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Bead Making in Southern Sri Lanka: Some Observations

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Abstract

Probe into literature indicates that there has been handful of studies on Beads of Ancient Sri Lanka. While couple of studies surmise of bead production no study has been confined to study bead making industry of Ancient Ruhuna. Therefore, the purpose of this study is to examine if there was a bead making industry in Ancient Ruhuna. The study attempts to elicit information from previous studies and findings of explorations and excavations already taken place. The paper intends to add to our knowledge of ancient Sri Lankan technology of bead making which is very little known and the study suggests avenues for further study.

Keywords: Bead Making Industry, Beads, Ancient Ruhuna

Introduction

Beads are small artefacts with a hole at its centre, made for stringing. They are of different shapes, sizes and materials, made of any materials that are solid and durable

(Francis, 1982). Beads are very often overlooked due to its small nature. However, the importance of the beads is not laid with the size, colour or material made of but the people that involved in them. Studies show that beads have contributed in many aspects of human life and shed light on the different roles of the ancient human behavior. For example, these small objects often symbolize status, position in the society and identity (Boram-Hays, 2005; Dubin, 1995; Roach and Eicher 1979: 12–18.) They have been an exotic prestige good, an excellent trade item, and used as an offering in religious activities. Beads were also used as currency among some communities and functioned as an object that can be used in protection from evil and enemy (Pokornowski, 1979: 104; Graeber, 1996).

Historical and ethno archeological studies have been carried out worldwide to study beads in many aspects (Francis, 1990; Kenoyer, 2001; Possehl, 1981; Dubin, 1995). In historical context there are very few instances that provide evidence of ancient bead production. For example in Egypt, use of bow drills in perforating beads are depicted in the ancient paintings (figure 1.).

Figure 1

Bead Makers (From Egyptian Wall Painting- Source Tait, 1991:4)

Even in Sri Lankan context there is a dearth of historical accounts on ancient bead production, origin of sources of raw materials, and on the communities who involved in the industry. Despite of lack of historical sources on beads thousands of beads are attested from

excavations and explorations in Sri Lanka. A probe into literature revealed that, previous research on beads found in Sri Lanka is very scarce. Sources of raw materials used to produce this array of beads have not been clearly identified so far. While few studies taken place on beads aimed at providing typological aspects, some describes about trade links discovered by beads. Handful of studies whilst investigating the beads found in the particular excavations, suggest about local bead production in Ancient Sri Lanka. For an example, on the basis of waste materials found in Gedige excavation Deraniygala (1972) implies there would have been local bead making in Ancient Sri Lanka. Coningham (2006) providing more concrete evidence on the basis of Anuradhapura Salgahawatta British Sri Lankan Excavations hypothesized about bead making at the site. Although not much attention is paid to Ancient Ruhuna until recent past in archaeological perspective, thousands of beads attested from the sites such as Ridiyagama, Akurugoda and Godawaya etc. indicate that beads has played a significant role in many aspects of life of the community of Ancient Ruhuna. Therefore, more recent efforts can be seen in discussing the evidence on bead making in Ancient Ruhuna by scholars such as Bopearachchi (1995), Hannibal-Deraniyagala (2001), and Somadeva (2006). Although aforementioned studies indicate about local bead production, no appropriate or sufficient evidence has been reported or detailed study has been carried out in this regard. Therefore, the purpose of this study is to examine if there was a bead making industry in Ancient Sri Lanka, a special attention will be drawn to Ancient Ruhuna. The study attempts to elicit information from previous studies and findings of explorations and excavations already taken place.

Previous Studies-A Glimpse

The first methodical record on the beads was published in 1972 by S.U. Dearaniyagala based on the findings of Anuradhapura Gedige area. Furnishing a comparative study on the beads discovered in Gedige excavation, an effort was taken to build up a relative chronology in the study. Bead making in the site is evident by the occurrence of cores and waste flakes. Discovered blanks (Forms 1b and 1c) bear the traces of using pressure flaking technology and lathe (Derarniyagala, 1972). In addition to the occurrence of carnelian nodules, bead production in the site is supported by the emergence of quartz and amethyst blanks (ibid, 135). The study point towards importing of raw

material for carnelian bead production from India, particularly in Gujarat and Guntur, since carnelian is not found naturally in Sri Lanka (Deraniyagala citing Parker 1885 and Wheeler 1946). Upon the basis of absence of glass ingots, study surmises that no glass beads were produced at the site.

