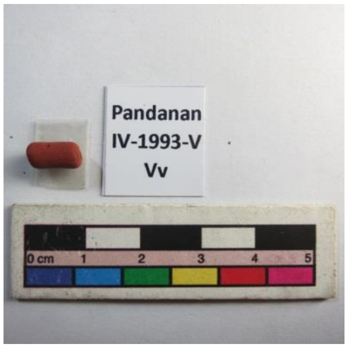

Pandanan
IV-1993-V
Sv

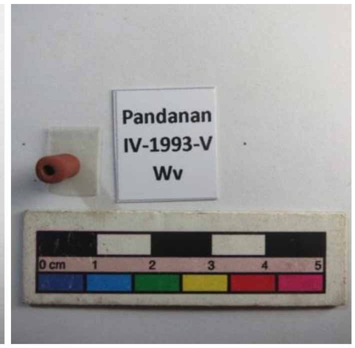

Pandanan
IV-1993-V
Uv

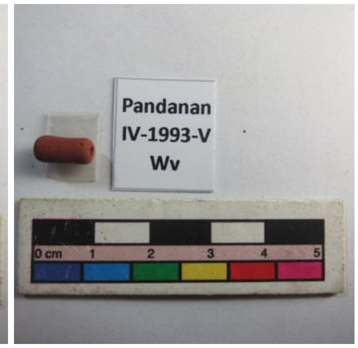

Pandanan
IV-1993-V
Uv

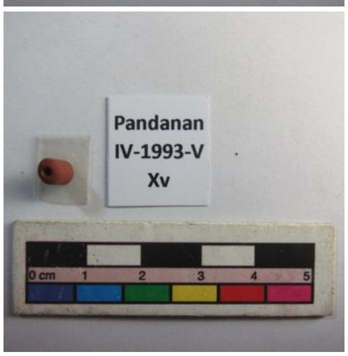

Pandanan
IV-1993-V
Vv

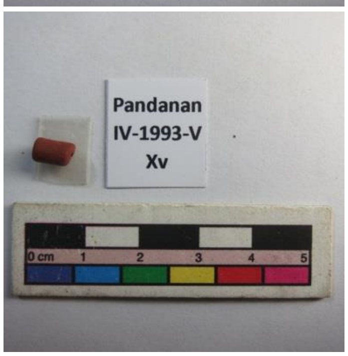

Pandanan
IV-1993-V
Vv

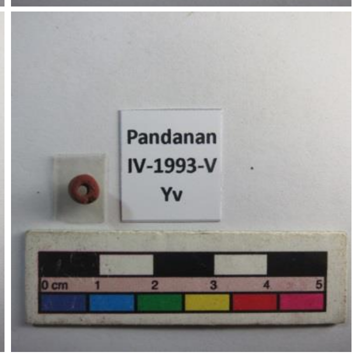

Pandanan
IV-1993-V
Vv

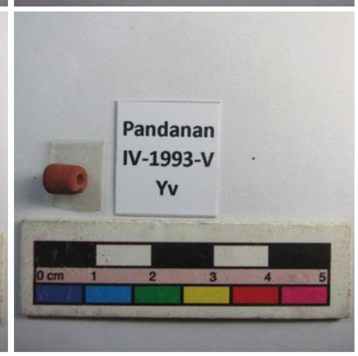

Pandanan
IV-1993-V
Wv

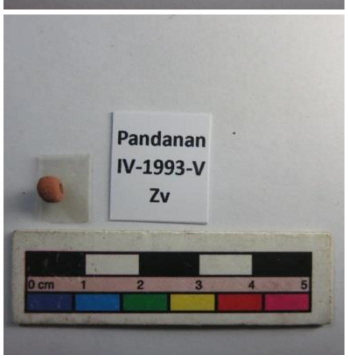

Pandanan
IV-1993-V
Wv

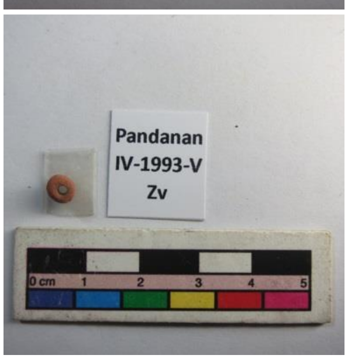

Pandanan
IV-1993-V
Xv

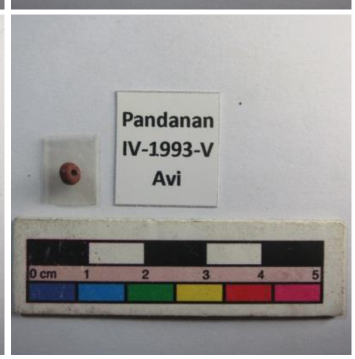

Pandanan
IV-1993-V
