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## Imported Glass Vessels: A Review of Finds in China and the Tarim Basin from the First Half of the 1st Millennium AD

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## ABSTRACT

### Imported Glass Vessels

A Review of Finds in China and the Tarim Basin from the First Half of the 1<sup>st</sup> Millennium CE

Brigitte Borell

The paper presents an updated overview of 'western' glass vessels imported into China and into the Tarim Basin in the first half of the 1<sup>st</sup> millennium CE. It follows a two-fold approach bringing together archaeological analysis of the visible features and published results from chemical analysis of the glasses. Three major types of glass have been discerned on the basis of their compositional analysis: Roman natron glass, and Sasanian and Central Asian plant-ash glasses. The results of this combined approach provide a more informed basis for provenancing the glass vessels and assessing a more refined date to them. It also helps to a better understanding of the glass vessels in their social contexts and the complexity of land and sea routes to be considered in the process of their transmission.

## KEYWORDS

China, Tarim Basin, Glass Vessels (Roman, Sasanian, Central Asian), Overland and Sea Routes

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# Imported Glass Vessels

## A Review of Finds in China and the Tarim Basin from the First Half of the 1<sup>st</sup> Millennium CE

### Preliminary Remark

<sup>1</sup> In 1984, An Jiayao published her study of early glass vessels in China. At the time, she was one of the few archaeologists with an interest in glass vessels – imported ones as well as those locally produced – and their history in China. Her overview was accompanied by an archaeometrical paper presenting chemical analyses of selected glass vessels carried out by Shi Meiguang and colleagues of the China Building Material Academy in Beijing (CBMA), the main objective being able to distinguish between imported and locally made glass vessels (An 1984; Shi – Qu – Zhang et al. 1984).

<sup>2</sup> Since then, excavations brought to light some more imported glass vessels, and, most importantly, analysing methods and techniques progressed enormously. Chemical analyses of ancient glasses including trace element and isotope studies allow distinguishing different compositional types of glass or ‘glass families’ and proved to be an excellent tool for provenancing glasses.

<sup>3</sup> Finds of imported glass vessels from two regions are considered here. Those discovered in China proper, the majority in Jiangsu province, were mainly excavated from burial contexts, the earliest from tombs of the Eastern Han period (24–220 CE) and the state of Wu (222–280 CE), the majority coming from later contexts dating from the Jin period (236–420 CE). Generally, an origin either from the Roman or Sasanian empires was assigned to them. For various reasons – one of them being their geographical distribution in easy reach from the coast –, it has been suggested that many of these glass vessels arrived in China on maritime routes.

<sup>4</sup> The other region with remains of glass vessels considered here is the Tarim Basin in present-day Xinjiang Uygur Autonomous Region (China). Generally, they are

believed to be representative for a transmission along land routes. They are included here to look for similarities or differences in the pattern of distribution. Only few complete glass vessels have survived, the others are fragments collected as stray finds. Preferably included in this review are fragments that have been compositionally analysed. This applies to fragments collected by European expeditions to the Tarim Basin in the early 20<sup>th</sup> century, which are now kept in museums in Europe. Selected fragments of them were analysed by Robert H. Brill at the Corning Museum of Glass in the 1990s and slightly later (Brill 2009; Brill 2012). More recent finds made by Chinese archaeologists have been analysed at various institutions in China, in particular by scientists of the group around Gan Fuxi at the Shanghai Institute of Optics and Fine Mechanics<sup>1</sup>.

<sup>5</sup> A central concern of this review, being written by an archaeologist, was the ambition to provide also illustrations of the analysed fragments as information on their physical appearance. This would not have been possible without the assistance and generous support of a number of museums, institutions, and colleagues listed below in the acknowledgements. To all of them go my sincere thanks. Inevitably, this review will have a preliminary character. The results of chemical analyses made over the years at various institutions and with different techniques are not easily comparable. Future finds and new, high standard chemical analyses – even of older finds – will add new information and bring modifications. Notwithstanding these inevitable shortcomings, it is hoped that this review will give a fresh impulse to the study of glass vessels imported into the Far East.

## 1. Introduction

<sup>6</sup> Western glass production on a larger scale began in the Near and Middle East and in Egypt in the mid 2<sup>nd</sup> millennium BCE. Basically, these Bronze Age glasses as well as the later glasses of the 1<sup>st</sup> millennia BCE and CE, belong to the group of soda-lime-silica glass consisting of three basic components: silica in the form of crushed quartz pebbles or sand; soda as a flux to lower the melting temperature of quartz, which is about 1700°C, a temperature impossible to reach in antiquity; and lime as a stabiliser to make the glass durable and resistant to the action of moisture.

<sup>7</sup> In contrast, early Chinese glass, first identified in the 1930s by Charles G. Seligman and Horace C. Beck, has a unique glass composition which contains, besides silica, large amounts of lead, which acted as a flux, and barium<sup>2</sup>. Often these glasses, produced from about the mid-1<sup>st</sup> millennium BCE onwards, had a certain turbidity and a greenish-whitish colour similar to jade. In fact, in the Warring States (475–221 BCE) and Han (206 BCE–220 CE) periods, many objects for funerary use, that were usually made of jade, were now also made of ‘artificial jade’, namely such a semi-opaque lead-barium-silica glass. In the Han period, production must have been on a large scale. Manufactured objects include *bi* disks, sword fittings, huge numbers of small plaques for funerary shrouds and mats, a few glass vessels, and even a set of chimes<sup>3</sup>.

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<sup>1</sup> Gan 2009; Li – Yu – Zhang et al. 2009; Liu – Li – Gan et al. 2011; Liu – Li – Gan et al. 2012.

<sup>2</sup> Seligman – Beck 1938. For recent archaeometrical analyses of Chinese lead-barium glasses, Cui – Wu – Huang 2011; see Dong – Li – Liu 2015; for recent experimental replication, see Qin – Wang – Chen et al. 2016; for a recent overview, see Henderson – An – Ma 2018. – Measured values for PbO range between 30 and 50 wt%, for BaO between 7 and 20 wt%.

<sup>3</sup> Kim 2012. – For burial shrouds, see Michaelson 1998–99; Yang 2004, 350 (tomb 104 at Baonüdu, on the date of the tomb see also Psarras 2015, 149); Cheng – Zhou 1991 (burial of concubine Mo Shu at Ganquanshan); and the plaques in the British Museum, [https://www.britishmuseum.org/collection/object/A\\_1934-0313-1-369](https://www.britishmuseum.org/collection/object/A_1934-0313-1-369), accessed September 2021; for recent finds, the glass mat from the burial of the Marquis of Haihun (died 59 BC) in Nanchang (Jiangxi), see Yang 2019, 81 fig. 31; for the glass mat in Han period burial at Tushantun M 147, Qingdao (Shandong), see *Kaogu Xuebao* 2019–3, 416–417 figs. 13–14. – On glass vessels made of lead-barium glass, see An 2004, 57. – On the set of chimes (Western Han), see Nanjing Museum 2015, 135 fig. 22;

8 Initially, researchers studying glass finds from China were satisfied being able to distinguish between Chinese-made lead-barium-silica glasses or the later lead-silica glasses and imported western soda-lime-silica glasses. Since lead oxide has an effect on the density, by calculating the density such a distinction between a soda-lime glass and a Chinese glass with high lead content could be established with simple non-destructive tests.

9 Finds of early glasses identified as not being made of Chinese lead-barium glass were automatically regarded as western imports. Thus, certain mould-formed glass vessels found in Han period burials in Guangxi in the 1950s were initially misidentified as Roman<sup>4</sup>. However, chemical analyses carried out in the 1980s revealed for this group a different glass composition, where potash of mineral origin and not soda served as flux in the process of glassmaking (Shi – He – Zhou 1987). Currently, this particular glass composition is classified as a subgroup of Asian potash glasses, most likely originating in southern China or northern Vietnam, at the time part of the Han empire. The glass vessels of this group therefore rather represent a local production<sup>5</sup>.

10 Starting with the seminal study by Edward V. Sayre and Ray Winfield Smith of 1961, important progress in the interpretation of analyses of western soda-lime glasses was made<sup>6</sup>. Two different types of soda-lime glasses were distinguished based on their different concentrations of some major and minor elements<sup>7</sup>, in particular magnesium oxide (MgO) and potassium oxide (K<sub>2</sub>O), which appeared to be correlated. Based on the analytical results as well as on historical texts, they concluded that two different types of soda were used, one a soda from a vegetal source derived from the ashes of certain halophytic plants that contained higher magnesia and potash concentrations (with levels in the analyses above 1.5 wt%), the other, a rather pure soda of mineral origin with lower magnesia and potash concentrations (below 1.5 wt%), from evaporites rich in sodium bicarbonate that occur naturally and are commonly called natron, the name derived from the large deposits in the Wadi Natrun in Egypt that were exploited in antiquity.

11 Subsequently, countless further analyses of western glasses revealed again and again the same pattern confirming the two basic types of soda-lime glass depending on the type of soda used in the production of their glass, the high-magnesia type using soda of vegetal origin called plant-ash soda, and the low-magnesia type using a soda of mineral origin, natron.

12 New analytical techniques were developed during the last decades which not only require ever smaller sample volumes, but also progressively refine the results. In addition, recent investigations increasingly include isotope analyses. Particular mention deserve the recent advances in the almost non-destructive method of laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) which also includes trace elements. Generally, the major and minor elements provide information on the recipe used, meaning the intentional anthropogenic choice of ingredients for glassmaking, in particular the flux used to lower the melting point of silica. In contrast, the trace elements, which accidentally came into the glass as impurities together with one or

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Li – Li – Gu 2016; on its replication, see Wang 2016.

4 For example, Moore 1998, 79 with endnote 6, where the glass vessels from Guixian excavated in 1957, the set of stemmed glass cup and saucer from Nandoucun tomb 8, and the cup from the tomb at the Railway Station, are included into his “dominant numbers of Roman glass finds in south China.” The latter glass cup is on display in the National Museum of China, Beijing, still with the label “Roman glass cup” (seen in June 2017). Earlier, An Jiayao had already expressed some caution regarding a Roman origin of these glass vessel, An 1984, 418–419; An 1987, 6; see also Borell 2011, 57.

5 Dussubieux 2016. On the glass vessels, see Borell 2011; Borell 2016, 57–65. Borell – Dussubieux 2022.

6 Sayre – Smith 1961; Sayre – Smith 1967. For a recent overview on glass compositions, see Rehren – Freestone 2015.

7 Major elements: present at levels above 1 wt.%; minor elements: present at levels between 0.1 and 1 wt.%.

more of the ingredients, usually the source of sand, may provide information on the geographical provenance of the glasses. Ideally, in some cases, the combined occurrence of certain trace elements may be regarded as a trace element signature, a ‘fingerprint’, making it possible to link the glass production to the geology of a certain geographical region (Gratuze 2013).

13 For example, the results of LA-ICP-MS analyses now allow a distinction between Bronze Age Egyptian and ‘Mesopotamian’ plant-ash soda glasses based on different patterns of trace element concentrations, in this case titanium, zirconium, lanthanum, and chromium, reflecting the different geological environment of raw materials available in the two different geographical regions (Shortland 2012, 157–158; Dussubieux 2016, 197).

## 2. Types of ancient soda-lime glasses in the late 1<sup>st</sup> millennium BCE and the mid-1<sup>st</sup> millennium CE

14 The principal distinction between two different types of ancient western soda-lime glasses based on their different sources of soda, a vegetal source of soda derived from plant-ash and a mineral source of soda, natron, is now generally accepted. On this basis, it is possible to give a broad outline of the chronological and regional development of ancient glassmaking. In archaeological terms, the first sizeable production of glass and manufacture of glass vessels began in the Late Bronze Age, in the late 16<sup>th</sup> to mid-15<sup>th</sup> century BCE in northern Syria, Mesopotamia and Egypt, using plant-ash as a source of soda. In the early 1<sup>st</sup> millennium BCE a change from plant-ash soda to natron can be observed in Egypt and the Levantine region. The traditional use of plant-ash soda for glassmaking did continue in the Middle East, broadly speaking in regions east of the Euphrates, whereas west of the Euphrates, natron glass was produced until about 800 CE, when another general change from natron to plant-ash soda occurred<sup>8</sup>. The prolific production of glass vessels in lands of the Islamic world was based on plant-ash soda glass.

### 2.1. Glasses using a mineral source of soda

15 As pointed out above, the production of natron glass began in the early 1<sup>st</sup> millennium BCE in Egypt and the Levantine region of Syria and Palestine, later the most important regions of glassmaking for the Mediterranean world in the Hellenistic and Roman periods.

#### 2.1.1. Egyptian and Mediterranean natron glasses (m-Na-Ca)

16 The glass beakers from the tomb of Nesikhons, dating from the 10<sup>th</sup> century BCE apparently represent an early phase in the making of natron glass (Schlick-Nolte – Werthmann 2003; Schlick-Nolte – Werthmann 2010). In this case, the use of natron in the glassmaking recipe resulted in a glass with an unusually low level of lime that left the finished glass vessels extremely sensitive to moisture and therefore prone to heavy corrosion. Early glassmakers were probably not aware of the importance of lime for a durable glass. With the plant-ashes used before, some lime and magnesia were naturally

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8 Recently, a regionally produced natron glass has been identified, characterised by high concentrations of boron, that was made somewhere around Pergamon (Turkey) from about the mid-1<sup>st</sup> millennium CE; its production appears to have outlasted the change to plant-ash glass around 800 CE. Rehren – Connolly – Schibille et al. 2015; Schwarzer – Rehren 2021, 184–189.

introduced into the glass as stabilisers and thus made it resistant to attack by water. The case of the Nesikhons beakers demonstrates the importance of the correct choice and combination of raw ingredients for a successful fusing of glass and the difficulties encountered by the glassmakers when substituting one of the ingredients. It is therefore possible that some of the early natron glasses of the early 1<sup>st</sup> millennium BCE simply did not survive in the archaeological record. A well developed Mediterranean production of durable natron glass vessels is attested from about the 6<sup>th</sup> century BCE onwards.