The next series of studies (1989; 1990; 1991; 2002) were carried out by Peter Francis Jr. He has paid more attention to the glass beads that are called "Indo pacific beads". In his studies Mantai was recognized as one of the seven sites that glass beads made. Lapidaries to Mantai have come from Oc-eo, Vietnam and/or Klong Thom, Thailand. All three places had contacts with Arikamedu. Mantai was dated from about 1st - 10th century A.D. However, stone beads were not made there before the 7th century. In terms of stone beads, Francis (1990) recognizes differences in production in Mantai. For example, crystalline beads discovered from Mantai was first pecked, then polished, and finally drilled. In the meantime, the microcrystalline (chalcedony) was ground, perforated, and then polished (Francis, 1990). In Mantai, beads of Chalcedony materials were drilled from one side which made an unsightly chip on the other end. In a study Gorelick and Gwinnett (1988) point out that hafted twin diamond drill was used to perforate Mantai beads. According to Francis (1990) bead makers of Mantai had move to another place (which is has not been identified so far), when the industry collapsed during the Chola invasion in the 10th century A.D.

The next major contribution towards beads has brought to light by Coningham (2006) on the basis of the findings of British-Sri Lankan excavations at Anuradhpura Salgahawatta 2, which recorded large number of beads and debitage. Beads made of greenstone, carnelian, chert, agate, chalcedony, sard, garnet; amethyst, amazonite, quartz and their diagnostic were discovered in the site. Production of beads in the site is proved by discovering, blanks, unperforated beads, unpolished beads and debitage of Carnelian and Clear quartz that are attested in large number. Due to the lack of evidence of glass bead making in the site, Conningham suggests production of glass in close proximity (ibid). This evidence is supported by discovery of possible glass production site at Giribawa (Dussubieux 2001), which is not far from Anuradhapura. Furnaces lined with vitrified

alumina-rich materials and blocks of raw glass has been found in Giribawa, in the site called Pabulugala, located in the Kala Oya Valley (Bopearachchi et. al, 2008; Šmit et al, 2000; Dussubieux 2001).

Bead Making in Ancient Ruhuna

Above literature review shows that Sri Lankan bead studies were confined to ancient Royal capital Anuradhapura and its surroundings. Until late 20th century, there was a dearth of systematic archaeological research on Southern Sri Lanka. A major diversion of perceptions on the Ancient Ruhuna could be seen after a century of establishing Archeological Department of Sri Lanka. Methodical surveys and excavations initiated during the period, shedding a new light to Archaeology of Sri Lanka. Accordingly, existence of pre-historic human settlements is evident by studies carried out in Bundala and Pathirajawela Pallemalala, and Mini-Ethliya (Deraniyagala,1990;1992; Katupotha, 1995; Kulatilake et al, 2014). Afterwards number of explorations and excavations were implemented in Southern Sri Lanka. Akurugoda and Godavaya excavations are some of the noteworthy archeological investigations led by KAVA project, Germany and Department of Archeology, Sri Lanka, in 1992 and consequent years. Discovery of large number of small finds during these efforts threw a new light to the history of Ancient Ruhuna, paving new directions to Archaeological research. First ever systematic study of analysis of Beads in Sri Lanka was performed on the basis of beads found in Akurugoda (Schussler, Rosch and Hock, 2001). With the interesting discoveries revealed in Akurugoda excavations, gradual attention was drawn to other peripheral sites that are of Archeological significance. One such investigation was carried out in Ridiyagama. Strategic location of Ancient Ruhuna empowered by the natural harbours was fortified by the results of excavations and surface explorations of Ridiyagama. Some of the artifacts found during archeological investigations that are of foreign origin, furnished new information about the marine and trade activities of Ancient Ruhuna. All these excavations and explorations, as well as follow up studies recovered large number of small findings. Beads attested in thousands from these sites are striking. In this study primary attention is drawn to results yielded by the excavations and explorations carried out in the Tissa-Akurugoda and Ridiyagama sites.

Tissa-Akurugoda

In 2001 KAVA Project published the results and analysis of Tissa-Akurugoda excavation under the title of Ancient *Ruhuna: Sri Lankan-German archaeological project in the southern province by H.J.* Weisshaar et. al. This publication shed a leading light to the research on beads of Sri Lanka, providing two significant articles on the beads found from Tissa-Akurugoda excavation. In this volume, Schussler, Rosch and Hock (2001) point toward a local making of garnet beads and glass beads in the site:

> " further argument points to a local production of opaque red glass in ancient Sri Lanka. The excavation in Akurugoda was performed in an ancient quarter. Pieces of raw garnet and beads of the same composition were found there, indicating that at least garnet beads may have been produced here. Since a large number of disc-shape beads also were recovered from this quarter, it seems reasonable that these beads were also manufactured here. The existence of furnaces for melting of copper and bronze in this area made it easy for ancient glass makers to get copper additions for the production of opaque red glass and the experience with the high temperature meting process was also locally available".

However, not referring to Carnelian beads in his study indicate that they have not been subjected to this systematic investigation.

In the same volume, while presenting a typology of glass and semi-precious stone beads, Hannibal-Dearniyagala (2001) suspects the availability of localized glass bead making industry in the site, due to the absence of certain stages of beads between the raw material and the finished bead. She further states, finding of unfinished carnelian bead from a trench in Akurugoda "should not be overvalued as an evidence for manufacturing of beads"(ibid). However, finally on the basis of unfinished beads of semi-precious stones found in the Akurugoda settlement site, she admits there might have been working of semi-precious stones in Akurugoda but not in the same site. Further to this assumption Somadeva (2006; pl.7.4 pg 296) presents a series of unstratified carnelian beads that represent different production stages from the same, Akurugoda area, indicating bead production in Akurugoda area.

Ridiyagama

Ridiyagama is a waterlogged ancient settlement site situated 12km from the estuary of Walawe River. Thousands of artefacts are appeared in each year in the months of August and September during the dry spell on the bank of the river. Architectural structures that are submerged in the water are also noticeable during this period. Significance of the site is emphasized by the location of site and discovery of cultural materials belonged to different time periods, ranging from Black and Red Ware to an inscription dated to 7th Century AD. Surface explorations and excavations in Ridiyagama led by French Mission of Archeological Co-operation in Sri Lanka and Department of Archaeology of Sri Lanka discovered a large number of artefacts. Beads made of different materials including carnelian, lapis lazuli, rock crystals, agate amethysts and glass were said to have been discovered from the site. Although no concrete evidence on the different production stages are presented, Bopearachchi & Wijepala (n.d.), suggest a local bead production at Ridiyagama. Authors assume that raw materials of coral, lapis lazuli and carnelian were imported and processed as beads for both local use and exporting . With regard to the discovery of glass beads in huge quantities, they further suggest about import of glass beads as early as pre-Christian era (Bopearachchi and Wijepala, n.d., p. 15).

In an another study, Bopearachchi and Wickremasinghe (1999), indicates a clue of local bead making industry on the basis of a metal rod stuck in the grove of a agate bead.

> " The agate bead with the metal rod with corundum tip (missing) used for perforation, still seen stuck in the cavity, is further proof that beads were cut, polished and perforated at the site of Tissamaharama (Bopearachchi and Wickremesinhe1999: 129, no. P.34; pl. 36, P.34)".

All aforementioned studies, suggests a local bead making in Ancient Ruhuna. Although, Bopearachchi, Wijepala and Hannibal-Deraniyalaga agree upon an availability of bead industry in ancient Ruhuna, no all manufacturing stages were presented. However, this lacuna could be filled by the assortment of semi-precious stone beads collected from a surface exploration by the author near Ridiyagama tank. These beads, including nodules, blanks and other debitage provide an insight to local bead manufacture in Ancient Ruhuna.

Unfortunately, as these artefacts were obtained as stray findings, the stratigraphic position is far from clear. However, these finds, clearly depicts different production stages (Photo 1). Evidence of production of beads, rings and seals out of Carnelian and clear quartz are noticeable. Some glass ingots are also reported as stray finds.

Stone beads

Carnelian, Rock crystal (clear, smoky, rose quartz) Garnet, Amethyst and Agate are occurred most commonly in Ridiyagama and Akurugoda. There are instances of finding Lapis Lazuli **(**Bopearachchi and Wijepala, n.d. p. 14) and Amazonite (Hannibal-Deraniyagala, 2001 p..).

Carnelian

The earliest evidence of Carnelian beads are reported from Ibbankatuwa early Iron age burial ground that has been dated to 770 BC to 395 BC. (Weisshaar, 1992). Non-occurrence of raw material for carnelian in Sri Lanka is pointed out by scholars (Deraniyagala, 1972; Parker, 1909; Bopearachchi,1999; Ray,1989; Seneviratne,1985). However, Cooray (1984: 167) mentions chalcedony occurs as rare deposits in Kal Aru Basin, in Northern Sri Lanka. Due to the rarity of these deposits, there is no doubt of importing carnelian from a foreign country, most probably from South India. In ancient times, it was common to transport raw materials from distance places to where the craftsmen were used to live. For an example, raw materials required for producing beads discovered from all major periods of Harappa was transported from 300 to 800 kms (Kenoyer, 2001). Also, for Arikamedu, which was a node of south Indian centre for bead making, all the raw materials, except for rock crystal, were transported from remote areas such as lower reaches of the Krishna, Godavari and Bhima, Deccan and Hyderabad (Francis, 1991). Theunissen, Grave and Bailey (2000) presenting results of non-destructive geochemical study of carnelian chips and beads found from excavations dated from 8th century B.C. to 2nd century A.D. in Anuradhapura, suggest possibility of importing carnelian from Thailand from post first century B.C.

