EARLY INDIAN OCEAN GLASS BEAD TRADE BETWEEN EGYPT AND MALAYSIA: A PILOT STUDY

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ABSTRACT

Glass beads were an important component of luxury goods used for centuries within the Indian Ocean trading system. Many varieties or bead "types" have been found at archaeological sites over wide geographical areas including Africa, India, Mainland and Island Southeast Asia. In this paper, plasma mass spectrometry was used to determine the Rare Earth Trace Element (REE) content of unique glass beads from Egypt and Peninsular Malaysia. "Factory" standard "Fustat Beads" made at al-Fustat (now old Cairo) between AD 800-900 were compared with "composite eye"[1] beads found at the coeval Malaysian site of Kampung Sungai Mas. Elemental chemical profiles show that the glass used to manufacture the Egyptian material is almost identical to that of the beads found in Malaysia. This period coincided with the dramatic rise of dar al Islam in Egypt and the spread of Islamic influence across the Indian Ocean. This information casts a new light on contact and trade between Africa and Malaysia more than a thousand years ago.

Glass beads are often the most ubiquitous and well-preserved artefacts found at prehistoric settlements throughout the world. They already played an important role in early Indian Ocean maritime networks prior to the first century AD and were crucial factors in the economic history and external trade relations of many developing hegemonies. They were easy to transport, durable and convenient to store. There is reason to suppose they were used as a form of currency and that in some areas the more rare – or exotic – beads may have commanded higher exchange values.

In the Malay Peninsula, especially in pre-Melakan sites, glass beads are often found together with imported ceramics and glass artefacts. Important early trading centres existed at the mouth of the Selingsing River in Perak and at Kampung Sungai Mas in the Bujang Valley, Kedah. The latter has produced Middle Eastern pottery dating from the 6th-10th centuries AD (Nik Hassan Shuhaimi and Yatim 1989). These events in Malaysia coincided with the rise of Islamic influence in Egypt and the consolidation of Muslim enterprise across North Africa, Western Asia and the Far East.

In AD 969, the Fatimids conquered Egypt and transferred their capital from Tunisia to a new one, which they built at al-Qahira (Cairo), adjacent to al-Fustat (now Old Cairo). Fustat by then was a successful commercial city (Figure 1) with a well-established glass and bead industry. It was also a forwarding centre for glass merchandise to and from other parts of the world. Distinctive glass beads, variously referred to as "Fustat Beads", "Fustat Fused Rod" or just "Fused

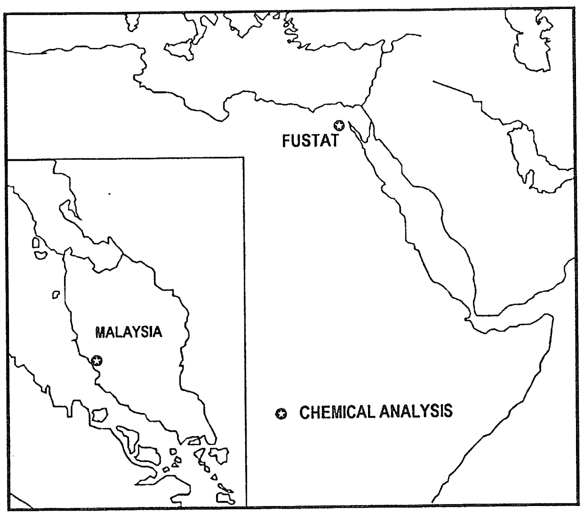

Figure 1: The locations of Fustat and Kampung Sungai Mas.

Rod" beads (Figure 2) were produced by Islamic glassmakers at Fustat.

Although the factory sites which produced glass beads and the trading centres which controlled their distribution could have changed many times, we considered Fustat the most likely manufacturing source for glass beads found in Malaysia[2]. In order to establish the connection between Fustat and Malaysia, comparative chemical analysis was carried out on Fustat material and on two "composite eye" beads excavated at Kampung Sungai Mas (Figure 3).