17 Regarding the glass production in late Hellenistic and Roman times, archaeometric investigations and archaeological discoveries during the last few decades led to a re-evaluation of ancient glass production<sup>9</sup>. It is now generally recognised that in the late Hellenistic and Roman periods a division of glass production existed into few large centres for glassmaking, the primary workshops, where glass was fused from its raw ingredients, and a multitude of secondary workshops for glassworking that obtained the raw glass and remelted it to fashion objects. The archaeometrical basis for this model rests on countless chemical analyses, isotopic and trace element studies of Roman glasses from all parts of the empire, the vast majority showing a rather uniform glass composition pointing to an eastern Mediterranean origin in Egypt and the Syro-Palestinian region. Further support for this model comes from archaeological evidence, on the one hand from shipwrecks documenting the trade in raw glass, and on the other hand, remains of huge installations for glassmaking discovered in the eastern Mediterranean. The primary glassmaking workshops were located close to the favoured sources of sand well-suited for glassmaking along the Syro-Palestinian coast, or in Egypt close to the source of natron from the Wadi Natrun. From these few glassmaking centres blocks of raw glass were traded across the Mediterranean to secondary workshops all over the Roman Empire (Scott – Degryse 2014; Degryse 2014, 106–112; Foy 2018).

18 Basically, these two regions of the south-eastern Mediterranean, namely Egypt and the coastal plain of Syria-Palestine, continued to be the main producers of natron glass in Late Antiquity. A number of subgroups of this late production have been identified with varying production periods. The most prominent is the so-called HIMT glass and its related groups, named after the higher iron, manganese and titanium concentrations. Produced in Egypt from about the mid-4<sup>th</sup> to the mid-7<sup>th</sup> century CE, it was widely distributed in the Mediterranean and Europe<sup>10</sup>. For example, two glass vessels of such Late Antique glass compositions have been identified in tombs of the Korean Silla period dating from the late 4<sup>th</sup> to the early 6<sup>th</sup> centuries CE. One is a blue cup made of a glass similar to *série* 2.1 Foy (sometimes also referred to as ‘weak HIMT’) of the wider HIMT group produced in Egypt, the other a colourless facet-cut bowl made from a glass similar to type Levantine 1 produced on the Syro-Palestinian coast between the 4<sup>th</sup> and 7<sup>th</sup> centuries CE<sup>11</sup>.

19 Although Pliny (*Naturalis historia* 36, 194–195) mentions suitable sands and glassmaking in other areas of the Mediterranean, in Campania (Italy), Gaul and Spain, archaeometric studies have not yet specified particular glassmaking regions in the central and western Mediterranean (Scott – Degryse 2014; Degryse 2014, 99–112). Recently, a regionally produced natron glass from Asia Minor has been identified, characterised by high concentrations of boron, made from about the mid-1<sup>st</sup> millennium CE, if not even earlier (Rehren – Connolly – Schibille et al. 2015; Schwarzer – Rehren 2021, 184–189). However, in general, the vast majority of archaeometric analyses point to the use of

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9 For a recent overview on the results of archaeometric research, see Freestone 2021.

10 Freestone – Degryse – Lankton et al. 2018. For a brief overview from the archaeologist’s point of view, see Nenna 2014.

11 Abe – Murakushi – Kim 2019, sample G003 from Tomb 4 at Ange-ri (blue cup) and sample GL013 from the Hwangnam Daechoeng northern tomb (colourless facet-cut bowl, decoloured with manganese).

south-eastern Mediterranean sands and the regions of coastal Syro-Palestine and Lower Egypt as the main producers of natron glass and to a continuous production of about 1500 years until the change to plant-ash soda glass around 800 CE.

### 2.1.2. South Asian glasses using a mineral source of soda (m-Na-Al)

20 For the sake of completeness, two types of South Asian soda glasses using a soda of mineral origin are briefly mentioned here. Lime is present in relatively low concentrations (CaO ~ 3 wt.%), the main stabiliser in these glasses is the high amount of alumina (higher than 5 wt.%, with an average ~ 10 wt.%), derived from feldspar-rich impure sands reflecting their granitic origin. The high alumina content as well as characteristic concentrations of certain trace elements, associated with different geographical regions in South Asia, set these glasses apart from Mediterranean glasses. At least five different types of such South Asian mineral soda glasses have been identified. Only two of them are attested in the period considered here, the distinction between them is based on their different concentrations of strontium, zirconium, caesium, barium, and uranium<sup>12</sup>. The first and most abundant type, named m-Na-Al 1, is associated with South India and Sri Lanka, whereas the other, named m-Na-Al 3, was apparently produced in the Ganges plain in present-day Uttar Pradesh with Kopia as a likely production site. These South Asian glass types were used for the manufacture of ornaments, predominantly beads that were widely traded, in particular along maritime routes. No glass vessels made from these glass types are known.

21 However, one particular type of South Asian glass deserves to be mentioned, the m-Na-Ca-Al glass with moderate lime and moderate alumina levels, which vary in a wide range, and often high concentrations of uranium (Dussubieux – Lankton – Bellina et al. 2012, 320–321, 323; Lankton 2022, 83–84). It has a wide distribution in South Asia but also in Southeast Asia. The provenance for this type of glass is still uncertain, possibly it might be associated with Sri Lanka. At least on the island of Sri Lanka this glass type was employed for glassblowing apparently as early as the 2<sup>nd</sup> century CE. As yet no blown glass vessels of this glass type are known, rather, it was used for the blowing of spherical objects to form the dome of miniature glass stupas that were discovered in reliquary deposits within the Nawagala stupa about 30 kilometres south of Anuradhapura<sup>13</sup>. Similar stupa-shaped glass reliquaries have also recently been discovered in the Neelagiri stupa in south-eastern Sri Lanka; they are made up of a blown globe for the dome that is set in a base of bangle-like glass rings of graded size representing the tiers of the basal terrace<sup>14</sup>. Fragments of blown objects of this type of glass have also been recovered in the excavations at Tissamaharama in the south-east of Sri Lanka in levels assigned to the 2<sup>nd</sup> and 3<sup>rd</sup> centuries CE (Borell – Dussubieux 2022, 39). Interestingly, an egg-shaped glass object or container made of m-Na-Ca-Al glass by the blowing technique was discovered in Thanh Hóa province in central Vietnam, in a burial dating probably from the later Eastern Han period (25–220 CE)<sup>15</sup>.

## 2.2. Glasses using a vegetal source of soda

22 As pointed out above, the Late Bronze Age tradition of glassmaking using plant-ash soda (v-Na-Ca) continued in regions east of the Euphrates, whereas in the

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12 Dussubieux – Gratuze 2013; Dussubieux 2021, esp. 492–493; Brill – Stapleton 2012, 503–510 on glass finds from Kopia.

13 For the miniature glass stupas, see <https://amazinglanka.com/wp/nawagala-raj-maha-viharaya/>.

14 Dissanayake – Perera 2017, 276–281. My sincere thanks are due to the Department of Archaeology, Colombo, for the opportunity to study them in August 2023 while they were there in storage.

15 Musée Guimet inv. no. MG 21772, from Hoành-chung tomb 2 (Thanh Hóa province, central Vietnam), see Janse 1951, 123–124, colour pl. III, 14a,b; Lankton – Dussubieux 2013, 441. Borell 2024a, 115.

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eastern Mediterranean a change to natron occurred in the early 1<sup>st</sup> millennium BC. Nevertheless, a modest production of glass using plant-ash soda existed in Hellenistic and early Roman times in Egypt, apparently for glasses of special colours.

### 2.2.1. Egyptian plant-ash glasses

23 Although very rare when compared to the huge production of natron glass and its distribution all over the Mediterranean, some primary production of plant-ash soda glass with concentrations of magnesia and potash above 1.5 wt.% is attested in Hellenistic and Roman period Egypt (Picon – Thirion-Merle – Vichy 2008). Strongly coloured plant-ash glasses, in particular red, orange, green and occasionally also blue, all coloured with copper in different forms, but also purple coloured with manganese, have been identified in Roman mosaic glass objects alongside and also in combination with natron glasses. However, in these cases the sands used for the production of both types of glass have an eastern Mediterranean, either Egyptian or Syro-Palestinian, origin (Nenna – Gratuze 2009; Gratuze 2013, 210–213). Plant-ash glass has also been used for making glass vessels, including even a ribbed bowl of 1<sup>st</sup> century CE type found at Armant (Rosenow – Rehren 2018, 305). Another widely distributed class consists of small, thick-walled ointment bottles (*unguentaria*) of low capacity (*unguentaria*) made of translucent dark green glass produced from the late 1<sup>st</sup> to the 3<sup>rd</sup> centuries CE probably in Middle Egypt. In addition to the raised levels of magnesia and potash, these plant-ash glasses also have higher phosphate concentrations in comparison to natron glass (Rosenow – Rehren 2014, 180–181; Rosenow – Rehren 2018, 305–309; Rosenow 2020, 163–164).

24 A special case seems to be the production of transparent emerald green glass made mainly in the early to mid-1<sup>st</sup> century CE. It was used by a number of secondary workshops in other parts of the Roman Empire for the manufacture of certain types of glass vessels, non-blown as well as blown ones. Almost all tested samples were made from glass with a plant-ash component. A special type of plant-ash high in phosphorus was apparently added to a natron glass of eastern Mediterranean, possibly Egyptian origin. Primarily, the colourants for emerald green are copper and iron. It appears that the addition of plant-ash facilitated the formation of this particular emerald green colour (Jackson – Cottam 2015; Cottam – Jackson 2018). It throws not only some light on the high degree of workshop specialisation, but also on the high level of technological skills of the ancient glassmakers and their sophisticated empirical understanding of colouring technologies.

### 2.2.2. Middle Eastern (Sasanian) plant-ash glasses (v-Na-Ca SAS)

25 Glass vessels of Middle Eastern production using plant-ash soda are sporadically known in the 1<sup>st</sup> millennium BCE (Schmidt 2019, 136–151). In Parthian contexts of the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE remains of glass vessels are rare and consist predominantly of closed shapes, mainly small bottles, imported and locally produced ones, as well as tableware imported from the Roman eastern Mediterranean<sup>16</sup>. In the Sasanian period (224–651 CE) a sizable production of glass vessels using a plant-ash soda glass is attested from about the mid-3<sup>rd</sup> century CE onwards. Current research indicates that glass production in the Sasanian empire was centred in Mesopotamia rather than in Iran<sup>17</sup>. A number of archaeometric studies were carried out on glass samples, the majority being fragments of vessel glass, excavated at Veh Ardashir,

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16 At Dibba (U.A.E.), a plant-ash glass has been identified used for small bottles from contexts of the 1<sup>st</sup> century CE, Van Ham-Meert – Claeys – Jasim et al. 2019 (local production or Middle Eastern import? Or from a yet unknown production centre?); Schibille 2022, 129–132.

17 For an overview, see Simpson 2014; Simpson 2015; Schibille 2022, 126–135.

the town founded by the first ruler of the Sasanian Empire on the west bank of the Tigris, facing the capital Ctesiphon on the east bank. These glasses are characterised by elevated concentrations of potash and magnesia higher than 2.0 wt.%<sup>18</sup>. Based on the levels of potash and magnesia, concentrations of certain trace elements as well as strontium and neodymium isotopic analyses, finer subdivisions have been made. Glass of the type Sasanian 1 was produced from about the mid-3<sup>rd</sup> century CE onwards for common utilitarian ware. It is further subdivided into Sasanian 1a and Sasanian 1b, the latter subgroup being attested from the 4<sup>th</sup> century CE onwards. Sasanian 2 apparently represents a smaller production of a superior glass for more sophisticated products. It came into use in the course of the 4<sup>th</sup> century CE. The analyses seem to indicate a common geological area for the provenance of the raw materials, but a diversified production of primary glasses with a trend to select purer sources of silica and ash, apparently with the aim to reduce unwanted hues of green or yellowish green caused by iron impurities in the glass and thus achieve a higher output of a nearly colourless glass. Decolourising the glass by intentional addition of antimony or manganese seems not to have been generally practiced (on decolourised glasses, see below 3.3.). For iron oxidation the Sasanian glassmakers rather relied on their skill to control the furnace atmosphere resulting in almost colourless glass only faintly tinted greenish, yellowish, yellowish-green or brownish<sup>19</sup>.

26 Chemical analyses of the three fragments of colourless facet-cut bowls found at Kizil (here nos. 64–66 in Table 1, part 2, and Fig. 14) in the northern Tarim Basin indicate a similarity to Sasanian 2 glass, using a silica source with few impurities, whereas the green fragment of a glass vessel with facet-cut decoration from Duldur-Akhur (no. 70 in Table 1, part 2, and Fig. 15), with its high iron content that is responsible for the greenish colour, should rather be classified into Sasanian 1a or 1b<sup>20</sup>.