Xv

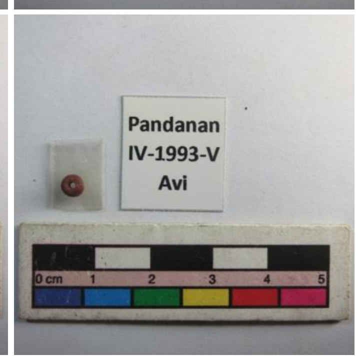

Pandanan
IV-1993-V
Yv

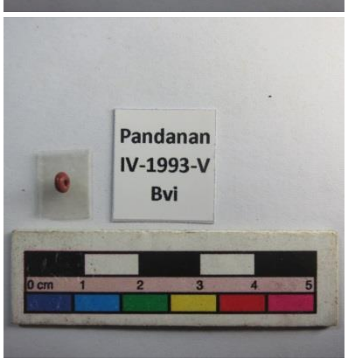

Pandanan
IV-1993-V
Yv

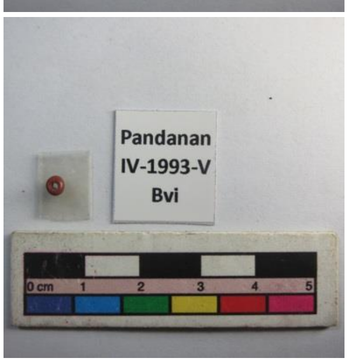

Pandanan
IV-1993-V
Zv


Pandanan
IV-1993-V
Zv

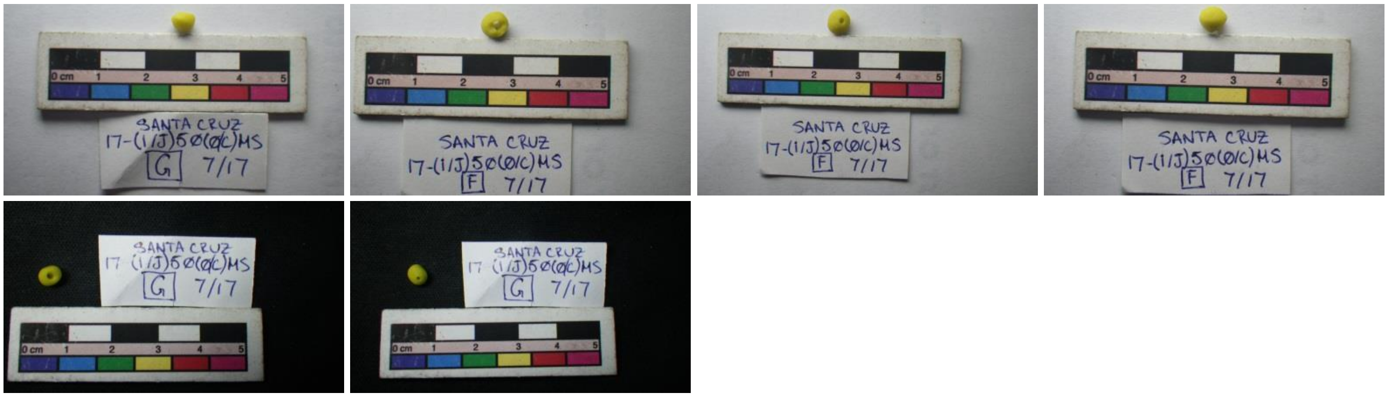

Pandanan
IV-1993-V
Avi


Pandanan
IV-1993-V
Avi

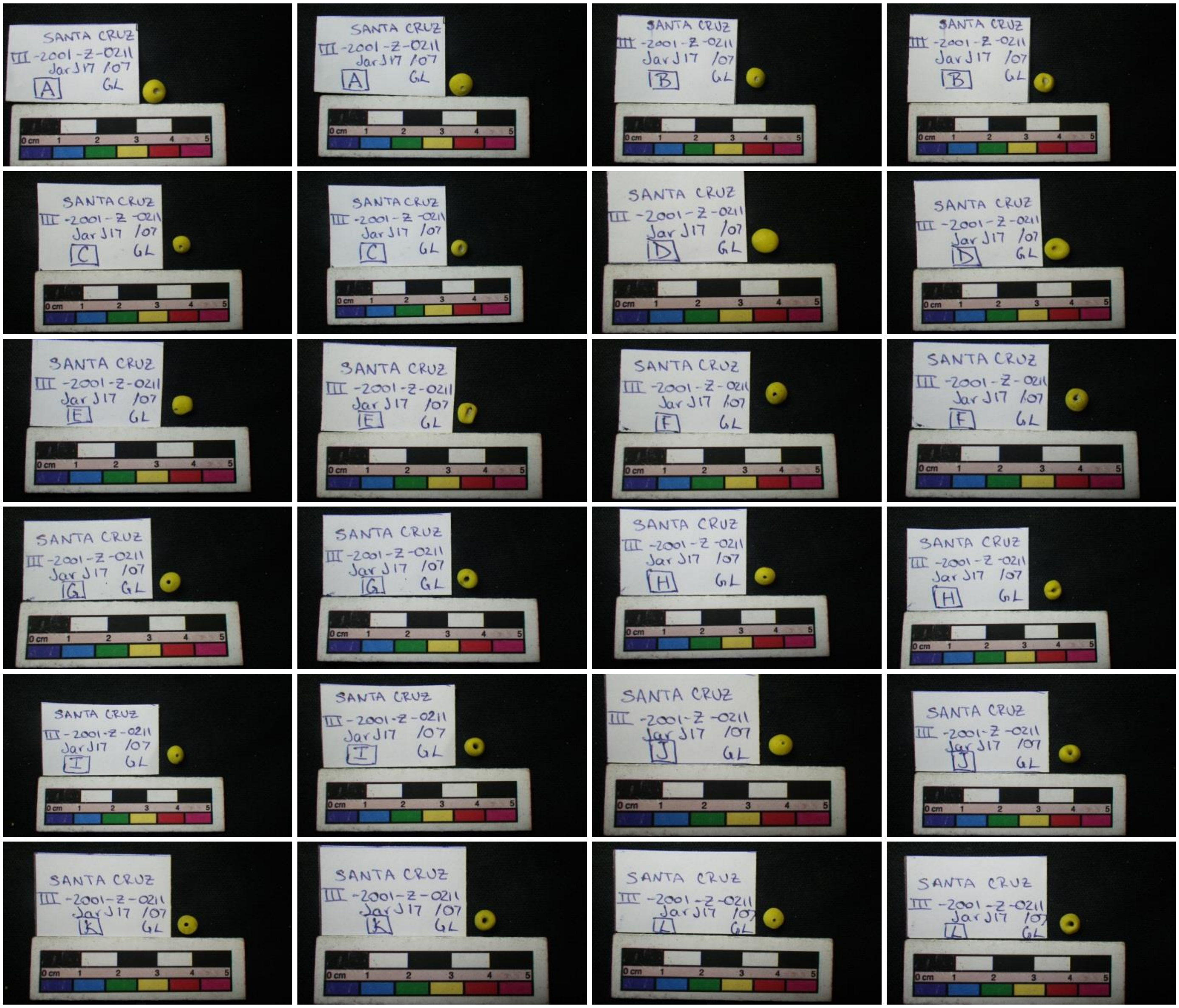

Pandanan
IV-1993-V
Bvi

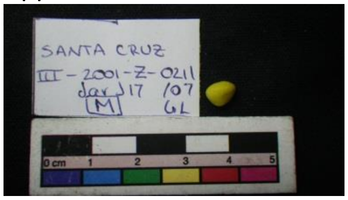

Pandanan
IV-1993-V
Bvi

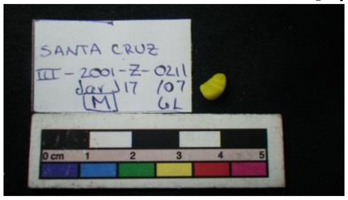
17J 50cms

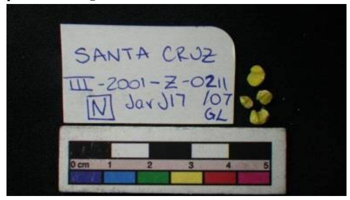


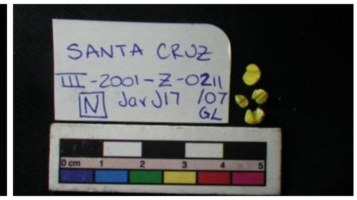
0211

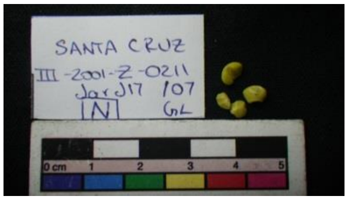



SANTA CRUZ