Onyx, agate and carnelian are sub varieties of Chalcedony. Carnelians are also similar to agate but range from pale yellowish brown to pink and deep red clear to translucent stone (Allchin, 1979). Chalcedony (SiO2) is a microcrystalline variety of Quartz that changes its colour by heating (Kenoyer, 2001). Processing the raw material for making carnelian bead is a long and complex process. Drying Iron-bearing chalcedony in the sun and heating repetitively is a widespread practice. Heated carnelians are reported at Harappa even by 3300-2800 B.C. (Kenoyer, 1997). Purpose of heating chalcedony was multitude; to remove the moisture inside; to establish uniformity of colour; to enhance the natural colour; and to obtain a glossier surface (Kenoyer, Vidale and Bhan, 1991; Arkell 1936; Allchin 1979). As mentioned above, number of firings is required in between the production stages to achieve the desired colour in chalcedony, (Figure 2). Before achieving the final stage, roughouts are heated several times until desired colour is reached (Kenoyer, 1991).

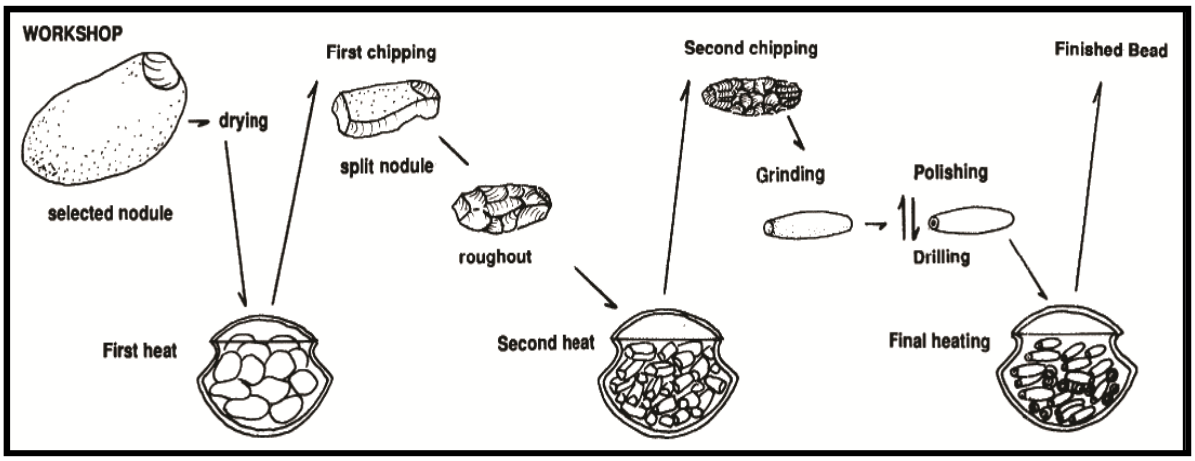

Figure 2

Carnelian Production Stages

(Source: Kenoyer, Vidale and Bhan 1991)

In making carnelian beads, once the selected chalcedony raw materials are heated to attain desired colour , the nodules are chipped into roughouts. In the next stage, roughouts are smoothening by finer chipping. Then these chipped blanks are sent for grounding, drilling and polishing. Specimens below (photo 1 & 2) depict different stages of carnelian beads discovered from Ridiyagama.

Although, different manufacturing stages of carnelian are reported from Ridiyagama and Akurugoda, evidence about the heat treatment at the sites have not been reported. All Carnelian nodules and blanks reported so far from Ibbankattuwa (Weisshaar, 1992), Anuradhapura Gedige (Deraniyagala, 1972), ASW2 (Coningham, 2006), Akurugoda (Hannibal-Deraniyagala, 2001; Somadeva, 2006; pl.7.4 pg 296) and Ridiyagama (Bopearachchi, n.d and photo 1,2, &3) are heat treated. Also, raw chalcedony has not been discovered, before subjecting to heat treatment from any archeological sites in Sri Lanka. Therefore, it can be assumed that heat treated chalcedony nodules had been imported to Ancient Sri Lanka for making beads and other accessories. Although raw chalcedony nodules and evidence about heat treatment have not been discovered yet from archaeological sites, knowledge about heat treatment is prevalent even today, among the communities engaged in the gem industry in Sri Lanka. Therefore, further research into heat treatment, would throw new light to ancient bead production in Sri Lanka.

Photo 1

1

Photo 2

Photo 3

Photo 4

Unfinished Carnelian Beads

Ridiyagama

Photo 5

Different Stages of Quartz beads, seals and intaglios- Ridiyagama

Rock Crystal Clear Quartz, Garnet and Amethyst Beads

Significant information on the local bead production is revealed at Anuradhapura ASW2 (Coningham, 2006). Among the many stone beads recovered clear quartz (Crystalline) is the most common material found in the site. Crystalline quartz beads in the site provides example for each major manufacturing stage. Findings of Ridiyagama also provide information about different stages of clear quartz beads, seals and intaglios (See Photo 5).

Amethyst and garnet beads also hint about bead manufacture in Ancient Ruhuna. However, these beads do not provide clear sequence of manufacture. Thirteen (13) garnet beads have been found in Akurugoda excavations (Hannibal-Deraniyagala, 2001). Due to high almandine percentage of the six garnet beads analyzed from Akurugoda and Court's garden (Akurugoda), it is suggested that these garnet beads were not made using raw materials obtained from Ratnapura. Therefore, it is indicated that raw materials for garnet bead making in Akurugoda would have been imported from South India (Schussler, Rosch and Hock, 2001).

Glass Bead Production

Francis (1991) suggests a production of small monochrome drawn beads (Indo-pacific beads) in Mantai upon the basis of variety of wasters discovered in the site. According to Francis (1991) beads with longitudinal lines on the surface and round orange flat disc beads were made in Mantai. Considering the size of the hole of the latter, Francis (2002) assumes that these beads have been made by slicing a wide glass cane and perforation was made either by chipping or pecking. However, these beads are ubiquitous in all Sri Lankan sites and attested in great quantities, hence chemical composition analysis is required to determine the producers of these beads.

In terms of glass bead production, no site has recorded ample number of glass wasters in Ancient Ruhuna. Possibility of glass production is evident only in Giribawa so far. Glass beads discovered in Ancient Ruhuna, reveal three techniques followed to produce monochrome and polychrome glass beads. They are namely: Drawn, wound and multi-technique.

Drawn Beads

Small drawn beads were known as Trade wind beads in 1960s (Sleen,1958) and later on they are known as Indo-Pacific Monochrome drawn glass beads or more popularly as Indo-pacific beads (Francis, 1990). These small glass beads that are the most commonly occurred beads in archeological sites and are ubiquitous from West Africa to Far East China and Korea.

Drawn beads are made in three major steps: glassmaking, tube making and making of beads from the tubes (Francis, 1990). Accordingly, the technique involves pulling a glass rod out of a gather of hot glass and cutting the rods into small segments. Beads are then reheated to remove sharp edges that resulted from cutting. Use of this technique is reported from Kopai site, Uttar Pradesh of Northern India about 700 B.C. (Kanungo & Brill 2009 : 11-25), and around 500 B.C. in Arikamedu, situated in southeastern part of India. Production of drawn glass beads is still practiced in Papanaidupet, India, following ancient techniques.

More than 70% and 80% of the glass beads from Akurugoda and Ridiyagama constitute of drawn beads of many colours. Upon the finding of 339 unrounded beads in Akurugoda, Hannibal-Deraniyagala (2001), suggests about re-heating segmented beads in clay pots. This is an indication of glass working in the site. Because, once the beads are segmented into desired size, they are re-heated to round up the sharp edges. However, due to absence of evidence, glass making in Akurugodaa was denied (ibid, 2001), Discovery of unrounded beads indicate working of glass carried out in the site itself while, glass making would have taken place in a remote area. It cannot be expected to discover evidence of glass making in major urban areas, as glass makers dwells in remote places located distantly from settlements, in order to get access to resources required for making glass. However, occurrence of coloured glass ingots, bangle like pieces that are from failed initial draws (Photo 6 & 7), pieces of perforated and un-perforated tubes discovered in Ridiyagama cannot be disregarded. In addition two small glass ingots were report from Polibindivala and Kirinda port (Somadeva, 2006) .

Photo 6

Glass Ingots-Ridiyagama

Photo 7

Bangle like pieces from failed initial draws

Photo 8

Drawn glass -Ridiyagama

Photo 9

Sandwich bead-Ridiyagama

Wound Beads

A piece of melted glass is twisted around a metal rod to make wound beads. When the iron rod is cooled beads are removed. Wound beads are characterized by the appearance of different size of holes in each side. "Round tablet beads with raised edge and centre" known as *stupa* beads by Francis (1990) are discovered in many colours all over Ancient Ruhuna (Figure 3). However, origin of them are yet to be discovered.

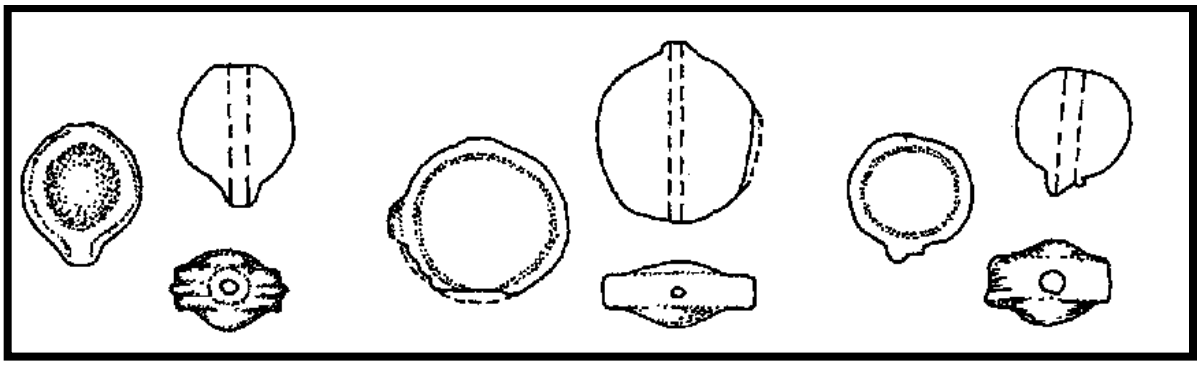

Figure 3

Stupa Beads - Ridiyagama

Multi-Technique Beads

In this method more than one technique is used to produce beads. For example beads are made amalgamating two or more techniques. Inner core of the glass bead is made using drawn method while a separate colour of glass is wound around the inner core (Rodcharoen, 2014). A white bread with a black trail made by adding thin rod of glass on the main bead (Figure 4) was found in Ridiyagama. Spaer (2001) provides example of creating a trail decoration on a bead (Photo 10).

Blue-white-Blue coloured sandwich beads are discovered in Akurugoda (Hannibal-Deraniyagala, 2001) and Ridiyagama (Photo 9). Bead of same colour and pattern is reported from Anuradhapura. Due to the less number of discoveries, these beads considered as imported. Beads of similar colour, shape and decoration are found in Oman and from Satavahana period (Schussler, Rosch and Hock, 2001). However, electron microprobe analysis and X-ray powder diffraction analysis of samples from Sri Lanka (Tissamaharama) and Oman (Samad), revealed different chemical compositions (Rösch et. al., 1997).

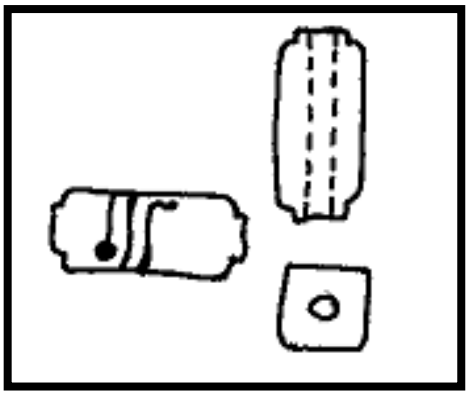

Figure 4

White bead with trail decoration -Ridigyagama

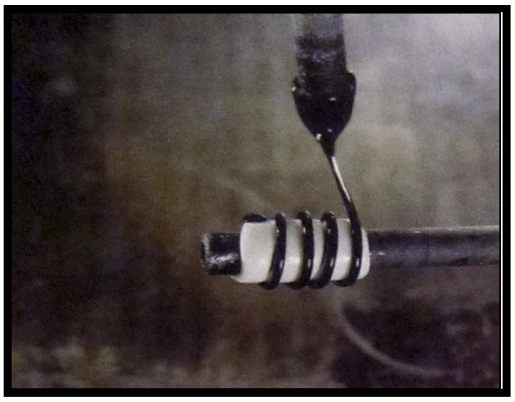

Photo 10

Creating Spiral Trail decoration

(Spaer, 2001: fig. 21)

Drilling Technology

In Harappa as early as third millennium B.C. stone drills powered by a bow were used to perforate beads. Same basic knowledge is used in Cambay and there is striking similarities between Harappa and contemporary bead manufacture in Cambay (Possehl, 1981). In addition to stone, wooden and copper drills were also used to perforate beads in ancient times. Use of diamond for drilling beads is recorded as early as 600 B.C in India. Diamond drills are used by Cambay bead makers even today in drilling carnelian. As pointed out by scholars (Possehl, 1981; Kenoyer, ; Coningham,)above examples show that though there are minor variations, changing of technologies are very little through the centuries.

Beads were drilled from both ends as well as from one end using diamond drills. There are multitude advantages of drilling from both ends, such as permitting to use shorter drill bits, prevention of breakage of the stone and minimizing the breakage of the drill bit (Lucas, 1989: 42; Gorelick and Gwinnett, 1981: 25). In using shorter drill bits, the second hole is not as deep as the first hole. Double tipped diamond drill was used in Arikamedu for perforating beads. Bead makers of Mantai who are decedents of Arikamedu also followed the similar technologies. In Mantai, carnelian beads are drilled only from one end making a small shatter in the other end (Francis, 1990). On the contrary to Francis' account, Both Ridiyagama and Akurugoda carnelian beads provide examples for drilling beads from both sides as well as from one side. Two carnelian beads were already bored from one end

and broken once attempting to bore from other end (photo 11) while spherical carnelian beads clearly show evidence of drilling from one side (photo 12) making a shatter in one end .As pointed out by Hannibal-Deraniyagala (2001) amethyst, carnelian, garnet, rose-quartz and amazonite unfinished beads found from Akurugoda have also drilled from one end and other end had left behind without drilling.

Photo 11
Carnelian –drilled from one side Ridiyagama

Photo 12
Carnelian-Ridiyagama

In the meantime, studies emphasize Mantai bead makers used diamond tipped drills to perforate beads. Sequence of drilling beads was different according to the site and tradition of bead makers. There are differences between chalcedony and crystalline materials in terms of drilling beads in Mantai (Francis, 1991). Accordingly crystalline materials was polished and then drilled, while microcrystalline materials (chalcedony) was first drilled and then polished. The order of drilling carnelian beads presented by Possehl and Kenoyer is also similar to drilling carnelian in Mantai. However, Coningham (2006) by using examples of actual finds of rock crystal from the site, a model of sequence is proposed to understand the different production stages. He further states this model could be applied to the understand the production of other semi-precious stone beads at the site.

1. Preparation of the Striking platform
2. Core preparation
3. Blank production
4. Rough-out production
5. Grinding

6. Polishing
7. Drilling

Above sequence can be applied to all the types of semi-precious stones of Ancient Ruhuna. Because, stone beads that are of various materials polished but not drilled are found in Ridiyagama and Akurugoda. For example, a faceted cylinder hexagonal amethyst bead found in Akurugoda is also polished but not drilled (Hannibal-Deraniyagala,2001: 208p.) Two polished carnelian beads discovered in Ridiyagama, were also bored from one end and other end was broken while attempting to perforate (see photo 11). A clear quartz rock crystal bead was polished but not drilled (Photo 13). Polishing of beads is labour intensive work carried out for days. Precise drilling is imperative to prevent wastage of polished beads. Proficiency of Bead makers of Ancient Ruhuna is indicated by drilling beads after polishing.

Photo 13
Polished, unperforated bead-Ridiyagama

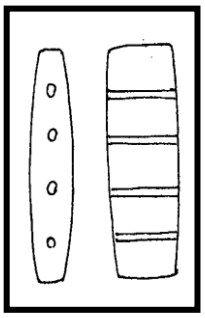

Figure 5
Carnelian Spacer Bead

As stone beads from Ancient Ruhuna were drilled after polishing, it seems their sequence of drilling is different from Mantai. In this context further research is called for examining how stone beads is perforated in Ancinet Ruhuna. Accordingly, Scanning Electron Microscope technique is suggested to understand the drilling method, as previous instances using this method was successful (Gorelick and Gwinnett 1988; Gwinnettt and Gorelick, 1996; Carter, 2010)

Discussion and Conclusions

Both Godawaya and Kirinda ports were in close proximity to Tissamaharama and Ridiyagama ancient cities. Knowledge of sea faring during the early periods is evident by

the discovery of an inscribed potsherd that depicts a vessel with a mast in Akurugoda . Occurrence of Kaboja and Kbojhiya-mahapugiyana in Koravakgala and Bovattegala inscriptions (Paranavitana, 1970) and finding of cast bronze seal of Nanadesis (Pathmanadan, 1984) indicate strong international trade links of southern harbours. An elliptical Carnelian seal-ring dated to 3rd century B.C. discovered from the Yatala dagoba would have been belonged to the Prince-monk or king of that time (Parker,1909). While its workmanship represents Indian origin, the figurine of the seal ring corresponds to strong Greek influence, which demonstrates the relationship between North India and Sri Lanka by the time. The seal-ring would have been deposited at the Relic Chamber closing ceremony. Magnitude of importance associated with carnelian being an exotic material is signified by depositing seal-ring in relic chamber. Trading of glass by sea is evident by discovery of Godawaya shipwreck glass ingots that surmises of south Indian origin (Lawler,2014). Aforementioned facts point toward commercial and political links prevailed during the time with different parts of India. Strategic significance of ports in ancient Ruhuna, in trading and maritime activities especially with India is emphasized by the findings of the Ridiyagama explorations and excavations. Raw materials and skills for bead production must have arrived Southern coasts through these commercial links. Therefore, diffusion of knowledge, skills as well as man power required for bead production must have been transmitted rapidly as a result of trading and seafaring activities during the time.

Making of beads requires specialized skills, equipment and tools. It is a noticeable fact that the methods of the manufacturing of beads had reached highly developed stage in the beads found in Ancient Ruhuna. Weather the drilling is from one end or both ends, precision of drilling is significant because, grading of beads are depending on the accuracy of these holes and how holes meet each other (Possehl, 1981) . Specialization and mastery of craft is evident by the less number of drilling errors reported at the sites. Drilling beads after polishing also indicates bead makers of Ancient Ruhuna has reached the required craft specialization. Because, if the bead makers are not confident about perforating beads are perforated before polishing to minimize the rate of wastage. In terms of technology used to drill carnelian beads, it is apparent that bead makers of Ancient Ruhuna are different from

Mantai. This indicates either, Mantai and Ancient Ruhuna bead makers are from two descends or same group of bead makers have changed their technology. Yet, the change of technologies are taking place very hardly (Coningham, 2006) therefore, it can be assumed that they are belonged to two different traditions.

Francis (1991) points out that there were no stone beads were made at Mantai before 7th century. However, it is evident that in Ancient Ruhuna there was bead making, even before 7th century A.D. Accordingly, not only in Ancient Ruhuna, but also in Anuradhapura Gedige and ASW2 beads appears to be produced before 7th century A.D. Therefore, it is apparent that bead makers from Southern part of Sri Lanka are a different group of community and these beads were not made by Mantai bead makers. This situation lead us to assume that, beads makers of Ancient Ruhuna might have the first bead producers of Sri Lanka and distributed their production all over Sri Lanka until Mantai starts production of stone beads. Beads found from *Gedige*, ASW2 and Ancient Ruhuna, are strikingly similar in their sizes and shapes. For example Round disc glass beads and multi spacers carnelian beads were discovered in many sites all over country are of precise size (Figure 5).

Production of precise size of beads and their wide spread distribution indicate some kind of control over the bead making, in order to prevent the diffusion of knowledge of specific bead tradition that may have been transmitted within a particular group of people (Francis,1991). As scholars pointed out "organization of carnelian bead making is controlled centrally and structure of the production is directly related to complex social stratification (Kenoyer,Vidale, & Bhan, 1991)". Places that records bead making is located in or around of hinterland of ancient harbours that are commercially important. Anuradhapura, Mantai, Ridiyagama and Akurugoda are examples. These workshops including craftsmen quarters must have produced beads required for the interior regions (Bopearachchi 1999). Association of bead manufacturing with other crafts is evident both in Akurugoda and Ridiyagama excavations. Beside beads, iron, copper and bronze working was evident in Akurugama. Ridiyagama excavations yielded evidence of copper working.

Location of all crafts in one area is easier for taxation and regulation of movement of raw materials and finish products (Kenoyer, 2001) .

My point is technology for beads have arrived from overseas with the migrant traders. Lamb as early as 1965 hypothesizes of a "a nomadic bead making group ... which established itself at various South-east Asian centres." Concept of itinerant bead makers are accepted by now (Francis, 1990; Bellina 2003). According to the legends associated with beads, they are known as Mukkaru gal (stones made of Mukkaru) among villagers. Megalithic burials are also known as Mukkaru sohon (Burials of Mukkaru) among them. This may be because the Megalithic burials yield beads made by Mukkaru or Mukkaru people are buried in these burials. Beads must have produced by the Mukkaru people who arrived Ancient Sri Lanka from India. These bead making communities may lived as a separate ethnic group and performed bead making activities in different parts of Sri Lanka. Non-availability of remnants of bead making as a craftsmanship among Sri Lankan traditions indicates that these communities were very secretive about their technology that prevents diffusion of knowledge among the local Sri Lankan communities. If ancient communities were aware of bead technology, beads made of local materials would have been available at early historic burial good, instead of carnelian or glass beads. Therefore, it is apparent, bead making was a foreign dexterity to ancient Sri Lankans and beads were manufactured by different foreign ethnic groups. Unfortunately there is no enough chronological information to determine technological and social change occurred over time. However, more research is needed to discover beads and their manufacturing debris from stratified context to be able to compare the technologies, shapes over time. More accurate scientific analyses are required to place the beads in proper context in Sri Lankan history.

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