Journal of Archaeological Science 53 (2015) 32–42

Contents lists available at ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

Study on production techniques and provenance of faience beads excavated in China

Yong Lei [a, *], Yin Xia [b]

[a] Conservation Department, Palace Museum, Beijing, 100009 China
[b] Terracotta Army Museum, Xi'an, 710061, China

ARTICLE INFO

Article history:
Received 6 December 2012
Received in revised form
12 September 2014
Accepted 27 September 2014
Available online 6 October 2014

Keywords:
Faience
Beads
Western Zhou
Sodium
Potassium
Provenance

ABSTRACT

Based on the results of scanning electron microscopy (SEM) with energy dispersive X-ray spectrometry (EDX), about 20 faience beads from several cemeteries discovered since 1970 in China were studied chronologically and typologically. Faience beads excavated in China can be classified into two groups, chemically by composition, and by periods and provenance as: soda-enriched made somewhere on the route from Egypt to central China (11–10th century BCE); and potash-enriched made in China (middle Western Zhou to Eastern Zhou). According to the continuous matrix of inter particle glass (IP glass) and inner micro-structure, the difference between soda- and potash-enriched faience beads was identified, even though the IP glass was badly preserved. The faience beads with potash-enriched glaze and high copper content were in a better state of preservation than those with soda-enriched glaze because of their tight inner structure.

1. Introduction

Faience is composed of crushed quartz or sand body with a soda–lime–silica glaze. It was produced in both Egypt and the Near East from the 4th millennium BC until the Roman period. The objects made from faience include bowls, tiles and small pieces such as amulets, beads, rings and scarabs. The two basic glaze colors were turquoise and black, which were produced by copper and manganese, respectively. Cobalt blue, manganese purple and lead antimonate yellow broadened the color range at the same time as the beginning of glass production around 1500 BC (Tite et al., 2007).

Both Vandiver (1983), and Tite et al. (1983, 1986), have confirmed the principal methods (direct application, efflorescence and cementation) for glazing faience in antiquity. They also suggested criteria for the identification of three glazing methods using scanning electron microscopy (SEM). Tite et al. (2003, 2007) have explored whether different types of plant ash were used for the production of faience, as well as whether the oxide ratios can be taken to represent the original plant ash composition. Rehren (2008) has reviewed the various factors affecting alkali and alkali earth oxides of Egyptian Faience.

In China, many beads, along with other larger objects, known as a type of "Liaozhu" (glass beads) were excavated from a number of tombs of the Western Zhou Dynasty (1046–771 BCE), and even later (Fu et al., 2006). They were often combined with jades and carnelians to form a collar-like necklace. Though they are not true glass, their surfaces are glassy. Their body is composed mostly of quartz, so they are real faience, but not glazed ceramic. Some of them do resemble Egyptian faience in overall appearance. Therefore, we describe all kinds of beads excavated in China as "Chinese Faience". The faience beads studied in this paper are those with glaze over quartz body, and do not include pigment beads made from a particulate material such as Chinese blue or purple, which do not have a glaze.

Ma et al. (2009) have listed archaeological sites in Shaanxi, Shanxi, Gansu and Henan that yielded Chinese faience beads. However, they provide chemical data for only 10 pieces. Most of these Chinese beads have a potash-enriched glaze, which indicates that most of those Chinese beads are potash-enriched glazes, distinguishing them from Egyptian faience. One exception is that Zhang and Ma (2009) also found one bead with soda-enriched glaze in Gansu, which was dated to the mid-Western Zhou period (Institute of Cultural Relics and Archaeology of Gansu Province, 2009). In that paper three samples (Sample GCYF-1, 2 &3) from the M94 in Yujiawan, Gansu (Fig. 11) were examined and only one

* Corresponding author.
E-mail address: leiyongleo@hotmail.com (Y. Lei).

http://dx.doi.org/10.1016/j.jas.2014.09.019
0305-4403/

(Sample GCYF-1) of them has a well-preserved soda glaze. The other two were badly preserved without any flux identified.

The published papers about Chinese faience have some limitations, leaving a key question unsolved: What is the relationship between Egyptian faience and Chinese faience, since both have similar appearance in shape or color? And why have soda-enriched beads been so rarely found in China?

The previous research efforts on Chinese faience, in our opinion, were not carried out taking typology into consideration. The small size of the beads may have led to omissions if microscopy was not employed. There may also have been some differences in shape, as well as in composition of those beads, which were not factored into the analysis.

The previous research on Chinese faience seems not to have incorporated the context in which the beads were discovered into their assessments, thus weakening the chronological studies. For example, bronzes with inscriptions buried with those beads actually provide excellent evidence for dating. If the inscriptions relate to reliable historical incidents confirmed by other historical scripts, exciting information both in terms of provenance and date might be gleaned. Furthermore, the typologies of bronzes and ceramics have been well established in China, providing additional possibilities for relating beads found in context with them. Thus, the sites or tombs with those excavated bronzes could actually provide more specific dates, such as the early, middle or late Western Zhou, rather only the general period. Taken together, the differences in composition combined with the styles and shapes of the Chinese faience can help to pinpoint specific dates.

This current study examines 20 faience beads excavated from several sites in northern China since 1970 (Fig. 1).

Table 1
Chronological assumption of the cemetery of Jin state by Li Boqian.

Tombs' number	Dates (BCE)
M114、M113	1000–925
M9、M13	935–855
M6、M7	910–845
M33、M32	880–831
M91、M92	860–816
M1、M2	834–804
M8、M31	814–796
M64、M62、M63	800–784
M93、M102	789–768

Fig. 1. Location of the archaeological sites mentioned in the article: 1 – Yujiawan, 2 – Baoiji (Rujiazhuang, Zhifangtou, Zhuyuangou), Yu state, 3 – Liangdaicun, Rui state, 4 – Tianma-Qucun, Jin state, 5 – Yangshe, Jin state, 6 – Hengshui, Peng state.