III-2001-Z-0211
Jar J17 /07
M
GL


SANTA CRUZ
III-2001-Z-0211
Jar J17 /07
M
GL

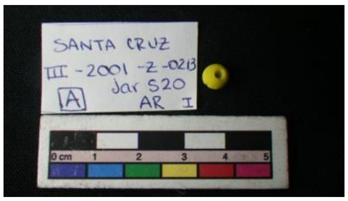

SANTA CRUZ
III-2001-Z-0211
N Jar J17 /07
GL

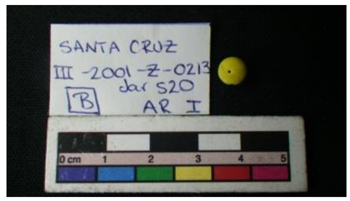

SANTA CRUZ
III-2001-Z-0211
N Jar J17 /07
GL

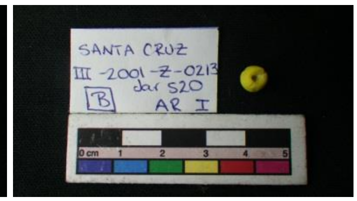

SANTA CRUZ
III-2001-Z-0211
Jar J17 /07
N
GL

0213

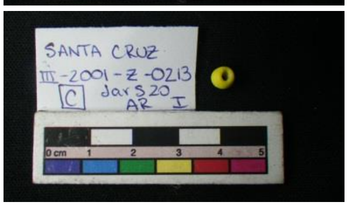

SANTA CRUZ
III-2001-Z-0213
Jar S20
A
AR I

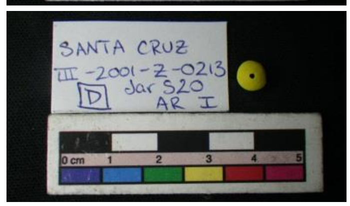

SANTA CRUZ
III-2001-Z-0213
Jar S20
A
AR I

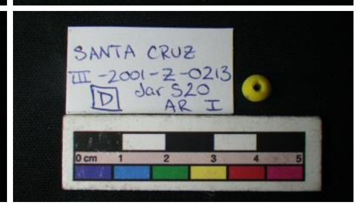

SANTA CRUZ
III-2001-Z-0213
Jar S20
B
AR I


SANTA CRUZ
III-2001-Z-0213
Jar S20
B
AR I


SANTA CRUZ
III-2001-Z-0213
C Jar S20
AR I

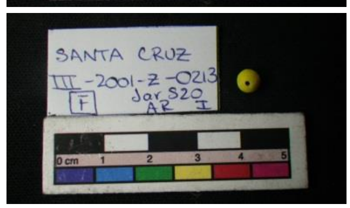

SANTA CRUZ
III-2001-Z-0213
C Jar S20
AR I

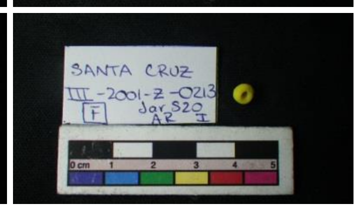

SANTA CRUZ
III-2001-Z-0213
D Jar S20
AR I

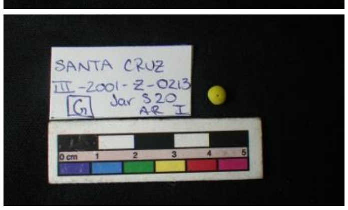

SANTA CRUZ
III-2001-Z-0213
D Jar S20
AR I

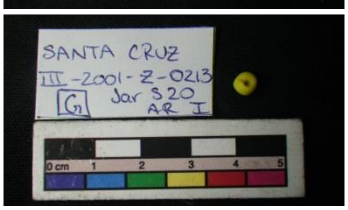

SANTA CRUZ
III-2001-Z-0213
E Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
E Jar S20
AR I

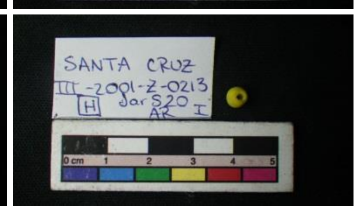

SANTA CRUZ
III-2001-Z-0213
F Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
F Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
G Jar S20
AR I

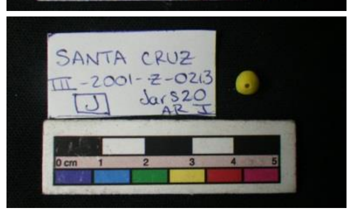

SANTA CRUZ
III-2001-Z-0213
G Jar S20
AR I

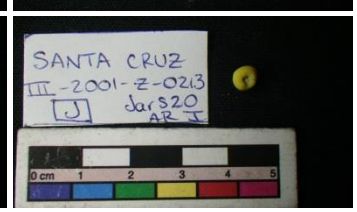

SANTA CRUZ
III-2001-Z-0213
H Jar S20
AR I

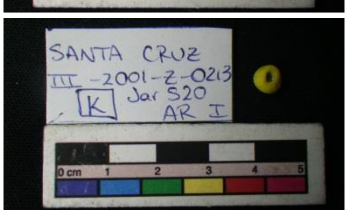

SANTA CRUZ
III-2001-Z-0213
H Jar S20
AR I

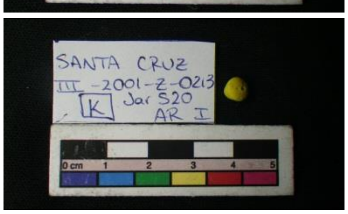

SANTA CRUZ
III-2001-Z-0213
I Jar S20
AR I

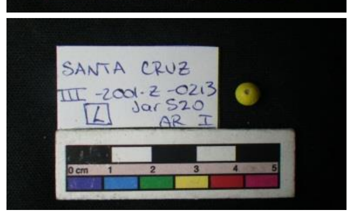

SANTA CRUZ
III-2001-Z-0213
I Jar S20
AR I

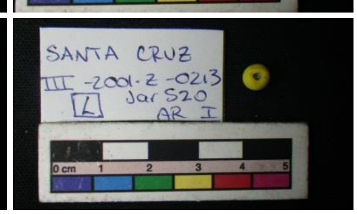

SANTA CRUZ
III-2001-Z-0213
J Jar S20
AR I

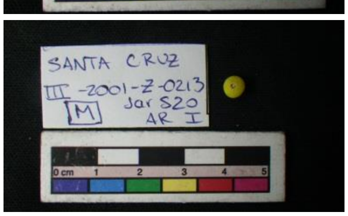

SANTA CRUZ
III-2001-Z-0213
J Jar S20
AR I

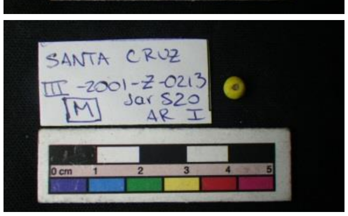

SANTA CRUZ
III-2001-Z-0213
K Jar S20
AR I

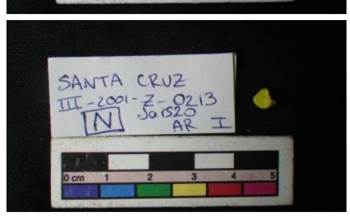

SANTA CRUZ
III-2001-Z-0213
K Jar S20
AR I

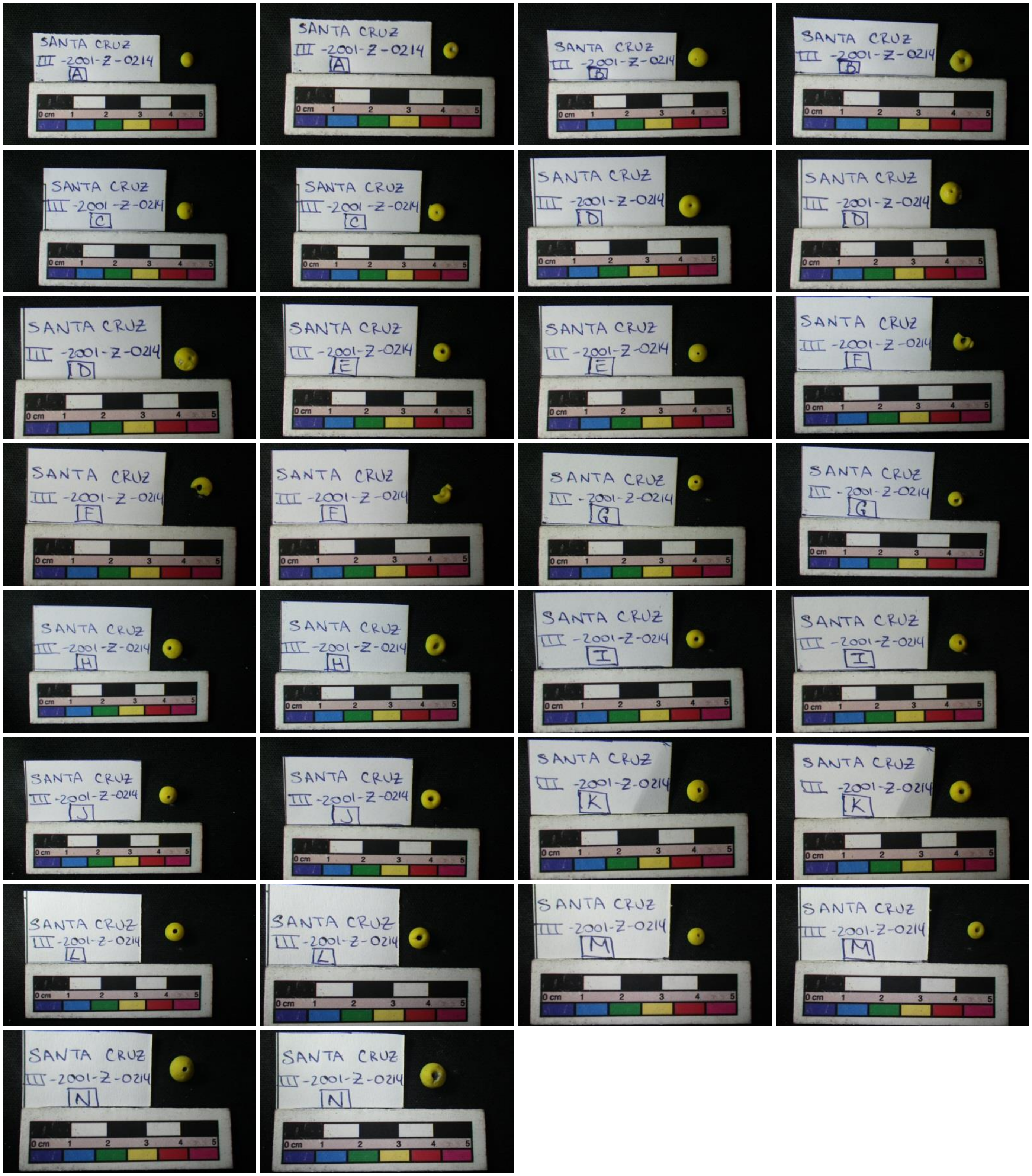

SANTA CRUZ
III-2001-Z-0213
L Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
L Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
M Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
M Jar S20
AR I


SANTA CRUZ
III-2001-Z-0213
N Jar S20
AR I


SANTA CRUZ
III -2001-Z-0214
A
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
A
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
B
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
B
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
C
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
C
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
D
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
D
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
D
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
E
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
E
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
F
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
F
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
F
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
G
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
G
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
H
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
H
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
I
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
I
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
J
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
J
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
K
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
K
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
L
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
L
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
M
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
M
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
N
0 cm 1 2 3 4 5
SANTA CRUZ
III -2001-Z-0214
N
0 cm 1 2 3 4 5

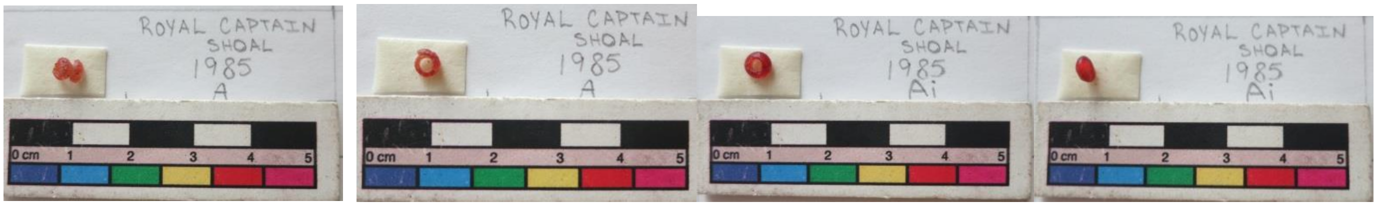
1171


SC III-01-Z- 1171 A
SC III-01-Z- 1171 A
SC III-01-Z 1171 B
SC III-01-Z 1171 B
SC 1171 C
SC 1171 C
SC 1171 D
SC 1171 D
SC 1171 E
SC 1171 E
SC 1171 F
SC 1171 F
SC 1171 G
SC 1171 G
SC 1171 H
SC 1171 H
SC 1171 I
SC 1171 I
SC 1171 J
SC 1171 J
SC 1171 K
SC 1171 K
SC 1171 L
SC 1171 L
SC 1171 M
SC 1171 M
SC 1171 N
SC 1171 N