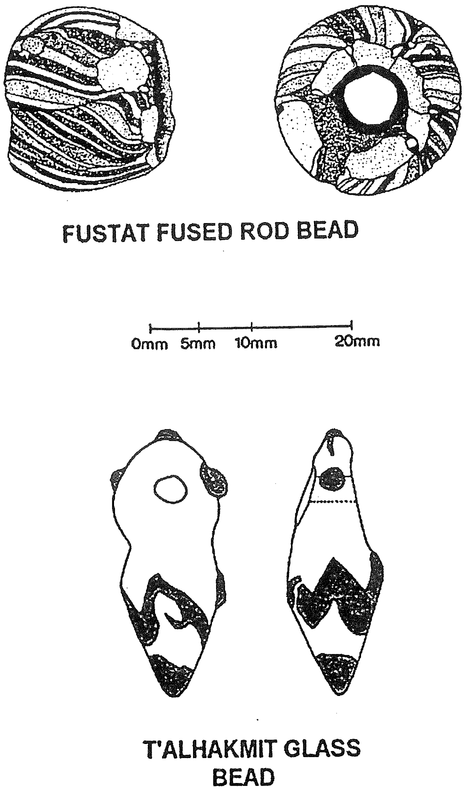

Figure 2: A Fustat Fused Rod bead and one described as a 'T'alhakmit' bead (identified in 1937 by the Director of the Museum of Arab Art, Cairo, as "Byzantine" from Foustât). Van Riet Lowe Collection, University of the Witwatersrand.

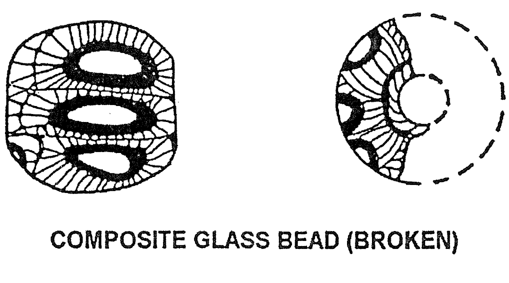

Figure 3: A "composite eye" glass bead from Kampung Sungai Mas.

The Egyptian Fustat beads

In this study, five beads attributed to Early Islamic glassmakers were used as factory site standards and temporal markers for comparative purposes. Three of them are "Fustat Beads" (Figure 2). Such beads form a definitive type although slight technical and colour combination differences exist between them. The multi-coloured glass components, such as veined or striped threads, eyes, etc. were made mostly from opaque glass. Fustat beads are dated between AD 800 and 900 (Pinder-Wilson and Scanlon 1987; Spaer 1993).

Seven, unstrung Fustat Beads were found together below the threshold of a house in Fustat (Pinder-Wilson and Scanlon 1987). Another single bead and some glass bead factory waste was also retrieved from a mound above the same house. This Fustat material was compared with the composite eye beads found at Kampung Sungai Mas.

The composite eye beads found at Sungai Mas

Two broken beads were available for analysis. Both contained an opaque yellow cane encased by a brick-red outer ring (forming the "eye"), surrounded by a layer of short, fused canes (Figure 3), turquoise/translucent blue in one case and translucent green and yellow in the other. Francis (1991) reported a large number of what he termed "mosaic eye" bead fragments from Sungai Mas. He speculated that the beads were made locally although the raw glass used to manufacture them was imported from the Islamic world (Francis 1991; Srisuchat 1996).

CHEMICAL ANALYSIS

Analytical Procedures

This preliminary study forms part of an existing research programme designed to compare the geochemical patterns displayed by the Rare Earth Elements (REE) found in trace quantities in most glasses (Saitowitz 1996, 1997, 1998; Saitowitz *et al.* 1996; Saitowitz and Lastovica 1998). The behaviour and distribution of this elemental group in the raw materials commonly used in glass making is well known (Henderson 1984; Taylor and McLennan 1985).

We have developed a micro-analysis technique where the REE can be determined in glass beads (parts per million level) with minimum preparation and modification, almost to the extent that it can be regarded as practically non-destructive. While it is preferable to mount chips of broken glass bead in an epoxy medium, for purposes of analysis, it is also possible to present whole samples for analysis provided they can be held in place for the duration of the run. The only modification that takes place is the formation of a microscopic pit (about 100 microns in diameter and 300 microns deep) on the surface of the specimen, so limited cosmetic damage takes place.

The technique is Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry (LA-ICP-MS), where a sharply focused laser is used to volatilise a small quantity of the glass, which is then carried by an argon gas stream to ionise in a plasma chamber. A linked quadrapole mass spectrometer analyses the ion beam. Variation in beam intensity is monitored by using calcium as an internal standard, since this element is always present in major proportions, and was determined independently by Electron Probe Microanalysis (EPMA). Specially doped glasses are used for standardisation. Replicate analysis of the REE in reference standards used during this investigation yielded an average relative error of 7%. Detection limits range from 0.05ppm for mono-isotopic species (La, Pr, Ho, Lu), to 0.1 ppm for the other REE.

The analytical data are listed in Table 1 and plotted graphically in Figure 4, where the elemental compositions are normalised to some useful reference material, such as chondritic meteorites (values in Taylor and McLennan 1985). This allows different samples to be compared more readily in the form of relative abundance profiles, since the diagnostic value is primarily in the nature of these characteristics (position, slope, interruptions, etc.).

Comparative Characterisation

For purposes of comparison a comprehensive database on the REE composition of Fustat type beads was initially compiled. Fragments or chips of a broken Fustat Bead, T'alhakmit and one other bead from Fustat (Figure 4, A and D) were mounted in epoxy and polished prior to analysis. Two unbroken "Fustat Beads" were analysed without any sample preparation (Figure 4, B and C).

Notwithstanding the multi-coloured nature of the beads, the laser technique allows careful analysis of each separate colour. Inspection of Table 1 shows that the different colours found in the two whole beads (labelled FTB1 and FTB2 respectively) are not controlled by the REE composition, since there is very little variation in abundance. The REE profiles of all the samples (Figure 4, A-D) are practically identical, showing relatively steep light REE enrichment (La to Sm), a small negative Eu anomaly and unfractionated heavy REE (Gd to Lu). Thus the Fustat collection displays a very coherent homogenous REE pattern, which is summarised in Figure 4F.

REE data for the two composite eye beads found in Malaysia are also listed in Table 1 and plotted separately in Figure 4E. Note that the different coloured domains in the glass also have very similar REE contents. There appear to

Table 1. Rare Earth Element analyses of glass beads from Egypt and Peninsular Malaysia (concentrations reported in pmm)

	FTB1-1	FTB1-2	FTB1-3	FTB1-4	FTB2-1	FTB2-2	FTB2-3
Locality	Fustat	Fustat	Fustat	Fustat	Fustat	Fustat	Fustat
Colour	Red	White	Pale Green	Dark Green	Black	White	Yellow
La	7.63	6.94	6.59	9.14	11.80	7.77	7.85
Ce	14.18	12.90	12.18	17.36	24.92	15.71	15.47
Pr	1.83	1.70	1.57	2.02	2.57	1.78	1.79
Nd	7.40	7.09	7.17	8.82	9.60	6.80	6.86
Sm	1.43	1.46	1.42	1.61	1.69	1.31	1.40
Eu	0.41	0.38	0.35	0.39	0.40	0.34	0.32
Gd	1.22	1.49	1.24	1.32	1.34	1.08	1.10
Dy	1.14	1.15	0.96	1.31	1.11	0.84	0.88
Ho	0.25	0.22	0.20	0.24	0.21	0.22	0.22
Er	0.58	0.61	0.60	0.65	0.53	0.59	0.63
Yb	0.63	0.71	0.58	0.65	0.71	0.59	0.60
Lu	0.08	0.09	0.09	0.09	0.11	0.10	0.09

	22a/r	22a/b	22a/g	23a	25a	74	75
Locality	Fustat	Fustat	Fustat	Fustat	Fustat	Malaysia	Malaysia
Colour	Red	Pale Brown	Blue-Green		Green	Red/Yellow	Blue/Red
La	7.79	7.52	9.54	6.73	6.18	5.89	5.95
Ce	14.82	13.83	18.11	12.64	11.17	10.20	10.80
Pr	1.65	1.61	2.17	1.52	1.35	1.23	1.27
Nd	6.73	6.42	8.53	6.80	5.70	5.17	5.11
Sm	1.34	1.27	1.68	1.43	1.12	1.04	0.94
Eu	0.35	0.35	0.43	0.39	0.29	0.22	0.22
Gd	1.08	1.00	1.35	1.18	0.96	0.79	0.75
Dy	1.03	1.02	1.29	1.15	0.95	0.85	0.75
Ho	0.21	0.21	0.28	0.26	0.20	0.20	0.13
Er	0.62	0.61	0.76	0.64	0.51	0.50	0.40
Yb	0.63	0.66	0.94	0.70	0.53	0.60	0.53
Lu	0.09	0.08	0.14	0.09	0.09	0.08	0.07

Average analytical errors (based on replicate analysis of glass standards) = 7% relative.
Detection limits: La, Pr, Ho, Lu (mono-isotopic species) = 0.05ppm. Other REE: 0.1ppm.

be slight disturbances in the heavy REE, so the average data are compared with the Fustat field in Figure 4F.

While the overall REE abundances in the Malaysian beads is shown to be at the lower limit of the Fustat Bead field, the important features are the similar slope of the light REE, the presence of the small negative Eu anomaly and the limited fractionation of the heavy REE. It is clear that the Malaysian beads have practically identical REE profiles as those obtained for Fustat.

CONCLUSION

Chemical analysis was used to characterise the glass composition of beads known to have been made in Egypt (al-Fustat) and two uncommon beads found in Malaysia (Sungai Mas). The factory site material from Fustat, including the unique "Fustat Beads" manufactured between AD 800-900, provided the bench mark or standards for the investigation.

Quantitative analysis of the Rare Earth Elements shows that that the composite eye beads found at Sungai Mas have almost identical chemical profile patterns or "finger-prints" as the type beads made in Fustat. This evidence is consistent with an Egyptian origin. The precise analytical data provide results which reflect the vast geographical extent of long distance trade links between Egypt and

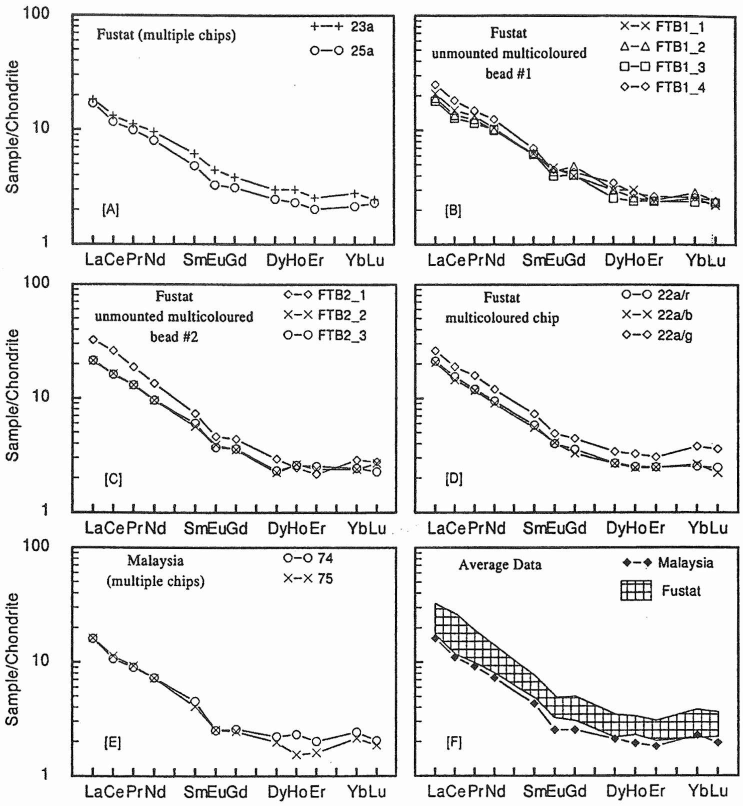

Figure 4: Rare Earth Element abundances in selected glass bead samples from Fustat (A-D) and Malaysia (E). Raw elemental data are normalised to chondrites (values listed in Taylor and McLennan 1985) and plotted on a log scale against elements in order of increasing atomic number.

Malaysia *c.* 1000 years ago. This report does not exclude the fact that glass beads from other supply centres were also in circulation and that the entrepôts which traded them could have changed many times.

In the absence of authoritative written sources on early Indian Ocean trading systems connecting the Mediterranean with Southeast Asia, comparative research on the composition of glass bead samples of known origin serves to unlock an important source of information for archaeologists and historians on numerous issues. Future research, using the investigative procedures presented here, can assist in confirming primary material and identifying foreign imports with confidence.

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NOTES

1. We are aware that significant research has been conducted by Allen (1982) and others on mosaic glass bead manufacture, and that a great deal of information exists on the subject. However, for the purpose of this study we have chosen to refer to "Fustat Beads" and "composite eye" throughout, and provide brief descriptions of their appearance under appropriate headings.

2. Ian Glover (pers.comm: 1999) prefers the notion that the majority of glass beads found at archaeological sites throughout Mainland and Southeast Asia had their origins in India, and that India was the preferred source for Southeast Asian beadmaking traditions. We did not feel it necessary to present the argument between local or "Indianised" manufacture in this paper, although our results suggest that other alternatives should be considered for further research (see also Theunissen *et al.* 2000).

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