27 Unsurprisingly, glass vessels of Sasanian production were apparently also transported along maritime routes starting from the Persian Gulf. Presumably, this applies for those found in southern China in burials of the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE (see below 3.3.1.). A few Sasanian glasses have been identified in southern Arabia<sup>21</sup>. Numerous vessel fragments made of plant-ash soda glass similar to Sasanian glass have been identified at Khlong Thom on the west coast of the Malay Peninsula in southern Thailand (Lankton – Dussubieux 2013, 438–439; see already earlier, Salisbury – Glover 1997, sample 41). A fragmented glass vessel was excavated at Ban Non Wat in the upper Mun Valley (northeast Thailand) from a Late Iron Age context (200–400 CE). Its chemical composition is similar to Sasanian 1 glass (Carter – Lankton 2012, 94 fig. 9:5 C).

### 2.2.3. Bara plant-ash glasses (v-Na-Ca Bara)

28 Another, apparently localised production of plant-ash soda glass has been identified at Bara near Peshawar in Pakistan dated within a period from the 2<sup>nd</sup> century BCE to the 2<sup>nd</sup> century CE. The chemical composition of the glass is characterised by elevated alumina values (Dussubieux – Gratuze 2003; Dussubieux – Gratuze 2013, 400–402). The objects made there were mainly beads, noteworthy is the production of gold-in-glass beads, but also small objects made in the mosaic glass technique. No production of glass vessels is known. Nevertheless, it is interesting to note that beads

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18 Brill 2009, 122; Mirti – Pace – Negro Ponzi et al. 2008; Mirti – Pace – Malandrino et al. 2009; Ganio – Gulmini – Latruwe et al. 2013.

19 Mirti – Pace – Negro Ponzi et al. 2008, 441–442; Mirti – Pace – Malandrino et al. 2009, 1067; very occasionally only, moderate amounts of manganese (below 1 wt.%) have been detected in the analyses that would point to an intentional addition of a manganese-containing ingredient. Abe – Shikaku – Yamamoto et al. 2018, 366 suggest the use of intentionally added manganese in the case of the fragment from the Kamigamo shrine, Kyoto. On the colours, see also Simpson 2014, 206.

20 Abe – Shikaku – Yamamoto et al. 2018, 366. For the analyses of these glasses, see Table 2 nos. 50–52 and 56.

21 Simpson 2014, 227; Keller 2010, 73–74 figs. 2–3 (Late Sasanian glass from Kush, Ras al-Khaimah, U.A.E.).

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made of Bara-type glass have been identified at sites in the Tarim Basin, for example at Niya and Shanpula<sup>22</sup>.

#### 2.2.4. Central Asian plant-ash glasses (v-Na-Ca Central Asia)

29 Over many decades, Abdougani Abdurazakov, one of the pioneers in the field, carried out analyses on Central Asian glass finds from the Bronze Age to the early 2<sup>nd</sup> millennium CE<sup>23</sup>. In the period of interest here, a considerable number of glass vessels and other objects made of plant-ash soda glass has been attributed to a Central Asian origin. Robert Brill distinguished three different “Central Asian” types of plant-ash based soda glasses, characterised by high potash levels (K<sub>2</sub>O about 4 wt.% and above) and varied alumina concentrations, by high alumina (Al<sub>2</sub>O<sub>3</sub> above 5 wt.%) and by moderate alumina levels (Al<sub>2</sub>O<sub>3</sub> between 3–6 wt.%), as well as a fourth type of mixed alkali with high alumina<sup>24</sup>. The basic distinction into these groups, established on the basis of major and minor elements, has been confirmed by trace element analyses and strontium isotope values. More detailed attributions to specific regions of origin may be possible in the future, however, many more analyses of glass objects from well-established and dated contexts are needed, ideally including those of waste from production sites. Recently, for a characterisation of Central Asian plant-ash glasses, Lü Qin-Qin and colleagues proposed a refined set of criteria including high strontium ratios, moderate to high levels of alumina, low cerium/lanthanum ratios, and moderate to low neodymium<sup>25</sup>.

30 Archaeometric studies also provide evidence that Central Asian glasses were transmitted farther east to the Tarim Basin and beyond (Liu – Li – Gan et al. 2012, 2137). Analyses of 103 glass samples from Niya in the Tarim Basin, a site which flourished from the 1<sup>st</sup> century BCE to the 4<sup>th</sup> century CE, revealed for the majority a Central Asian glass composition (Lin Yixian 2010, 208–209). Other important results were achieved by analysing glass vessels from tombs in Gyeongju (Korea), the capital of the Silla kingdom. Two studies by James Lankton and colleagues, published in 2009 and 2010, revealed for six glass vessels from the southern burial of Hwangnam Daechong (early to mid-5<sup>th</sup> century CE) a Central Asian composition, possibly originating from northern Afghanistan<sup>26</sup>. This came as a surprise at the time, since the jug with trefoil mouth from this tomb had often been compared to Syrian glassware and was even thought to be an import from the eastern Mediterranean, an attribution which is now ruled out by its glass composition (Lankton – Gratuze – Kim et al. 2010, 226 fig. 1 no. 1). In a recent study, Yoshinari Abe and colleagues investigated 21 glass vessels from various Silla tombs dating from the late 4<sup>th</sup> to the early 6<sup>th</sup> centuries CE that are now in the Gyeongju National Museum. Only six were made of Roman natron glass, two of these were further examined and revealed two different Late Antique glass compositions,

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22 Lin Yixian 2010, 208–209 fig. 5 (Niya); Liu – Li – Gan et al. 2012, samples XJ-8-2 (Niya), XJ-40-2 (Shanpula), XJ-41 (Hetian); Cheng – Zhang – Guo et al. 2019, sample SC-8 fig. 3 (Shanpula).

23 Abdurazakov 2001; Abdurazakov 2009. On Central Asian glass production, see also Rehren – Osório – Anarbaev 2010; Baypakov 2011.

24 Brill 2009; Brill 2012; some samples, which Brill had formerly assigned to his fourth “Central Asian” group of mixed alkali, have been reassigned by him to the Central Asian group with high K<sub>2</sub>O and high Al<sub>2</sub>O<sub>3</sub>, on the basis of trace element analyses, see Brill 2012, 523 table 3. On these samples from Hasa Tam/Saqal Tam (nos. 75–82, see also below 3.3.3) with high alumina levels, see also Rehren – Osório – Anarbaev 2010, 101 (there very broadly addressed as ‘Sasanian’); the authors cite the chemical composition of these glasses as the closest parallel to the high alumina formulations in glasses from Akhsiket and Kuva in the Ferghana Valley (Uzbekistan) dated to the 10<sup>th</sup> and 11<sup>th</sup> centuries CE, which they consider to “represent a genuinely Central Asian tradition”.

25 Lü – Basafa – Henderson 2023, 12, their criteria <sup>87</sup>Sr/<sup>86</sup>Sr > 0.7087, Al<sub>2</sub>O<sub>3</sub> > 2.5%, Nd > 6 ppm, Cr/La > 5, and TiO<sub>2</sub> > 0.1%.

26 Lankton – Lee – Kim et al. 2009; Lankton – Gratuze – Kim et al. 2010. – For another fragment of streaky amber glass from the Neungsalli Temple in Buyeo, Baekje period, see Koh – Kang – Kim et al. 2012, fig. 1 right (sample NSV-02); mentioned and commented on by Szmoniewski 2018, 161. – See also, Żuchowska – Szmoniewski 2017, 179–180.

whereas for fifteen of them a Central Asian origin of their glasses was confirmed (Abe – Murakushi – Kim 2019).

### 3. Glass vessels

31 It is not intended here to present a thorough discussion of each glass vessel or fragment listed in Table 1, parts 1 and 2 (Fig. 28 and Fig. 29). In many cases data are insufficient, many fragments are of small size and difficult to attribute to a particular shape. Only selected examples will be discussed, preferably those that are chemically analysed and from well-published archaeological contexts or with features sufficiently diagnostic to allow an attribution and dating. Those examples mentioned in the text will be cited by the number given to them in Table 1 where further information and references will be found.

#### 3.1. Techniques of making glass vessels

32 In the Mediterranean model, as pointed out above, the production of primary glass took place in only a limited number of large glassmaking centres, mainly in Egypt and the Syro-Palestinian coast, from where the raw glass was transported to a multitude of secondary workshops all over the Roman Empire, where glass vessels and other glass objects were crafted (for an introduction, see Foy 2018). In these workshops, the chunks of raw glass would then be softened by heat. The hot and viscous glass could then be manipulated in a number of different ways.

33 Before the invention of glassblowing in the mid-1<sup>st</sup> century BCE, glass vessels were formed around a core that was removed after cooling. It was mainly used for small vessels of closed shape holding perfumed oils, cosmetics and other unguents and lasted until the late 1<sup>st</sup> century BCE or even slightly beyond. Open shapes like bowls could be formed by sagging a circular blank of glass over or into a mould. In eastern Mediterranean workshops of the late centuries BCE, this technique developed in a first kind of mass production. It was still applied throughout the 1<sup>st</sup> century CE for the ribbed bowls made by sagging hot and viscous glass over a convex mould and tooling the radiating ribs on its exterior side. Mould-formed glass vessels also include some luxury categories made in the mosaic glass technique (see below 3.2).

34 After its invention, glassblowing developed in the course of the 1<sup>st</sup> century CE into the dominant technique and became a fast, efficient and economic way of making glass vessels. Decorations with molten trailed-on glass threads would have been applied in the same process while the glass vessel was still hot. The finished but still hot glass vessel needs to be annealed, that is a gradual cooling process, to avoid stress in the glass. After cooling, glass vessels could be embellished in a number of ways, for example, by cold-working techniques like grinding and facet-cutting which are found on a number of glass vessels discussed here. A proper annealing was of essential importance for glass vessels intended for grinding or cutting, especially because such ‘blanks’ for facet-cutting often were particularly thick-walled. They would have needed a slow and well-controlled annealing to stand the stress of grinding and cutting. The cold-working would not necessarily have to take place at the same workshop where the glass vessels were fashioned, but could have done in a specialist workshop excelling in this particular craft. It is assumed that such tertiary workshops would have obtained the freshly annealed objects as blanks from the secondary workshops (Whitehouse 2012, 9–14).

35 Similar to the three dates of an archaeological object – date of manufacture, date of arrival at its place of consumption, date of disposal –, for a glass vessel, at least

in the Mediterranean model, three provenances are to be considered: place of making the raw glass, place of manufacturing the object, place of archaeological discovery.

### 3.2. Coloured glass vessels

36 Early Roman glass vessels are often made of strongly coloured glass. Analyses identified oxides of seven metals that are responsible, singly or in combination, for the range of glass colours (for a recent summarising review, see Freestone 2021, 249–251). In the mosaic glass technique, thin rods of such coloured glasses were assembled into composite rods, forming a variety of patterns. For making mosaic glass vessels, cross sections or lengths of such prefabricated composite rods would then be assembled and fused together to form a circular blank, which was then sagged into or over a mould (for the technique, see Stern – Schlick-Nolte 1994, 65–71).

37 An elaborate early Roman ribbed bowl of mosaic glass, tooled to give the marbled appearance of veined natural stone, was recovered in fragments from an Eastern Han tomb near Yangzhou, Jiangsu (here no.1). It is to be regarded as a costly object of high prestige (Borell 2010, 127–128). The tomb is probably that of Liu Jing, King of Guangling, a high-ranking member of the imperial family, who died in 67 CE (Psarras 2015, 8, 9, 21, 143–144).

38 Ribbed bowls are widely distributed in Indian Ocean trade<sup>27</sup>. Shipped from the Red Sea ports Myos Hormos (Quseir al-Qadim) and Berenike they arrived in large numbers on the western coast of India<sup>28</sup>. In the excavation at Pattanam (Kerala, India), more than one hundred fragments of ribbed bowls were recovered, the majority being monochrome but in a variety of different colours, examples made of mosaic glass being rare in comparison (Cherian 2014; Cherian 2015). They are frequently found at settlement sites and burials on the Arabian Peninsula, including one complete example of translucent purple and opaque white mosaic glass from a high status burial at Shakoura (Bahrain)<sup>29</sup>. They are also known from Taxila (Pakistan), Begram (Afghanistan) and Khalchayan (Uzbekistan)<sup>30</sup>. In Mongolia, fragments of two ribbed bowls, one monochrome translucent purple, the other of translucent blue and opaque white mosaic glass were recently discovered in Gol Mod 2 Tomb 1, the principal tomb in the centre of the complex and a burial of the highest aristocratic level dated to the 1<sup>st</sup> century CE<sup>31</sup>.

39 Early Roman glass vessels made by blowing coloured glass are rare in Far Eastern contexts. One is the thin-walled cup of translucent blue glass with copper as colourant (probably Isings Form 29)<sup>32</sup> from another Eastern Han tomb near Yangzhou, dated to about 90 CE (here no. 2). The burial certainly belonged to a person of high rank. The Marquis of Guangling who succeeded the deceased Liu Jing, has been suggested as its occupant (Psarras 2015, 21, 151 (dated around 90 CE)). The other find is a bottle from an Eastern Han burial in Luoyang (here no. 19), its pyriforme shape with inward

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27 The type is Isings Form 3, Isings 1957, 17–21. On their distribution in Indian Ocean trade, see Borell 2024b.

28 Peacock 2011, 61–62 no. 36 fig. 7.3 (Quseir al-Qadim); Kucharczyk, pers. comm. April 2020 (Berenike, blue and white).

29 During Caspers 1980, 14 fig. 6a pls 25–26 (British Museum 1999,1030.1). – A small fragment of purple and white mosaic glass from Seleucia, Negro Ponzi 2002, 76 fig. 2.2. – On finds of glass vessels imported into South Arabia, see Japp 2019, 171–178.

30 Marshall 1951, 688 no. 9 pl. 209. l (Taxila); Menninger 1996, 26 pl. 6.1 = Cambon 2006, 228 no. 171 (colour illustration) (Begram); Pugachenkova 1966, 55–56 fig.32 (Khalchayan).

31 Ėrdėnėbaatar 2015, 179 fig. 5.2, 185 pl. 3.12, fig. 5.4 pl. 3.13; Otani 2017, 67 fig. 23.1–2; Nakamura – Tamura – Warashina et al. 2021, 109 fig. 2 c–e (purple), fig. 2a (blue and white mosaic glass). – On the date of the burial, Brosseder 2015, 261.

32 For the discussion of the shape of this badly damaged glass cup, see Borell 2016, 47–48.

folded rim is characteristic of the 1<sup>st</sup> century CE<sup>33</sup>. Produced in large numbers, such bottles were used to hold perfumed oils, cosmetics or perhaps medicinal substances. Usually being monochrome, the production of those enriched with an additional glass thread of different colour – commonly opaque white – are possibly to be associated with eastern Mediterranean workshops<sup>34</sup>. Most likely, the bottle from Luoyang travelled that far because of its precious contents, for which it merely served as a container albeit an attractive one (Foy 2018, 268, 275–276). Similar examples distributed to eastern destinations are known from burial 6 at Tilia Tepe (Afghanistan) still with the dried-up remains of their contents inside<sup>35</sup>, from Taxila (Pakistan) (Marshall 1951, pl. 210; Luczanits 2009, 348 cat. 275) and Ter (Maharashtra, India) (Stern 1991, 115 fig. 6.4). Another one, still with its stopper, has been discovered at Qaryat al-Faw in southern Arabia (Saudi Arabia)<sup>36</sup>.

40 Remains of at least two Roman glass vessels made of dark blue glass (nos. 9 and 11) were discovered in tombs in the Nanjing area dating from the Eastern Jin.

41 A blown cup, thin-walled and fragile, was discovered in Satellite Burial 30 of Gol Mod 2<sup>37</sup>. It is a so-called *Zarte Rippenschale* (Isings Form 17) dating from the early to mid-1<sup>st</sup> century CE, made of translucent dark blue glass decorated with a spiralling opaque white thread and probably pinched ribs. Next to the main tomb where the remains of two ribbed bowls mentioned above were discovered, this is the most important burial excavated from the complex. The buried person must have been closely connected to the person buried in the main tomb, most likely a concubine. Cups of the type *Zarte Rippenschale* were mainly produced in western workshops in Italy, maybe also elsewhere. They are not very frequently found in the eastern part of the Roman Empire<sup>38</sup>. An opaque white such cup with a spiralling blue thread has been found in southern Arabia<sup>39</sup>.

### 3.3. Colourless glass vessels

42 In the course of the 1<sup>st</sup> century CE, consumers in the Roman world developed a taste for transparent colourless glass vessels<sup>40</sup>. Artists, as well as scientists had become fascinated with the effect of transparent glass. Wall paintings at the Vesuvian sites like Pompeii and Herculaneum, all pre-dating 79 CE, depict transparent colourless glass

33 For the shape, compare Isings 1957, Form 26a; for dating and the variation in shapes, see also Fünfschilling 2015, 405 Form AR 132.

34 From the Red Sea port Quseir al-Qadim comes a very similar example of dark green marvered with opaque white, Meyer 1992, 28–29 cat. 182 (with mention of another one not illustrated); 156–157 pl.9, 182; two more from Quseir al-Qadim, Peacock 2011, 61 fig. 7,34 and 35. – See also, Arveiller-Dulong – Nenna 2005, 185, 200 nos. 560–561.

35 Sarianidi 1985, 47, 205 illustration 147; 259 cat. burial 6 no. 38. The burial is dated to the 1<sup>st</sup> century CE, Hiebert – Cambon 2008, 284.

36 Al-Ghabban – André-Salvini – Demange et al. 2010, 354 no. 197. For one from a burial at Bahrain, see Nenna 1999, 185 cat. 280; for another one from Bahrain, see Andersen 2007, 28 cat. no. 6.9 fig. 28. From ed-Dur, see Whitehouse 2000, 108–109 no. 88 figs 23–34.

37 Erdenebaatar – Iderkhangai – Galbadrakh et al. 2011, 311 fig. 11.1; Eregzen 2011, 186–187. Brosseder 2015, 261–264. On the type of *Zarte Rippenschale* (Isings Form 17), see Stern 2001, 82–83 cat. 24.

38 However, occasionally they occur there, see Stern 2001, 82–83 no. 24. For additional finds from Pergamon, see Rehren – Connolly – Schibille et al. 2015, Suppl. Data illustrations of samples PER 012 and PER 050 (both dark blue with opaque white thread); Schwarzer – Rehren 2021, 168 pl.4–5 nos. 36–37; from Beirut, Reinhardt 2019, 26–27 fig. 7; from Israel, see Gorin-Rosen 2021, 31–32 fig. 2.2.10, with further references; from Palmyra (Syria), see Ployer 2013, 147, 176 no. 68 fig. 124, 195 fig. 141; from Seleucia (Iraq), Negro Ponzi 2002, 79 fig. 2:1.

39 Likely, the example from Qaryat al-Faw might have come to southern Arabia by maritime trade, Al-Ghabban – André-Salvini – Demange et al. 2010, 353 no. 193. A fragment of a 'Zarte Rippenschale' was recovered at the Red Sea port Quseir al-Qadim, Meyer 1992, 17, 140–141 pl. 1,1.

40 Pliny, *Naturalis historiae* XXXVII 198.

vessels with their contents visible through the glass. The painters of these ‘still lifes’ clearly enjoyed playing with the effects of light and transparency<sup>41</sup>.

43 Uncoloured glasses often have a bluish, greenish, or yellowish tint caused by iron oxides present as impurities in the raw ingredients, usually in the sands. In order to get rid of these unwanted hues, ancient glassmakers added ‘decolourants’ containing either antimony or manganese. Antimony and manganese decolourise glass by oxidising the iron. Antimony is not only a stronger decolourant than manganese, but also produces a more brilliant glass<sup>42</sup>. Manganese was used as a decolouriser since about the 2<sup>nd</sup> century BCE. Antimony was frequently used since the mid-1<sup>st</sup> century BCE, though occasionally it occurs already earlier in the 1<sup>st</sup> millennium BCE in colourless glasses. The use of antimony ceased in the early to mid-4<sup>th</sup> century CE, presumably owing to supply problems (Jackson – Paynter 2016; Paynter – Jackson 2019; Freestone 2021, 249–250, 256). Some colourless glass vessels, in particular those of later date of the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE, show in their glass composition the presence of both, antimony and manganese, suggesting the use of recycled glass (Jackson – Paynter 2016, 76, 81–82; Gratuze 2018, 253–255; Freestone 2021, 254–255).

44 Archaeometric studies of colourless Roman glasses dating from the late 1<sup>st</sup> to early 3<sup>rd</sup> centuries CE generally distinguish between two different compositional groups on the basis of minor and trace elements. One group showing great homogeneity is assigned a geographical origin in Egypt; this group is decolourised by antimony and predominantly used for ‘high status’ tableware like cups and plates. The other group is assigned to an origin in Syro-Palestina; glass of this group is decolourised by manganese and was also used for tableware, but to a larger extent for ‘lower status’ glassware such as bottles<sup>43</sup>.

45 Corrosion often impairs the appearance of archaeological finds of transparent colourless glass. Its original brilliance is preserved under exceptional depositional conditions only, for example, the spectacular large dish with facet-cut decoration recovered together with two small plates from the Cave of the Letters at Ein Gedi (Israel) pre-dating 135 CE<sup>44</sup>.

### 3.3.1. Colourless glass vessels with facet-cutting

46 Colourless glass vessels, predominantly tableware, were further embellished by cold-working techniques like the cutting of multiple facets using the play of light to achieve special effects<sup>45</sup>. Roman facet-cut glass vessels had a first flourishing in the last third of the 1<sup>st</sup> and early 2<sup>nd</sup> centuries CE. Vessels with close-set facets that frequently overlap creating diamond or hexagon shapes are well-known from the Begram hoard, whereas at other sites they often survived in small fragments only (Foy – Labaune-Jean – Leblond et al. 2018, vol. 2, 13–27). Their blanks were either mould-formed or blown. High-quality transparent glass decolourised by antimony was favoured for the manufacture of such facet-cut glass vessels<sup>46</sup>. Given an Egyptian primary production of

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41 See, for example, Beretta – Di Pasquale 2004, 89–93 figs. 2–4; 177, 253, 328–329. Tatton-Brown 2012, 64 fig. 76.

42 It also acts as a fining agent in glass by removing dissolved gases, Jackson 2005, 764.

43 Silvestri – Molin – Salviulo 2008; Gliozzo 2017; Gratuze 2018; Barford – Freestone – Lichtenberger et al. 2018, esp. 631–632; Barford – Freestone – Leshner et al. 2020. – For a brief summary, see Schibille 2022, 32–36. – However, for production of both antimony-decolourised and manganese-decolourised glass in the Wadi Natrun, see Picon – Thirion-Merle – Vichy 2008.

44 Now in the Israel Museum, Jerusalem. Yadin 1963, 105–110 pl. 29–30; for colour illustrations, see <https://www.imj.org.il/en/collections/198094?itemNum=198094> (accessed 7 February 2022); Barber – Jagendorf 2005, 250.

45 On cut glasses produced in Roman Egypt from the 1<sup>st</sup> to 5<sup>th</sup> century CE, see Nenna 2003; Nenna 2012.

46 For chemical analyses of faceted colourless glasses from the Begram hoard that are antimony-decolourised, see Brill 1999, samples 6203, 6204, 6208 vol. 1, 71, vol. 2, 123. Dussubieux – Gratuze 2001, sample BEGBT3. Dussubieux – Gratuze 2003, 318, 320 sample Begram 3.



Fig. 1: Rim fragment of facet-cut cup from Loulan 80LBC: 180A (no. 34), estimated H of fragment c. 7.0 cm.

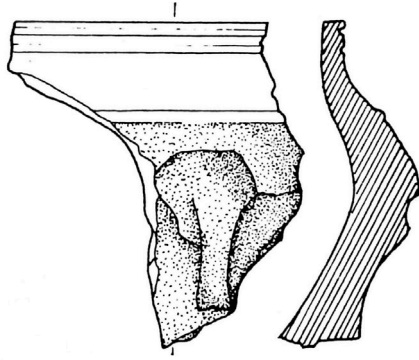


Fig. 2: Paris, Musée Guimet 21425. Roman facet-cut glass cup from Begram, H 8 cm.

such antimony-decoloured glass, it is plausible that some secondary workshops making such luxury tableware for elite consumers would also be operating in Egypt (Nenna 2003; Nenna 2012).

<sup>47</sup> The thick-walled cup fragment from the ruins of Loulan (no. 34 and Fig. 1)<sup>47</sup>, made of Roman natron glass, apparently belongs to this early group dating from the late 1<sup>st</sup> to early 2<sup>nd</sup> century CE. Its shape closely compares to the ovoid and globular facet-cut cups with an overall pattern of overlapping facets that are well represented in the Begram hoard (Fig. 2)<sup>48</sup>. Its chemical analysis likewise indicates an antimony-decoloured glass. Another close parallel, in particular for the rim zone, is an ovoid jar found in Nijmwegen (Netherlands)<sup>49</sup>.

<sup>48</sup> Another fragment from Loulan (no. 35) also seems to belong to this early group of Roman facet-cut glass<sup>50</sup>. It might stem from the wall of a tall conical cup or beaker, as they are also attested in the Begram hoard<sup>51</sup>.

<sup>49</sup> In the later 2<sup>nd</sup> and 3<sup>rd</sup> centuries CE, facet-cut glass vessels became widely popular and were obviously made in a number of workshops in the eastern and western provinces of the Roman empire. Based on their distribution, various production areas have been suggested, in the Rhineland presumably centred around Cologne, in Egypt, in Syria, and outside the Roman empire in the Bosporan kingdom in the region of the northern Black Sea littoral<sup>52</sup>. Characteristic are horizontal zones with equally spaced facets of circular or oval shape including the so-called rice-grain facets of narrow oval shape. In the course of the 3<sup>rd</sup> century the designs with oval and circular or rice-grain facets were further embellished by the addition of engraved strokes and other elements

<sup>47</sup> It was collected in 1980, apparently near a small stupa, by Chinese archaeologists during investigations and excavations carried out in the vicinity of Stein's Loulan Site L. A. (also called 'Loulan Station'), Xinjiang 1988, 17–18 figs. 71.1 and 81. Site L. A. is assumed to be the ancient Loulan known from the sources as the capital of the Shanshan kingdom. For help with understanding the report of the 1980 investigation and fruitful discussion, I thank Armin Selbitschka, pers. comm. July 2023.

<sup>48</sup> See also Żuchowska – Szmoniewski 2017, 166; Foy – Labaune-Jean – Leblond et al. 2018, vol. 2, 26–27 (forms IN 18–19). For those from Begram, see Delacour 1993, 59–60, in particular MG 21425; Morris 2021, 213–214 type C globular bowls, and esp. 209, 404–405 on the Loulan fragment.

<sup>49</sup> For the cup from Nijmwegen, see Oliver 1984, 42 fig. 15.

<sup>50</sup> See already Taniichi 1990, 316 fig. 1; An 2002, 62; Weinberg – Stern 2009, 52.

<sup>51</sup> Foy – Labaune-Jean – Leblond et al. 2018, vol. 2, 19–20 (form IN 11); see also Oliver 1984; for the Begram hoard see Delacour 1993, 56–59; Morris 2021, 215–216 Hamelin type G. For other similar beaker fragments found in the eastern Mediterranean region, see Jackson-Tal 2016, 82–83 fig. 7.2 (from Obada, Israel).

<sup>52</sup> Stern 2001, 24–25, 137; Von Saldern 2004, 368–379; Arveiller-Dulong – Nenna 2005, 357, 451; Weinberg – Stern 2009, 94–95.

creating more complex geometrical designs (Weinberg – Stern 2009, 94; Foy – Labaune-Jean – Leblond et al. 2018, vol. 2, 107–109, 119).

50 Examples of this new style with rice-grain facets are the thin-walled hemispherical cups or bowls found in Eastern Jin burials in Jiangsu (Borell 2016, 52–55). An almost complete example is the bowl from Xianheguan Tomb 6 (no. 7 and Fig. 3). So far, its glass has not been chemically analysed, but a closely similar cup recovered in fragments from the burial at Nanjing University (no. 8 and Fig. 4) revealed an antimony-decolourised Roman natron glass, whereas another fragmented colourless cup from the Great Tomb at Mufushan (no. 10 and Fig. 5) is made of manganese-decolourised glass. Bowls of very similar shape and decoration were found in Egypt, at Karanis and Medinet Madi in the Fayum, the latter dated to the second half of the 2<sup>nd</sup> century CE, suggesting a possible Egyptian manufacture of such bowls<sup>53</sup>. Another bowl of similar shape with rice-grain facets was recovered in excavations at Zeugma in Roman Syria pre-dating 253 CE (Grossmann 2013, 231 G 36 fig. 35).

51 The thick-walled fragment decorated with spaced circular facets (no. 33 and Fig. 6) was collected by Aurel Stein from the stupa at Loulan Site L. B.<sup>54</sup> It is made of antimony-decolourised Roman natron glass<sup>55</sup>. Although the orientation of the fragment cannot be determined with certainty, its thickness and the size of its facets measuring 2.5 cm in diameter – another one possibly up to 2.9 cm – suggest a large dish or bowl. Such large bowls were found in Egypt – though usually fragments only – and are dated to the second half of the 2<sup>nd</sup> and the 3<sup>rd</sup> centuries CE<sup>56</sup>.

### 3.3.1.1. *The case of the two beakers from Xiangshan Tomb 7, Nanjing*

52 Excavated in 1972, the Tomb 7 at Xiangshan of the Eastern Jin period is situated within the cemetery area of the Wang family of Langye. Three persons had been laid to rest in the tomb chamber, the male occupant being in the centre. One of the two glass beakers (nos. 5–6 and Fig. 7 and Fig. 8) was found in the man's coffin in the centre, the other in the wife's coffin to his right, in both cases apparently placed in the coffin's head compartment. Although no epitaph tablet has been found, the tomb is believed to be that of Wang Yi who died in 322 CE, because of its wealth and grandeur pointing to a high-ranking member of the family, and because of the burial's date in the early Eastern Jin period suggested by its ceramic assemblage<sup>57</sup>.

53 The two beakers are similar in shape and decoration, the main decor being a zone with seven large oval facets, framed above and below by a row of small oval facets between incised horizontal lines, and a large circular facet at the bottom. As yet, neither of the two beakers from Xiangshan has been chemically analysed, at least no published analysis came to my knowledge<sup>58</sup>. Generally, the two glass beakers are thought to be

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53 Harden 1936, 120 no. 317 pl. XIV (Karanis); Silvano 2009, 223–224 fig. 3–3 (Medinet Madi).

54 On Stein's numbering system preceded by two zeros, here L. B. 0015, see Stein 1921, xv footnote 16.

55 The glass has been analysed by Robert Brill at the Corning Museum of Glass Laboratories, his sample 8501, Brill 2009; and in 2002 at the British Museum Laboratories by Ian Freestone, pers. comm. Sept. 2022. See Table 2, part 2 (Fig. 32), analyses no. 18 and no. 19.

56 See for example, Harden 1936, 120 no. 316 pl. XIV (from Karanis, Egypt); Bailey 2007, 240 no. 37 fig. 8.3 (from Mons Porphyrites, Egypt); Brun 2011, 218 no. 46 fig. 264 (from Didymoi, Eastern Desert, from a context dated to the second quarter of the 3<sup>rd</sup> century CE). – See also, Arveiller-Dulong – Nenna 2005, 370 no. 977 pl. 78 (with a provenance from Syria, but possibly of Egyptian production); Foy – Labaune-Jean – Leblond et al. 2018, vol. 2, 107–108.

57 See excavation report, Nanjing 1972. For the discussion, see also Kieser 2002, 91–93, 110–115; Kieser 2011, 68.

58 Confusingly, in some publications, the chemical analyses of the fragments from the Great Tomb at Mufushan (here nos. 10 and 11, the analyses no. 5 and no. 7 in Table 2, part 1 (Fig. 30)) have erroneously been assigned to Xiangshan Tomb 7, for example, in Li – Luo 2006, 33 table 1; and in Wang 2011, 59 table 2; Wang 2015, 428 table 2. A similar misunderstanding appears in Żuchowska and Szmoniewski 2017, 167; the analysis, cited in Gan 2009, 93 table 2.8, erroneously ascribed to the beaker from Xiangshan Tomb 7, is in fact that of the colourless vessel fragments from the Great Tomb at Mufushan (see above). Possibly, the phrasing in the

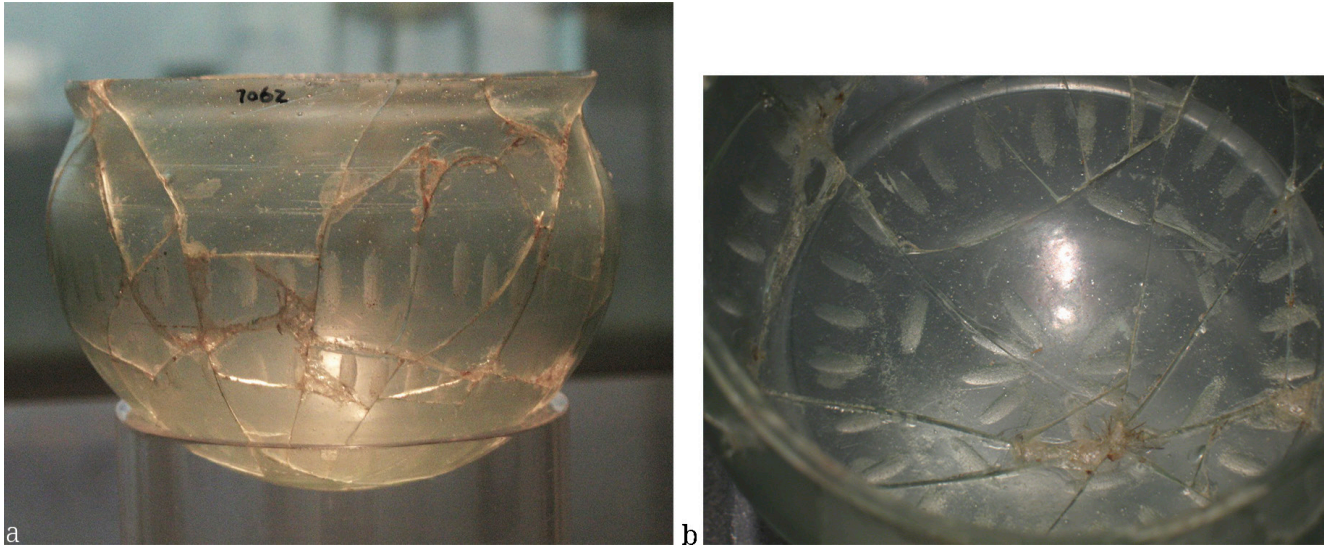


Fig. 3: Nanjing, Nanjing Municipal Museum. Glass bowl with facet-cutting from Xianheguan Tomb 6, Nanjing (no. 7), H 7 cm, D rim 7 cm.

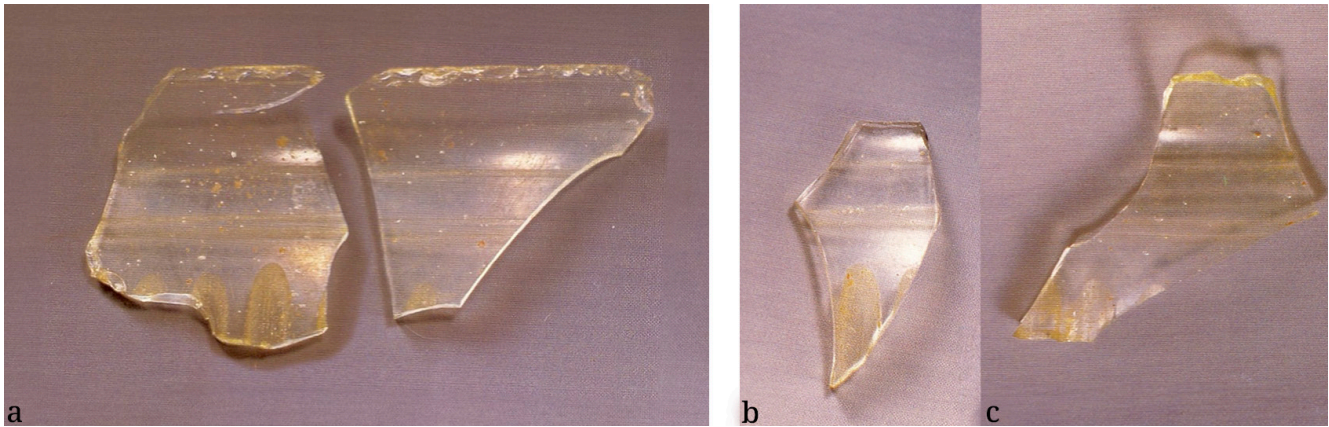


Fig. 4: Fragments of glass bowl with facet-cutting from Tomb at Nanjing University (no. 8).



Fig. 5: Rim fragment of glass bowl with facet-cutting from Great Tomb at Mufushan; Nanjing (no. 10), 5.5 x 3.0 cm.



Fig. 6: London, British Museum MAS 697 (Aurel Stein collection). Fragment with cut facets from Loulan Site L. B. (no. 33), 4.9 x 3.3 cm.



Fig. 7: Nanjing, Nanjing Municipal Museum. Two beakers M7:31 and M7:23 from Xiangshan Tomb 7, Nanjing (nos. 5 and 6). H 10.4 cm. D rim 0.4 cm.



Fig. 8: Detail of beaker M7:23 from Xiangshan Tomb 7 (no. 5).



Fig. 9: London, British Museum EA 77396, Reg.no. 1894,0924.30. Fragment of glass beaker. From Koptos (Egypt). 6.5 cm x 4.9 cm.



Fig. 10: London, British Museum MAS 576 (Aurel Stein collection). From Endere, E. Ft. 0011. (no. 53). Height of fragment 4.6 cm, estimated D c. 7.6 cm.

products of a Roman workshop presumably located in the eastern part of the empire (An 1984, 415–416 pl. 3,5; An 2002, 48–49 fig. 8; Żuchowska – Szmoniewski 2017, 167 fig. 3). Such beakers with almost straight walls, sometimes with a slightly everted rim, and elaborate facet-cut decoration find parallels in Roman glass tableware from the 2<sup>nd</sup> to early 4<sup>th</sup> centuries<sup>59</sup>. A very similar cut decoration is found on a beaker fragment from Koptos in Egypt showing a row of large ovals above a row with small oval facets (Fig. 9). Between the large ovals an additional motif is incised consisting of a vertical stroke with an oval facet at its top end and a small horizontal facet below. This motif resembles

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English translation of An 2002, 62, discussing some fragments from Xinjiang and comparing them to the beaker from Xiangshan Tomb 7, might have been misunderstood as if the beaker from Xiangshan had been analysed; however, An 2002, 49, explicitly states that it had never been tested for chemical composition.

59 For those from Dura Europos, all pre-dating 256 CE, see Clairmont 1963, 63–66 Groups b and c, esp. no. 248 pls VII and XXV. – A close parallel for the shape is the beaker from Pécs with cut decoration including an inscription in Greek, Barkóczy 1988, no. 186 pl. XV, which is probably to be dated to the late 3<sup>rd</sup> to 4<sup>th</sup> centuries CE, see Fünfschilling 2015, vol. 1, 88 fig. 106,4; Foy – Labaune-jean – Leblond et al. 2018 vol. 2, 109, no. 4 (mid 3<sup>rd</sup> to early 4<sup>th</sup> centuries CE).

the so-called ‘Roman numeral I’ motif, a characteristic motif on Roman faceted glass of the later 3<sup>rd</sup> and 4<sup>th</sup> centuries CE<sup>60</sup>. Seemingly, such a motif was also engraved on the Xiangshan beakers (Fig. 8).

54 A similar scheme of cut decoration appears on a fragment from Endere in Xinjiang (no. 53 and Fig. 10) made of antimony-decoloured Roman natron glass<sup>61</sup>. The fragment, probably from a beaker, preserves remains of a row of small oval facets, a narrow band with vertical strokes, and a zone of large oval facets with short oblique strokes above each oval. This latter detail recalls the arcaded facets of oval or circular shape, a motif commonly found in the Roman facet-cut designs that developed into more complicated geometrical designs in the course of the 3<sup>rd</sup> century CE<sup>62</sup>.

55 An Jiayao compared the two vessels from Xiangshan tomb 7 to a colourless beaker in the British Museum, similar in shape and facet-cut decoration<sup>63</sup>. This beaker was acquired in 1966 from the art-market and others attributed it to Sasanian glassware because of its reported provenance from the Amlash region in Gilan province (Iran) (Barnett – Curtis 1973, 128 pl. LX b; Simpson 2015, 83 fig. 6 (early Sasanian)). The glass composition of this beaker has not yet been tested, however, its cut decoration would be very similar to Roman glassware<sup>64</sup>.

### 3.3.1.2. *The case of the three facet-cut cups from Yingpan and Zhagunluke*

56 Three colourless glass cups decorated with rows of oval and circular facets (nos. 31–32 and 52, Fig. 11 and Fig. 13) were excavated at archaeological sites in the Tarim Basin, two at Yingpan and a third at Zhagunluke.

57 One of the Yingpan cups (no. 32 and Fig. 13) was excavated by Aurel Stein in 1915 from a man’s burial<sup>65</sup>. In Stein’s publication of 1928 it is said to have been “found intact”, however, in the catalogue entry it is described as “complete, but broken and now mended” and is illustrated in its reassembled state<sup>66</sup>. At present, in the National Museum of India, New Delhi, merely the large rim fragment (Fig. 13) has been identified, which obviously came apart from the old mending<sup>67</sup>. Stein had avoided a narrow dating for the Yingpan burials excavated by him, although he seems not to exclude a date similar to the flourishing of the Loulan sites predating the mid-4<sup>th</sup> century CE<sup>68</sup>. In 1939, Folke

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60 Weinberg – Stern 2009, 96. For this particular design, cf. Fremersdorf 1967, pls. 61, 62, 82, 107 (all found in the area of Cologne); see also Rütli 1991, 69 cat. 1336 pls. 60 and 190 (from Augusta Raurica, Switzerland).

61 It has been analysed by Robert Brill at the laboratory of The Corning Museum of Glass after April 2000, see Brill 2009, 146 (CMG sample 8500); as well as by Ian Freestone at the laboratories of the British Museum, Department of Scientific Research, in 2002, see unpublished report dated 11 October 2002, Freestone, pers. comm. Sept. 2022 (both analyses here in Table 2, part 2 (Fig. 34), analyses nos. 36–37).

62 Fünfschilling 2015, vol. 1, 88 fig. 106,1; 310; vol. 2, 482 cat. 1187 pl. 22; Foy – Labaune-Jean – Leblond et al. 2018, vol. 2, 109 esp. nos. 1, 4 and 6.

63 The beaker is mentioned in An’s catalogue entry for the Xiangshan T. 7 cups, in Watt 2004, 210–211 cat. no. 116. – It is the beaker British Museum 134885 = Reg. 1966,1212.1; [https://www.britishmuseum.org/collection/object/W\\_1966-1212-1](https://www.britishmuseum.org/collection/object/W_1966-1212-1).

64 Interestingly, related designs also appear on two other beakers likewise reported to come from northern Iran, see Fremersdorf 1967, 137–138 pls. 165–166. – See below on the problems distinguishing between Roman and Sasanian glassware (3.3.2.)

65 Burial Yingpan III. 3, see Stein 1928, 756; 760–761 pl. CX. – Erroneously, this glass beaker is sometimes referred to as found by Stein at Loulan Site L. K., see discussion in Selbitschka 2010, 52–56. Zhao 2014, 79 fig. 2.1 and 2.2 mistakes it for two different but very similar beakers, one erroneously from site L. K., the other from Yingpan.

66 The mending was presumably done in 1924, when specimens from the collection selected for illustrations were temporarily taken to London to the British Museum. According to the agreement, they were subsequently returned to the Government of India for the Central Asian Antiquities Museum in New Delhi, and the collection is now kept in the National Museum of India in New Delhi. See, Stein 1928, xv; Andrews 1935, 317 Ying. III. 3. 06.

67 My thanks for the photograph and additional information go to the curators Yogesh Mallinathpur and Nazia Kamal, National Museum of India, New Delhi, as well as to Alok Kanungo for his assistance in this matter.

68 Stein 1928, 756–757. For a review of the suggested dates for the Yingpan burials, from the end of the 1<sup>st</sup> century BCE to the first quarter of the 5<sup>th</sup> century CE based, in particular, on burials excavated in the 1990s, see Selbitschka 2010, 52–56.



Fig. 11: Glass cup M9:1 from Yingpan Tomb 95BYM9 (no. 31). H 8.8 cm. D rim 10.8 cm.

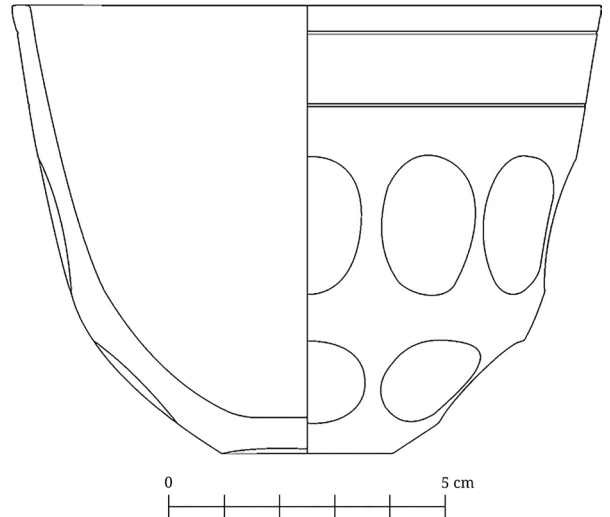


Fig. 12: Glass cup from Palmyra, inv. PA99G02. H 8.1 cm, D rim 10.6 cm.



Fig. 13: New Delhi, National Museum of India, acc. no. 2002/3/533 (formerly Central Asian Antiquities Museum, New Delhi). Rim fragment of beaker from Yingpan Ying. III. 3. 06 from Tomb Ying. III. 3 (no. 32), excavated by Aurel Stein. D rim 6.8 cm.

Bergman briefly commented on this tumbler and suggested an origin from Roman Syria<sup>69</sup>.

58 The other two cups (nos. 31 and 52, Fig. 11) come from burials excavated by Chinese archaeologists in 1995, Yingpan tomb 9, and in 1996, Zhagunluke tomb 49. Yingpan tomb 9 is the burial of man and wife, the glass cup placed close to the man's head. The sites have been dated within wide time frames. For the Yingpan burials a time span equivalent to the Han to Jin periods has been suggested. The Zhagunluke burial M49 has been assigned to the 'Third-period-culture' of the site covering the 3<sup>rd</sup> to 6<sup>th</sup> centuries CE. However, for the two burials in question, a narrower time frame

69 Bergman 1939, 181. – Similarly also Żuchowska – Szmoniewski 2017, 164–166.

corresponding to the Eastern Jin period has been suggested<sup>70</sup>, and either a Roman or Sasanian origin has been proposed for the glass cups in the past. The latter is now ruled out on the basis of the chemical composition of the glasses that are characteristic of Roman natron glass of the 1<sup>st</sup> to 3<sup>rd</sup> centuries CE. The glass of the cup from Yingpan tomb 9 is an antimony-decolourised glass, likely pointing to an Egyptian origin<sup>71</sup>, the one from Zhagunluke tomb 49 is made of a glass assigned a Syro-Palestinian origin and manganese-decolourised (Cheng – Wang – Guo 2011; Cheng – Guo – Wang et al. 2016, 198–200).

59 The cup from Yingpan tomb 9 (no. 31 and Fig. 11) finds close parallels in eastern Roman glassware. Its almost tronco-conical shape widening towards the rim and strongly tapering in its lower part towards the base, as well as its cut decoration of two rows of single facets, oval in the upper and circular in the lower row, are almost identical in shape, size, and decoration to a cup from Palmyra (Fig. 12), excavated from a context dated to the mid-3<sup>rd</sup> century CE (Ployer 2013, 158–159, 182 no. 194 fig. 129, 200 fig. 146). Closely resembling glass cups were found at Dura Europos, predating the Sasanian conquest of 256 CE<sup>72</sup>. Fragments of facet-cut glass cups of various shapes are known from other sites in the region pre-dating the mid-3<sup>rd</sup> century CE when these sites fell to Sasanian attacks and were destroyed<sup>73</sup>. Interestingly, a glass cup similar in shape and decoration has been excavated from a burial at Shimam in Gilan province<sup>74</sup>. The tomb has been dated to the late Parthian period therefore implying a date before the second quarter of the 3<sup>rd</sup> century CE. The glass cup may be one of the imports of Roman glassware discussed below (3.3.2).

60 The parallels from dated contexts point to a 3<sup>rd</sup> century CE date for the cup from Yingpan tomb 9, and similar dates and a provenance from workshops in the eastern provinces of the Roman empire might also apply for the Zhagunluke cup and the old find from Yingpan of 1915<sup>75</sup>.

### 3.3.2. Sasanian or not Sasanian

61 With the finds of facet-cut glass vessels in the East, in particular those with circular and oval facets, scholars are confronted with the challenge of “distinguishing between what is and what is not Sasanian” (Whitehouse 2005, 10), generally amounting

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70 For brief overviews, see An 2002, 62–63; Selbitschka 2010, 55, 135–138; Wang – Lu 2009; Wang – Wang – Happer et al. 2016, 69–71, 83, 333; Lin Yixian 2017; An 2021, 338–339.

71 A small fragment of Yingpan cup M9:1 had been passed on to Robert Brill for chemical analysis; it is published as CMG sample 7015, see Brill 1999; Brill 2009; see also, An 2002, 63 footnote 59 (with preliminary data). For verifying the identity of sample 7015 with Yingpan cup M9:1, I am greatly indebted to Katherine Larson, pers. comm. July 2022, researching this for me in the documentation at the Corning Museum of Glass, as well as to An Jiayao, pers. comm. July 2022, for confirming it.

72 Clairmont 1963, 68–70 fig. 4 (group e); for the chemical analysis of one glass fragment of this group, no. 262, see 6 table 2 indicating a natron glass.

73 For example, in northern Iraq, the Roman frontier post (Zaguræ?) at Ain Sinu, probably predating 237 CE, Oates – Oates 1959, 236 no. 9, pl. LV,16 and LIX,9; and Hatra, predating 241 CE, Dorna Metzger 2000, 254–255 figs. 4–7.

74 Fukai 1977, 29 and 41 figs. 14–15; Simpson 2015, 86. – Similar other cups reportedly from Gilan and acquired from the art market, for example Fukai 1977, 40 fig. 31, pl. 7, might explain why the Yingpan cup M9:1 was assigned a Persian origin.

75 In her well-researched study, Lin Yixian (Lin Yixian 2017), clearly saw the relation of these three cups to Roman-style glassware for which she proposed a date between the mid-3<sup>rd</sup> and mid-4<sup>th</sup> centuries CE and a provenance from the northern Black Sea region. She compared them to the numerous facet-cut beakers found along trade routes in the vast region between the Baltic and the Black Sea, mainly dating to the 4<sup>th</sup> and early 5<sup>th</sup> centuries CE. In particular, she compared them with the earliest group of small wide-mouthed glass cups, type Varpelev A or Sakrau II A named after their find places in northern and eastern Europe (see Von Saldern 2004, 375–385; Grane 2013, 41–42 fig. 7). For the facet-cut beakers found in the area of the Chernyakhov Culture north of the Black Sea recent analyses revealed mainly Late Antique glass compositions, see Rummyantseva – Belikov 2017; Rummyantseva – Lyubitchev – Petrauskas et al. 2021. However, the parallels from the eastern provinces of the Roman empire seem to be more convincing and are also supported by the compositional analysis of the glasses.

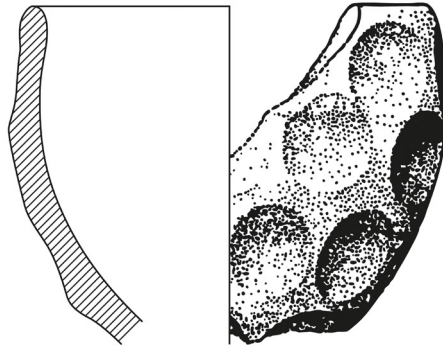


Fig. 14: a–b: Berlin, Museum für Asiatische Kunst inv. III 7101 (Albert von Le Coq collection). Rim fragment of a facet-cut bowl from Kizil (no. 64). D rim c. 10 cm. Photo B. Borell. Drawing A. Seidel after Brill 2009 fig. 3.3



Fig. 16: London, British Museum 1928, 1022.10 (Aurel Stein collection). Rim fragment from Loulan Site L. K. (no. 44), 2.6 x 2.9 cm.

Fig. 15: Paris, Musée Guimet 23736 (Paul Pelliot collection P. 595d). Facet-cut fragment of bowl from Duldur-Akhur, Kucha (no. 70). 3.7 x 2.1 cm.

to the question whether they are imports from regions of the Roman empire or from the Sasanian empire (Meredith-Goymour 2006). In the Sasanian period (225–651 CE), a production of facet-cut glass vessels flourished, apparently beginning in the 4<sup>th</sup> century CE and reaching its perfection in the Late Sasanian thick-walled hemispherical bowls with deep-cut facets that sometimes overlap forming hexagons in a honeycomb pattern (Simpson 2014, 214; Simpson 2015). Bowls of this type are distinctly and uniquely Sasanian, probably the most famous example is the perfectly preserved bowl in the Shōsō-in at Nara (Japan)<sup>76</sup>. Fragments of bowls of this shape and decoration have been discovered in the region of Kucha in the northern Tarim Basin, at Kizil, Hiçar, and Duldur-Akhur (nos. 64–65, 69–70 and Fig. 14 and Fig. 15). Two other rim fragments, one from Kizil and one from Kumtura (here nos. 66–67), appear to be from shallow bowls with cut facets on the exterior, a less common type in Sasanian glassware<sup>77</sup>. As

76 For the type, see Whitehouse 2005, 42–44 nos. 46–48 with further references. Simpson 2014, 214 figs. 20.24, 20.25.2–16, 20.26.

77 For shallow Sasanian bowls, cf. Simpson 2014, 214, 224 fig. 20.25.17. Simpson 2015, 93 fig. 15.15. See also the shallow bowl from the burial of Wang Shiliang and his wife at Xianyang (Shaanxi), dated to 583 CE, Watt 2004, 258–259 cat.no. 159.

far as tested the chemical composition of their glasses indicates the use of plant-ash soda and thus confirms their Sasanian origin, their glass composition being similar to Sasanian 2 glass (nos. 64–66) and Sasanian 1a or 1b (no. 70) respectively (see above 2.2.2). Currently suggested dates for these types of Late Sasanian glass vessels are the 6<sup>th</sup> and early 7<sup>th</sup> centuries CE, rather than the 4<sup>th</sup> and 5<sup>th</sup> centuries CE that have previously been proposed.

62 Exceptional is the faceted fragment (no. 44 and Fig. 16) found in the vicinity of the ruined fort at Loulan Site L.K. On the evidence of the coins and other finds, Aurel Stein dated the site to approximately the same period as Site L. A., that is the third and early 4<sup>th</sup> centuries CE, not extending much beyond the first 30 years of the 4<sup>th</sup> century (Stein 1928, 188–189). Generally, the heyday of Loulan is thought to have ended with the fourth century CE (see below 4.2.). The thin-walled fragment has rather straight sides slightly tapering towards the rim, possibly similar to the cup from Yingpan tomb 9 (no. 31 and Fig. 11). Unusual is the use of a translucent purple glass for facet-cutting and also the arrangement of the facets overlapping horizontally like fish scales<sup>78</sup>.

63 The analysis of Brill's sample 8502, believed to represent this fragment, clearly indicates a plant-ash soda glass<sup>79</sup>. Brill had assigned it to his broad Sasanian/Islamic category. Very few cases of purple-coloured Sasanian glass with MnO levels above 1 wt% are known<sup>80</sup>. In addition, its elevated levels for magnesia and potash are lower than those characteristic for Sasanian glasses, whereas its soda content is very high<sup>81</sup>. However, more traditions of plant-ash soda glasses have recently come into focus dating from the Hellenistic and Roman periods, for example, plant-ash soda glass produced in Egypt (see above 2.2.1) (See also Phelps 2017, 333–343). On the basis of the data presently available, it is not possible to arrive at a conclusive assessment.

64 Early Sasanian glass vessels of the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE rarely seem to have been decorated with facet-cutting. Characteristic types are bowls or cups with applied and pinched-out decorations like the glass cups from two tombs of the Western Jin period (265–316 CE) in Pizhou (Jiangsu) and Beijing (Hebei) (nos. 3 and 24) decorated with a horizontal row of applied prunts – in the case of the cup from Pizhou with an additional row of vertical ribs below – and, on the base, tiny spurs are pinched out as feet arranged in a circle. Such shapes are well attested for the early Sasanian period and known from archaeological contexts dated to the 3<sup>rd</sup> century CE, probably lasting into the 4<sup>th</sup> century CE<sup>82</sup>.

65 The thin-walled glass fragments recovered from the Western Jin tomb at Wulidun, Echeng (Hubei) (nos. 22–23 Fig. 17) have been allocated to two individual, but very similar bowls of globular shape with everted rims, differing only in their maximum diameters, and decorated with rows of spaced shallow-cut roundels. Chemical analysis of the glass composition as well as the shape indicate Sasanian production. Close parallels

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78 Purple glass was used for the cups Varpelev A and Sakrau II, see Von Saldern 2004, 376–377 fig. 51a and pl. 318. – Facets arranged in a 'fish scale' pattern appear on a Sasanian goblet in the Corning Museum of Glass, Whitehouse 2005, 49 cat. no. 57 (there described as a honeycomb pattern).

79 Brill 2009, 146; Brill – Stapleton 2012, 77. It is the only fragment that lacks an inventory number of any kind in Brill's list of samples from the Stein collection in the British Museum. However, there is only one purple fragment in the British Museum's Stein collection, namely the one from Loulan site L. K. 060 already published and illustrated by Stein (Stein 1928, 190 pl. XXIV), now with the British Museum registration number 1928.1022.10. It matches Brill's brief description and, in all likelihood, it is the fragment analysed by him. This is further confirmed by comparing the old illustration published in 1928 with the present state of the fragment showing a slightly different extension along one of the breaks, where apparently the small sample had been taken off for analysis. For their kind help and information in identifying the parent fragment of Brill's sample 8502, I thank Helen Wang, Andrew Meeks and Ian Freestone.

80 Mirti – Pace – Negro Ponzi et al. 2008, 441–442, esp. sample SE07; Mirti – Pace – Malandrino et al. 2009, 1063 samples VA53 and VA63; but see Negro Ponzi 2005, 144.

81 For a concise overview, see Schibille 2022, 127 table 6.

82 Whitehouse 2005, 25–26 nos. 11–13 with further references. Simpson 2014, 206 figs. 20.11,2–3 and 20.12. Compare also finds from Bahrain, Andersen 2007, 78–82. Simpson 2023, 72.

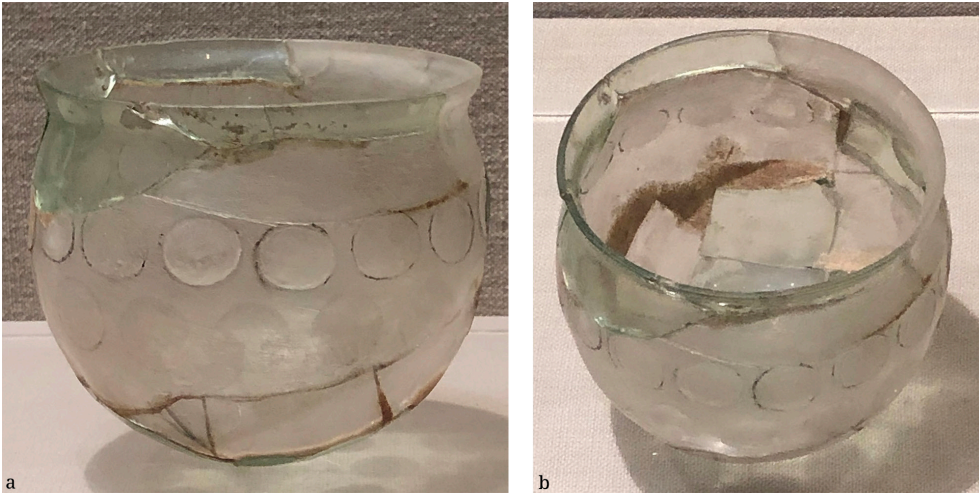


Fig. 17: Echeng, Echeng Municipal Museum. Glass cup from Wulidun Tomb 4021, Echeng (no. 22). H 9.4 cm, D rim 10.2 cm.

have been excavated in Mesopotamia, at Tell Mahuz and at Veh Ardashir, at the latter place from levels assigned to the second half of the 4<sup>th</sup> century CE<sup>83</sup>. Excavated already in 1978, a published report of the Wulidun tomb is lacking. Accepting its attribution to the Western Jin period (265–316 CE), this would suggest a date for the two bowls not later than the early 4<sup>th</sup> century CE, which would make them the earliest facet-cut Sasanian glass bowls from a dated context<sup>84</sup>.

66 In other cases it is not so easy to come to a decision based alone on typological and stylistic features. Often, merely fragments are preserved, making it difficult to assign them to either Roman or Sasanian production as the facet-cut surfaces of both can look very similar. And indeed, the technique as well as some shapes, in particular those for tableware like cups or beakers for drinking were derived from eastern Mediterranean forms. The majority of glass vessel fragments analysed from the Parthian layers of Seleucia as well as some from Sasanian Veh Ardashir – including a few colourless facet-cut examples – turned out to be made of Roman natron glass indicating import of glass vessels from the Roman empire, probably from its eastern provinces<sup>85</sup>. Apart from typological parallels and other morphological features, the chemical composition of the glass provides an additional and decisive argument to distinguish between Roman and Sasanian production. In this respect, it would be most interesting to learn something about the chemical composition of the thin-walled facet-cut bowl with everted rim from Jurong (no. 16) made of colourless glass that survived in perfect condition. In its style and flair of its features it retains the traditions of the Roman facet-cut glass of the late 1<sup>st</sup> and 2<sup>nd</sup> centuries CE (see above 3.3.1.). A close parallel, although made of a glass with a notable greenish tinge, is kept in the Eretz Israel Museum in Tel Aviv<sup>86</sup>. The late date

83 Negro Ponzi 1968–69, 361 no. 71 figs. 157 and 161; Negro Ponzi Mancini 1984, 35–36 fig. 4.1; Simpson 2014, 214 fig. 20.21.12. A related bowl from Bahrain (tomb 2, Dar Kulayab), Andersen 2007, 79–82 cat. no. 41.2 figs. 319–320; Andersen 2022, 425–426 fig. 6.C.

84 An 2004, 61 fig. 51. – Others suggested an even earlier date of the tomb in the early part of the Western Jin period, Echeng Liu Chao mu 2007, 437. However, only two ceramic vessels from the tomb have been published, see *ib.* 170 fig. 135–5 (M4021:2) and 183–184 fig. 142–10 and pl. 54-4 (M4021:1), seemingly a too narrow basis for such a dating of the tomb as it would appear unusually early for Sasanian facet-cut glass vessels.

85 Negro Ponzi 2002; Mirti – Pace – Negro Ponzi et al. 2008, Roman natron glass from Veh Ardashir, samples VA07 (blue), VA11, VA13, VA 20, VA21, VA28 (their group of LMG glass), two of them, VA11 and VA28, decoloured with antimony (= Negro Ponzi Mancini 1984, fig. 4.11 and 13), two decoloured with manganese, VA13 and VA20; for another facet-cut fragment from Veh Ardashir, analysed by Robert Brill (sample 1252), made of Roman natron glass decoloured with manganese, see Brill 1999 vol. 1, 83, vol. 2, 156 = Brill 2005, 67. Simpson 2014, 206, 214, 226–227, 228; Simpson 2015, 81–87.

86 *Journal of Glass Studies* 7, 1965, 120–121 no.3; Delacour 1993, 60 fig. 18.

of the otherwise unpublished Jurong burial – its occupant is said to have died in 439 CE – might suggest that the glass vessel was a treasured heirloom.

67 In the late 1950s and 1960s, numerous glass vessels appeared on the art market, reportedly found in Gilan province in north-western Iran, south of the Caspian Sea, many of them with facet-cutting in characteristic Sasanian style. In 1960 and 1964, the Tokyo University Iraq-Iran Archaeological Expedition and, in 1966, the Iranian Center of Archaeological Research carried out surveys and excavations of burials at some sites in Gilan dating to the Parthian and Sasanian periods (Fukai 1977, 24–29; Simpson 2015, 85). Finds also included imports of Roman glass from the eastern Mediterranean, glass vessels but also a Harpokrates bead of probably Egyptian manufacture, the latter discovered in a burial assigned to the 1<sup>st</sup> to 3<sup>rd</sup> centuries CE<sup>87</sup>. Similar Harpokrates beads have been found in the northern Black Sea area, and a route along the southern Caucasus has been suggested for the introduction of glass objects of various origins into Gilan (Simpson 2015, 81, 87–94).

68 Recent archaeometric investigations into the chemical composition of some glass vessels reportedly found in Iran and acquired by various museums and institutions in Japan, revealed for the majority glass compositions consistent with Sasanian types of glass (see above 2.2.2) (Abe – Shikaku 2021). However, four glass vessels of the 36 glass objects tested, are made of Roman natron glasses. These are a globular bowl with everted rim decorated with dense rows of rice grains facets and a beaker with four rows of facets, alternating a row with rice grain and a row with more oval facets<sup>88</sup>. Both are made of antimony-decolourised natron glass characteristic of the 1<sup>st</sup> to 3<sup>rd</sup> centuries CE<sup>89</sup>. The two other glass vessels are also colourless but decorated with a horizontal row of dark blue blobs. One is a conical beaker or lamp, a shape well known in the corpus of Late Roman glass, the other a deep bowl with additional facet-cutting. Their analyses revealed a Late Antique glass type, Levantine 1, produced in Syro-Palestina between the 4<sup>th</sup> and 7<sup>th</sup> centuries CE and manganese-decolourised<sup>90</sup>.

69 The evidence presently available from archaeological excavations and surveys suggests that in the Parthian period the range of locally produced glass vessels was limited and consisted mainly of small bottles and jarlets, presumably used as containers for aromatics or perfumed oils (Negro Ponzi 2005, 141), whereas tableware preferably was imported from the eastern Mediterranean region. Glass production on a large scale appears to have developed in the Sasanian period and to have been centered in Mesopotamia (in central and southern Iraq) rather than in Iran. It is assumed that the glass vessels from Gilan province, a remote and somewhat inaccessible region, were not produced there but brought into the area from somewhere else, a few from regions of the Roman empire, the majority from Sasanian glass producing sites in Mesopotamia.

70 In a recent study, Yoshinobu Tatsumi and Yoshinari Abe investigated three glass cups in the Tenri University Sankokan Museum that were acquired at the art market

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87 On glass vessels assumed to be imported from Roman Syria into the Iranian highlands, see Fukai 1977, 23, 30; Simpson 2015, 84 fig. 11. – For the Harpokrates bead, see Fukai 1977, 27 fig. 12 (misidentified as female); for comparisons, see Spaer 1993, 17–18 figs. 11–12. Spaer 2001, 131; Gennett 2013, 16; a similar gold-in-glass bead in the Metropolitan Museum of Art, New York, acc.no. 10.130.2475; Borell 2024b, 39–40 fig. 3k1, for such a Harpokrates bead from the Isthmus of Kra region.

88 Interestingly, the decoration of the beaker closely parallels two beakers found in southern Scandinavia, Fremersdorf 1967, 79 pl. 52 (Bremsnes, Norway); Gavritukhin 2011, 48 fig. 4B,9–10 (from Gjerla and Bremsnes).

89 Abe – Shikaku 2021, 40–43, Okayama Orient Museum 434–2143 and 423–2111, pl. 65. For the beaker compare the fragment Negro Ponzi Mancini 1984, fig. 4,2.

90 Abe – Shikaku 2021, 40–43, 66 Okayama Orient Museum 085-0397 and Ancient Egyptian Museum, Tokyo AEM-F017; the latter (= Fukai 1977, pl. 8 fig. 54; Simpson 2015, 95 fig. 17.1) is further embellished by secondary facet-cut decoration that was obviously added later and probably not in the Mediterranean region, although elements of its layout appear related to Roman facet-cut styles of the later 3<sup>rd</sup> and 4<sup>th</sup> centuries CE. For additional information on the bowl AEM F-017 that was acquired by Shinji Fukai in Iran and remained in his possession until his death, I am indebted to Yoshinari Abe, pers. comm. September 2023.

and reportedly found in north-western Iran (Tatsumi – Abe 2019). The three cups, being superficially very similar, are of roughly hemispherical shape decorated with rows of oval to circular facets, all three made from almost colourless glass displaying various tints in a range from pale greenish to brownish. The small cup (B, rim diameter 9.7 cm) with three rows of touching or slightly overlapping oval or circular facets shows a pronounced tapering towards the base accentuated by two rows of trapezoidal facets. Analysis of its almost colourless glass with a faint greenish tint revealed a typical Roman natron glass characteristic of the 1<sup>st</sup> to 3<sup>rd</sup> centuries CE of probably Syro-Palestinian origin with low concentrations of manganese. The transparent pale greenish glass of another cup (A, rim diameter 10.8 cm) was identified as a Late Roman glass composition of the HIMT type produced probably in Egypt between the 4<sup>th</sup> to 8<sup>th</sup> centuries CE. Merely the large cup (C, rim diameter 12.4 cm) with a pale brownish tint turned out to be made from plant-ash soda glass of Sasanian type, namely Sasanian 2, produced in Mesopotamia from about the 5<sup>th</sup> century CE. Tatsumi and Abe regard cup B as an earlier import of Roman production. For cup A, which is made from Late Roman HIMT glass but in appearance close to Sasanian style, they discuss various scenarios: the raw glass was imported, or a blank was imported and the facet-cutting carried out in a Sasanian workshop, or it was made in the brief period when under Xusro II (591–628 CE), the Sasanian empire briefly extended its influence as far west as the Sinai Peninsula and Egypt.

71 For other examples, like some colourless vessels decorated with blue blobs well-known from Late Roman glasses, but – unlike Late Roman style – further embellished with cut decoration, St. John Simpson suggested that the glass vessels were imported from the eastern Mediterranean, but that the cold-worked decoration was added in Sasanian workshops (Simpson 2015, 95 fig. 17). It appears that the relationship between Sasanian and eastern Roman glass production may have been more complex than hitherto assumed.

### 3.3.3. Central Asian glass vessels

72 The vast majority of the finds survived only as small fragments (Fig. 18 to Fig. 23). More than half of the vessel glass samples from the Tarim Basin analysed by Brill were assigned by him to Central Asian glass compositions. These fragments, collected by European expeditions in the early 20<sup>th</sup> century, come from specified sites, but they lack well-dated contexts and some may post-date our chosen time frame<sup>91</sup>. However, they also include a number of fragments from early sites like Loulan and Niya that were abandoned after the 4<sup>th</sup> century CE. Analyses of glass objects excavated at Niya sites between 1988 and 1995, for which the excavators give a time frame from the 1<sup>st</sup> century BCE to the 4<sup>th</sup> century CE, revealed a dominant presence of Central Asian glasses (Lin Yixian 2010, 209–209). Given the geographical situation and the strong Central Asian influences recognised at Niya, this may not come as such a surprise (Bertrand 2012; Hansen 2017, 38–42, 53–54).

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91 This applies in particular to the finds from the sites Hasa Tam and Saqal Tam (nos. 75–82) near Khan-oi (Kashgar), apparently settlement sites, for which a date as late as the early Islamic period up to the twelfth century may be possible, Hambis 1964, 23–26; on the site, see also Di Castro – Vicziány – Xuan 2019, 148. On the chemical composition of these glasses, see above 2.2.4. – For the stems of goblets from Hasa Tam / Saqal Tam (nos. 78–79), the so-called “clous de verre”, initially misinterpreted as lotus flowers (see Hambis 1964, 25), compare finds from Kuva and Akhsiket (Uzbekistan), 11<sup>th</sup>–12<sup>th</sup> centuries, Baypakov 2011, 99, 108 fig. 11.1, 141–142 pl. XVI.1–4, XVII.1–5, XVIII, 144 pl. XXI.3; from Dashlydja-depe site, Misrian, and Shekhr-Islam (Turkmenistan), 10<sup>th</sup>–12<sup>th</sup> centuries, Baypakov 2011, 83–87 fig. 2–3, 113–115 pl. II, IIa, III–VI. On the technique of making such stemmed goblets from a single blown glass bubble, see Fünfschilling and Lafli 2013, 37–38 fig. 6; 61 (in English). – For a close parallel to the fragment no. 80, see the mould-blown bowl from Kalai Bolo fortress (Tajikistan), 10<sup>th</sup> to 13<sup>th</sup> centuries, Baypakov 2011, 70, 73 fig. 12.9. – The fragment no. 77 may stem from a lamp with loop handles like those from Khulbuk (Tajikistan), first half of the 11<sup>th</sup> century, Baypakov 2011, 76, 78–79 fig. 20 and 21.1.



Fig. 18: Fragment with applied decoration from Niya cemetery 93MNII (no. 57), dimensions c. 2.0 x 1.8 cm.



Fig. 19: Stockholm, Museum of Ethnography 1903.26.0257.A (Sven Hedin collection). Fragment with applied decoration from Loulan (no. 51).



Fig. 20: Stockholm, Museum of Ethnography 1903.26.0260.K (Sven Hedin collection). Fragment from Loulan (no. 46).



Fig. 21: Stockholm, Museum of Ethnography 1903.26.0260.E (Sven Hedin collection). Fragment from Loulan (no. 49).

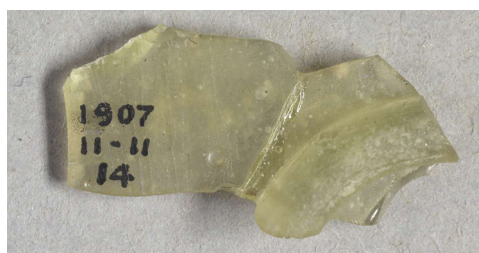


Fig. 22: London, British Museum 1907.1111.14 (Aurel Stein collection). Fragment from Togujai with applied decoration (no. 63), 1.06 x 0.6 cm.

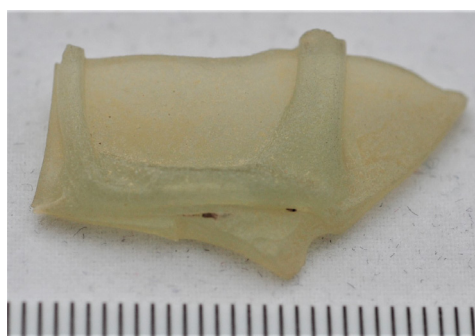


Fig. 23: Fragment from Endere with applied decoration (no. 56).

73 Although still understudied, Central Asian production of glass vessels is presently coming more into focus. Of particular importance are the results from archaeometric studies of glass vessels found in Korea, excavated from royal tombs of Silla dating from the late 4<sup>th</sup> to early 6<sup>th</sup> centuries CE. Chemical analyses revealed a predominance of Central Asian glasses (see above 2.2.4). The glass vessels are generally blown. For decoration applied glass threads are favoured that were trailed-on during the hot-working process. These are mainly horizontal trails and zigzags, multiple

zigzags sometimes forming a net pattern<sup>92</sup>. Examples of this kind of decoration are the blue fragments from Niya and Loulan (nos. 51, 57 and Fig. 18, Fig. 19) and the colourless fragments from Endere, Togujai and Loulan (nos. 46, 56, 63 and Fig. 22, Fig. 23), as well as the colourless rhyton from Niya (no. 58)<sup>93</sup>. The trailed-on zigzags appear on a number of glass beakers from the Korean tombs, including the tested examples from Wolseong-ro tomb Ga-13, Hwangnam Daechong south mound (Fig. 24), and Geumgwanchong (Gold Crown Tomb), which closely resemble beakers from tomb contexts of the 4<sup>th</sup> and 5<sup>th</sup> centuries CE excavated in Kyrgyzstan and Kazakhstan<sup>94</sup>.

74 These results also throw a new light on the glass vessels in the Northern Yan tomb of Feng Sufu who died in 415 CE, excavated at Beipiao in Liaoning province in 1965 (nos. 26–30). Initially, suggested origins for the five glass vessels in Feng Sufu's tomb ranged from local production to import from the Roman empire, including already an early cautious proposal by Sabine Werner for a Central Asian origin<sup>95</sup>. The glass composition of the globular bowl from the burial of Feng Sufu (no. 26), published in 1984 and often addressed as an alms bowl (鉢 *bō*), has already been recognised as Central Asian (Lankton – Lee – Kim et al. 2009; Lankton – Gratuze – Kim et al. 2010). Such an origin seems likely also for the other glass vessels (nos. 28–30) from the same tomb<sup>96</sup>. When discussing the rhyton from Niya (no. 58), Yu Zhiyong convincingly pointed out similarities with the animal-shaped glass vessel from Feng Sufu's tomb with its decoration of applied glass threads as well as some glassware from the Silla tombs at Gyeongju, some of the latter now analysed and identified as Central Asian glasses (Yu 2010, 195–196; Yu 2013, 108).

75 This new recognition of Central Asian glass vessels may also call for a re-evaluation of the glass cup with applied decoration from the tomb of Madame Zu. The burial is located within the cemetery of the Feng family at Jingxian (Hebei) and probably dates to the early 6<sup>th</sup> century CE<sup>97</sup>. The cup's shape with its rim bulge created by inward folding, recalls similar cups or beakers from Korean tombs as well as parallels from Central Asia, some undecorated, others with a similar net-pattern formed by applied multiple zigzags<sup>98</sup>. Another example, likewise post-dating our chosen time frame, is the

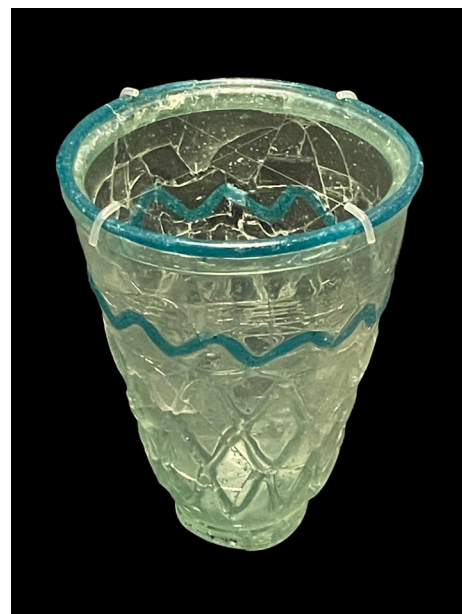


Fig. 24: Beaker from Hwangnam Daechong, south mound. H 12.7 cm.

92 The part of decoration preserved on the Loulan fragment (no. 49 and Figure 21) shows, how the net pattern was formed by additional squeezing, described by Brill 2009, 143 sample 6817 as “nript diamond waies” effect. In fact, the so-called nript diamond waies were formed in a different way, see Gudenrath 2012, 261 figs. 179–183; 270. <https://www.cmog.org/glass-dictionary/nript-diamond-waies>.

93 Similar are also other fragments collected at Niya and Endere, Stein 1907, 411 pl. LXXIV: no. N.XV.001.f; 442 pl. LII: no. E.002. – For bringing the chemical analysis of the Niya rhyton to my attention, I am indebted to James Lankton, pers. comm. October 2023; for the unpublished report by Lin Yixian on its compositional analysis by LA-ICP-MS, see Yu 2013, 108 with note 16.

94 Lankton – Gratuze – Kim et al. 2010, 226 fig. 1.6; Lee 2010, 216 fig. 5. For the analyses, see Abe – Murakushi – Kim 2019, samples GL002, GL021, GL023, GL024, and GL016; see also Otani 2022, 35, 40 figs. 6–7: VII-2a and VII-6a. – For the parallels, see Szmoniewski 2018, 164–166, 185 fig. 10; Otani 2022, 52 fig. 11.

95 Li 1973, 17; Li 1974, 123; Werner 1981, 148–149; An 1984, 417.

96 A Central Asian origin was already suggested by James Lankton, pers. comm. December 2008, and recently by Maliya Aihaiti (Aihaiti 2018) on the basis of the SEM-EDS analyses of three other glass vessels from the tomb, carried out in 2002 at the Institute of Metal Research, Chinese Academy of Sciences, in Shenyang (Liaoning) and published in 2015, Su – Gao – Liu 2015. However, the measured values result – probably for curatorial reasons – from non-destructive analysis of the weathered surface layer that make a reconstruction of the initial glass difficult. On this general problem, see Liu – Li – Gan et al. 2011, 368; Shortland – