華大博雅学术文库

丛书主编 肖丰
美术文化研究丛书

汉代前的中国玻璃工艺

李会/著

華中師範大学出版社

丛书主编 肖 丰
美术文化研究丛书

汉代前的中国玻璃工艺

華大博雅学术文库

李 会/著

華中師範大學出版社

新出图证(鄂)字 10 号

图书在版编目(CIP)数据

汉代前的中国玻璃工艺/李会　著.—武汉:华中师范大学出版社,2014.11
(美术文化研究丛书)
ISBN 978-7-5622-6465-1

Ⅰ.①汉…　Ⅱ.①李…　Ⅲ.①玻璃-工艺美术史-中国-古代
Ⅳ.①J527.3

中国版本图书馆 CIP 数据核字(2013)第 306006 号

责任编辑:廖国春　　**封面设计**:甘　英
责任校对:易　雯
编辑室:学术出版中心　　**电话**:027-67863220
出版发行:华中师范大学出版社
社址:湖北省武汉市珞喻路 152 号　**邮编**:430079
电话:027-67863426/3280(发行部)　027-67861321(邮购)
传真:027-67863291
网址:http://www.ccnupress.com　　**电子信箱**:hscbs@public.wh.hb.cn
印刷:华中理工大学印刷厂　　**督印**:章光琼
字数:430 千字
开本:710mm×1000mm　1/16　　**印张**:24.75
版次:2014 年 11 月第 1 版　　**印次**:2014 年 11 月第 1 次印刷
定价:58.00 元

欢迎上网查询、购书

美术文化研究丛书

总　序

英国艺术评论家拉斯金说过："伟大的民族以三种手稿撰写自己的传记：记载行为之书、记载言论之书和记载艺术之书。欲理解其中一部必以其他两部为基础，但尤以艺术之书最值得信赖。"中华民族是一个拥有数千年历史的伟大民族，其艺术之书丰富而独特。记载艺术之书与记载行为之书和记载言论之书有更加密切的关系，可以说，当下提倡的多学科交叉、跨学科的研究方式与这"三种手稿"之间的天然关系是相吻合的。

华中师范大学美术学院推出的美术文化研究丛书表达了一种具有方向感的学术追求。这种追求属于一个拥有数千年艺术史研究传统的自然延伸。研究者们打破画地为牢的艺术学科分类，采取多学科整合的研究取向，将艺术史、美术文献、美术考古、设计史、民间美术、美术批评、美术管理等相关学科进行有机结合，对美术文化领域相关专题进行专项研究，为其提供互动性的平台和动力。从这个意义上说，这套丛书不仅是提供给那些倾心于艺术史的人们阅读的，同时也是提供给热爱文化史的人们阅览的。该丛书强调学术传统与个人情感的融合。在具体研究中，作者既把个案的、区域的研究置于对整体艺术史的关怀之中，注意从中国历史的实际和中国人的意识出发理解传统艺术史中的中国艺术现象，又关注西方的艺术传统和当下的艺术思潮。在这样一个大的

思维框架下，每一个研究领域既注重整合相关资源，又注重整理与之相适应的新方法和视角，对涉及该领域的多个方面进行了更为深入的探索和阐释，借以获得对该领域的全息观照。

这套丛书的作者们都是长期共事的研究群体。在我看来，最值得注意的是他们这种研究方式所产生的文化意义，这种文化意义在很大程度上体现了美术文化的终极价值。在大多数情况下，丛书的作者所从事的是一项与个人情感交融在一起的研究，学术传统与个人情感的交融赋予这样的工作以独特的魅力。同时，他们也期望这样的工作可以参与到一个更大的学术共同体所共同关注的问题中去。在理论假定、研究方法、资料分析和过程重建等多个层次进行有深度的理论探索，并以此回应艺术史研究中面对的各种重要问题，力图对人文社会科学的整体发展有所贡献。

我知道要将同仁们进行的对理想主义精神复兴的研究进行定义和归类是一件十分困难的事情，不过也不必这样做。事实上，我们的研究不属于任何定义，我们只属于拥有自己方式的艺术品格和由此搭建的文化体系，这正是人们期待已久的精神旨归和真正意义上的艺术方向。

肖　丰

2009 年 4 月 16 日

目 录

Chapter 1 Introduction ····· 1

1. 1 The History of Glass ····· 3

1. 2 The Study of Glass Outside China ····· 8

1. 3 The Research Background of Early Glass Studies in China ····· 8

1. 4 Previous Studies on Chinese Glass ····· 9

1. 5 The Goals of This Research ····· 13

Chapter 2 The Distribution of Early Glass Eye Beads Outside China ····· 15

2. 1 Glass Eye Beads in Egypt ····· 17

2. 2 Glass Eye Beads in Greece ····· 20

2. 3 Glass Eye Beads in West Asia ····· 21

2. 4 Glass Eye Beads in Iran ····· 23

2. 5 Glass Eye Beads on the Eurasian Steppe ····· 24

2. 6 Glass Eye Beads in India ····· 26

Chapter 3 Early Eye Beads in China ····· 29

3. 1 Glass Eye Beads in China ····· 31

3. 2 Glass Eye Tubes in China ····· 45

3. 3 Discoveries of Faience Eye Tubes and Beads in China ····· 46

Chapter 4 Other Characteristic Glass Artifacts of China ····· 57

4. 1 Glass *Bi* (璧) Disc (Table 3:13, Map 4-01) ····· 59

4. 2 Glass *Huan* (环) (Table 3:14, Map 4-02) ····· 63
4. 3 Glass Furniture for Sword ····· 63
4. 4 Other Glass Products (Table 3:14) ····· 65
4. 5 Conclusion ····· 66

Chapter 5 Comparison of Early Chinese and Non-Chinese Glass ····· 69

5. 1 Typological Comparison ····· 71
5. 2 Comparison of Chemical Compositions ····· 106
5. 3 Conclusion ····· 109

Chapter 6 The Development of Productive Techniques and Uses of Glass in China ····· 111

6. 1 The Historical Background of Glass in Early China ····· 113
6. 2 Contacts Between Chinese and Non-Chinese Cultures as Reflected by the Occurrence of Glass ····· 114
6. 3 The Development of Glass in China ····· 133
6. 4 Uses of Glass Products ····· 141

Chapter 7 Glass-making in China ····· 151

7. 1 Manufacturing Techniques for Glass Eye Beads ····· 153
7. 2 Manufacturing Techniques for Other Glass Artifacts ····· 156
7. 3 The Origin of the Art of Glass-Making in China ····· 157

Chapter 8 Glass Finds and Chu Culture ····· 175

8. 1 Chu History ····· 177
8. 2 Chu Culture ····· 178
8. 3 Chu Business ····· 179
8. 4 Glass Development and Chu Culture ····· 181
8. 5 The Disappearance of Glass Artifacts ····· 183

Chapter 9 Conclusion 189
Tables 197
Figures 253
Captions 304
Maps 329
Bibliography 346

Chapter 1

Introduction

1.1 The History of Glass

Glass is a material which primarily consists of silica. It is fused at a high temperature and never crystallizes once it has arrived at its target state. While it has no sharp melting point, glass generally softens and becomes mobile at approximately 1,000 centidegree. Unlike most substances, which would crystallize into a solid mass, molten glass congeals into a hard, highly viscous, amorphous state when it is rapidly cooled off below this temperature. Most scholars agree that glass was developed in the late third millennium B.C., possibly in interrelation with the advancement of faience production.

To this day, the history of glass manufacture remains a contested subject, and different opinions regarding its invention and geographical origin coexist. Previous excavations have rendered the earliest sample of glass, which dates back to the early 3rd millennium B.C., from Tell Judeideh, Syria.① The find justifies the conclusion that people were capable of intentionally producing glass from this time onward.② Furthermore, it is known that the first glass vessels were produced at about 1,500 B.C. in Mesopotamia.

As the potential of the new material was not immediately realized, only beads and other small objects were initially produced, formed or cast with the aid of simple tools.

Both surviving colors and textual references prove early examples of glass-making to be imitations of such precious and semi-precious stones like the lapis-lazuli or the turquoise (blue) and gold (yellow). However, the nature of the habitats of these excavated pieces, which are rather temple ruins, palaces, or tombs than private houses, imply that glass was a luxury material in its own right, produced in major cities for an aristocratic market, generally royal or priestly. Worldwide, there are scarcely any finds of glass products which date prior to 1,500 B.C. However, when the first vessels appeared in Western Asia, glass became common.

---

① Braidwood/Howe 1960, 341.

② Schweiz 2003, 78.

The introduction of the core-forming technique in the middle of the sixteenth century B.C. constituted a technological breakthrough which resulted in the creation of the first glass vessels and allowed the industry to become an independent manufacturing entity. The method's impact is reflected by the fact that it dominated the manufacture of vessels throughout the following 1,500 years. The earliest examples of core-forming appear to have been produced in northern Mesopotamia, taking on shapes like long, straight-sided beakers with button bases, which are similar to contemporary pottery vessels, and bottles of several varieties with pointed bottoms or disc bases. A caned network of spirally twisted threads of different colors can often be found enclosing the pieces' rims.

During the late 16th and 15th centuries B.C., glass-making rapidly evolved in northern Mesopotamia. Glass vessels and other objects originating in the area were discovered at many sites in the Middle and Near East, from Persia (today's Iran), Elam, and Babylonia in the east to Syria and Palestine on the Mediterranean coast, but also in Mycenaean Greece. It is likely that the Asiatic industry, encouraged by the military conquests of the Egyptian pharaoh Tuthmosis Ⅲ, which reached from Syria to the Mesopotamian borders of about 1,450 B.C.,① sent workers to Egypt in order to introduce glass production, and that glass-making consequently peaked in both Western Asia and Egypt at the time. It continued to flourish and spread its influence further sill until about 1,200 B.C. Yet, the destructions and disasters which brought the Bronze Age civilization into a period of near anarchy toward the close of the thirteenth century concluded the heyday of the glass industry. The markets, which had depended on palace culture, collapsed. Accordingly, the amount of glass vessel discoveries dating to the period of roughly 1,200-900 B.C. is limited, although small objects, such as beads, seals, and trinkets were probably still being made, especially in Syria.

The renaissance of the glass industry in the ninth century B.C. occurred before the background of a cultural revival which affected the whole of Western Asia, the Levant, and the Mediterranean world. Glass-making was revived in Mesopotamia at around 700 B.C. and in Egypt at around 500 B.C. Over the following 500 years,

① Vandiver 1983, 239-247.

Egypt, Syria, and other countries along the eastern shore of the Mediterranean Sea were the centers of glass-making. Coinciding with the advent of the age of Augustus, the first Roman emperor (27 B.C.– 14 A.D.), was a glass industry revolution brought about by the invention of blowing. Glassblowing techniques spread throughout the Roman world and blown wares rapidly replaced those produced by older methods everywhere. While, Venice, particularly the island of Murano, became a hub for high quality glass manufacture in the late medieval period, the fact remains that Central Asia and China also played an important role in the history of glass production. In the discussion of the report on the first congress des Journies internationals du verre, held in Liege, Belgium, Sayre and Smith pointed out that even during the earliest days of glass-making, all large towns of Central Asia had a highly developed glass manufacturing industry, e.g. Samarkand and Bukhara.① Glass objects, beginning as early as the thirteenth to the eleventh century B.C. and lasting to the fifteenth century A.D., have been found in Middle Asia. Colored opaque glass beads, for instance, were reported from southern Kazakhstani tombs of the Bronze Age steppe culture Tau Tary as well as in the tumulus kokcha-3 in Khorezma, all dating from the thirteenth to the eleventh century B.C.② Evidence of glass beads was discovered in tombs of the sixth and fifth centuries B.C., and in the areas of the Tianshan Mountains (Kirgizia) and Pamirs a number of vessels, flasks, and drinking horns (rhytons) were found.③

E.V. Sayre and R.W. Smith collected a series of approximately 200 fragments and powdered samples of ancient glass from Europe, Western Asia, and Africa, roughly dated to the time between the fifteenth century B.C. and the twelfth century A.D. Spectrographic, flame photometric, colorimetric, and other analyses of hundreds of these samples revealed 26 elementary components which enabled Sayre and Smith to suggest a categorization of ancient glass into the following five broad groups, not considering the ancient production in the Far East.

1. Glass group of the second millennium B.C.—Confined to the period from the fifteenth to the seventh century B.C., this group typically consists of soda-lime

① Besborodov/Zadreprovsky 1973.

② Engle 1973, 45-46.

③ Singh 1989, 20.

glass with a high MgO (4.6%-2.9%) and a low K_2O (1.89%-0.69%) content, as well as with traces of oxides Mn (0.046%-0.021%), Sb (0.32%-0.011%), and Pb (0.0068%). This kind of glass was produced throughout the Mediterranean area, e.g. in Egypt, Mesopotamia, Greece (Mycenae), and Persia (Elam).

2. Antimony-rich glass group of the period from roughly the sixth century B. C. to the fourth century A. D. —This group is characterized by lower MgO (1.24%-0.60%) and K_2O (0.47%-0.17%) contents, a consistently high level of antimony oxide (1.93%-0.53%) and traces of MnO, PbO etc. Samples of this group have turned up in Greece (Olympia), Asia Minor (Gordion), Persia (Persepolis), Begram, and Dura Europos.

3. Glass group of Roman composition — Confined to the period from the early fifth to the seventh century A.D., this group is marked by low percentages of MgO (1.47%-0.73%) and K_2O (0.63%-0.22%), a greater proportion of MnO (1.60%-0.10%) and lower contents of antimony (0.089%-0.018%) and lead. The far-reaching geographical spread of this group has already been discussed.

4. Early Islamic group, flourishing from the eighth to the tenth century A.D. —A typical soda-lime glass with high MgO (6.5%-3.5%) and K_2O (2.2%-0.94%) contents, a high proportion of manganese (1.07%-0.21%) and low antimony and lead parts. With the exception of its high manganese content, this group appears to be a return to the composition of group 1 glass. It is represented by finds from Nishapur, Susa, Quadrisia, Kish, Raqqa, Fostat, and some Iraqi sites.

5. Islamic lead glass group from the eighth to the tenth century A.D. —This group, very few samples of which have been found, contains a high percentage of lead (40%-33%), low levels of alkali and lime, and lower percentages of MgO, K_2O, MnO, and Sb_2O_5. The type differs from both the lead-barium glass made in China and the lead glass samples found in the U.S.S.R.①

The four preceding categories represent only relatively minor variations in the basic soda-lime glass of Western antiquity. The distributions of the major components, silicon, sodium, and calcium oxide, essentially overlap for the

① Sayre/Smith 1961, 1824.

different categories with a standard deviation of the order of 25% of the mean values.

In a later report, based on the analytical data of over 300 glass samples, Smith declared that all ancient glasses could be assigned to two general types which are independent of the above-mentioned five compositional groups, viz. (a) low-magnesia glasses and (b) high-magnesia glasses. In this connection, "antimony-rich" and "Roman" glasses are typical of the first group due to their relatively low magnesium concentrations, varying from 0.5%–4% and with a mean concentration lying at around 1%. At 5% the "second millennium B.C." and "early Islamic" groups contain characteristically high proportions of magnesium. Thus the mean concentration in the high-magnesia type is nearly five times greater than the one contained in the low-magnesia type. The latter is furthermore marked by a low potassium concentration, whereas the high-magnesia type has an elevated proportion of potassium. Here the difference in the mean values of potassium concentrations is also great.①

Two equally plausible hypotheses exist, which explain the discovery of glass. On the one hand, some scholars believe that glass arose from a metallurgical operation, seeing as the smelting of copper and lead ores often produces glassy slags. In this context, a time-based consistency can be derived from the fact that copper was smelted from azurite and malachite in the mining centers of Asia Minor by 3,000 B.C. It is furthermore possible that the practice was continued on Cyprus and on a Sinai Peninsula in that region which would later become renowned as King Solomon's Mines.② On the other hand, many scholars are inclined to argue that glass originates from a background of ceramic material and is closely related to faience-working.③ Stone voiced the highly convincing argument that the techniques involved in the development of faience were strictly antecedent to the subsequent development of true glass.④ In 1979, Goldstein argued along the same line when

① Smith 1963, 283-290.
② Tylecote 1962, 27.
③ Oppenheim 1973, 259-266.
④ Stone/Thomas 1956, 37.

he claimed that glass evolved out of the tinkering of faience manufacturers.①

1.2 The Study of Glass Outside China

It was in the nineteenth century that people first attended to ancient glass and began researching the material. Such early important contributors to the study of the origin of glass like Apsley Pellat jt,② Flinders Petrie,③ and Horace C. Beck④ paved the way for later analyses. From the very beginning of glass studies, scientists have employed technical methods of analysis in order to compare glass finds from varying regions, to aid the determination of the origin of particular glasses where these was doubt, and to detect possible relationships between different objects, and the techniques are still an essential part of research today. One special glass artifact, the eye bead, is ornamented with one or more spots, i.e. the eponymous eyes which may be circular, oval, triangular, or square. Its emergence as a man-made product can be traced back to the XVII—XX dynasties in Egypt. A sudden expansion of the bead industry occurred during the mid-2nd millennium and production centers developed in several areas. As a result, a great number of glass eye beads could be located in Africa, Asia, Europe, and America. The first study dealing exclusively with eye beads was put forward by Eisen and contains an elementary classification based on technological principles which remains valid to this day.⑤ Another meaningful contribution to bead research is Beck's 1928 general classification of beads, which also included eye beads.⑥ As ever more glass eye beads emerge worldwide, their importance as an archaeological theme steadily increases.

1.3 The Research Background of Early Glass Studies in China

The plundering of several tombs inLuoyang during the mid-1930s resulted in

① Goldstein 1979, 24-27.
② Thorpe 1935, 235.
③ Petrie 1984.
④ Beck 1934, 19.
⑤ Eisen 1916, 1-27.
⑥ Beck 1926, 1-76.