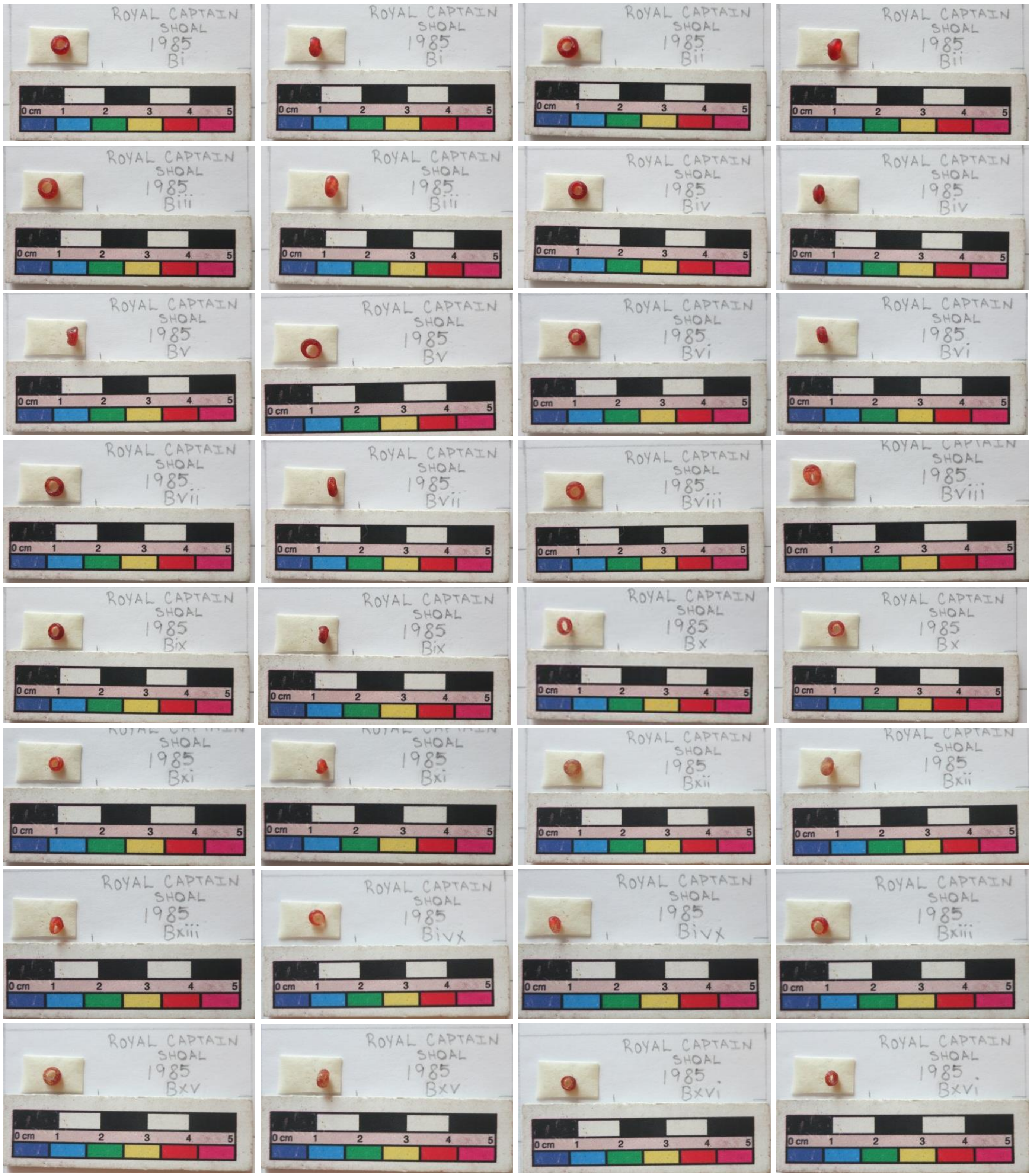
N.A. BLACK BEADS


SANTA CRUZ III - 2001 - Z S
SANTA CRUZ III - 2001 - Z S
SANTA CRUZ III - 2001 - Z T
SANTA CRUZ III - 2001 - Z T
SANTA CRUZ III - 2001 - Z U
SANTA CRUZ III - 2001 - Z U
SANTA CRUZ III - 2001 - Z V
SANTA CRUZ III - 2001 - Z V
SANTA CRUZ III - 2001 - Z W
SANTA CRUZ III - 2001 - Z W
SANTA CRUZ III - 2001 - Z X
SANTA CRUZ III - 2001 - Z X
SANTA CRUZ III - 2001 - Z Y
SANTA CRUZ III - 2001 - Z Y
III - 2001 - Z Z
SANTA CRUZ III - 2001 - Z Z
SANTA CRUZ III - 2001 - Z Ai
SANTA CRUZ III - 2001 - Z Ai
SANTA CRU III - 2001 - Z Bi
SANTA CRUZ III - 2001 - Z Bi
SANTA CRUZ III - 2001 - Z Ci
SANTA CRUZ III - 2001 - Z Ci
SANTA CRUZ III - 2001 - Z Di Ei Fi
SANTA CRUZ III - 2001 - Z Di Ei Fi
SANTA CRUZ III - 2001 - Z Gi Hi
SANTA CRUZ III - 2001 - Z Gi Hi
SANTA CRUZ III - 2001 - Z Ii Ji Ki
SANTA CRUZ III - 2001 - Z Ii Ji Ki

1985 A

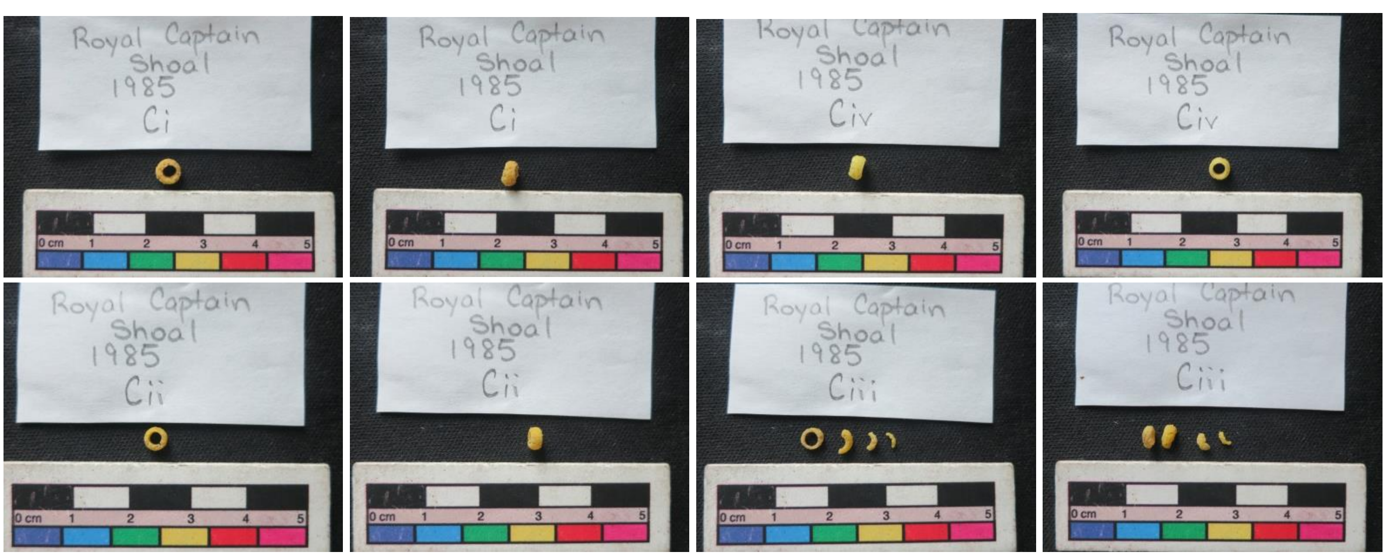

ROYAL CAPTAIN SHOAL 1985 A
ROYAL CAPTAIN SHOAL 1985 A
ROYAL CAPTAIN SHOAL 1985 Ai
ROYAL CAPTAIN SHOAL 1985 Ai

1985 B


ROYAL CAPTAIN SHOAL 1985 Bi
ROYAL CAPTAIN SHOAL 1985 Bi
ROYAL CAPTAIN SHOAL 1985 Bii
ROYAL CAPTAIN SHOAL 1985 Bii
ROYAL CAPTAIN SHOAL 1985 Biii
ROYAL CAPTAIN SHOAL 1985 Biii
ROYAL CAPTAIN SHOAL 1985 Biv
ROYAL CAPTAIN SHOAL 1985 Biv
ROYAL CAPTAIN SHOAL 1985 Bv
ROYAL CAPTAIN SHOAL 1985 Bv
ROYAL CAPTAIN SHOAL 1985 Bvi
ROYAL CAPTAIN SHOAL 1985 Bvi
ROYAL CAPTAIN SHOAL 1985 Bvii
ROYAL CAPTAIN SHOAL 1985 Bvii
ROYAL CAPTAIN SHOAL 1985 Bviii
SHOAL 1985 Bviii
ROYAL CAPTAIN SHOAL 1985 Bix
ROYAL CAPTAIN SHOAL 1985 Bix
ROYAL CAPTAIN SHOAL 1985 Bx
ROYAL CAPTAIN SHOAL 1985 Bx
SHOAL 1985 Bxi
SHOAL 1985 Bxi
ROYAL CAPTAIN SHOAL 1985 Bxii
ROYAL CAPTAIN SHOAL 1985 Bxii
ROYAL CAPTAIN SHOAL 1985 Bxiii
ROYAL CAPTAIN SHOAL 1985 Bivx
ROYAL CAPTAIN SHOAL 1985 Bivx
ROYAL CAPTAIN SHOAL 1985 Bxiii
ROYAL CAPTAIN SHOAL 1985 Bxv
ROYAL CAPTAIN SHOAL 1985 Bxv
ROYAL CAPTAIN SHOAL 1985 Bxvi
ROYAL CAPTAIN SHOAL 1985 Bxvi


ROYAL CAPTAIN SHOAL 1985 Bxvii
ROYAL CAPTAIN SHOAL 1985 Bxvii
ROYAL CAPTAIN SHOAL 1985 Bxviii
ROYAL CAPTAIN SHOAL 1985 Bxviii
ROYAL CAPTAIN SHOAL 1985 Bxix
ROYAL CAPTAIN SHOAL 1985 Bxix
ROYAL CAPTAIN SHOAL 1985 Bxx
ROYAL CAPTAIN SHOAL 1985 Bxx
ROYAL CAPTAIN SHOAL 1985 Bxxi
ROYAL CAPTAIN SHOAL 1985 Bxxi
ROYAL CAPTAIN SHOAL 1985 Bxxii
ROYAL CAPTAIN SHOAL 1985 Bxxii
ROYAL CAPTAIN SHOAL 1985 Bxxiii
ROYAL CAPTAIN SHOAL 1985 Bxxiii
ROYAL CAPTAIN SHOAL 1985 Bxxiv
ROYAL CAPTAIN SHOAL 1985 Bxxiv
ROYAL CAPTAIN SHOAL 1985 Bxxv
ROYAL CAPTAIN SHOAL 1985 Bxxv
ROYAL CAPTAIN SHOAL 1985 Bxxvi
ROYAL CAPTAIN SHOAL 1985 Bxxvi
ROYAL CAPTAIN SHOAL 1985 Bxxvii
ROYAL CAPTAIN SHOAL 1985 Bxxvii
ROYAL CAPTAIN SHOAL 1985 Bxxviii

1985 C


Royal Captain Shoal 1985 Ci
Royal Captain Shoal 1985 Ci
Royal Captain Shoal 1985 Civ
Royal Captain Shoal 1985 Civ
Royal Captain Shoal 1985 Cii
Royal Captain Shoal 1985 Cii
Royal Captain Shoal 1985 Ciii
Royal Captain Shoal 1985 Ciii

1985 D

1985 E

1985 F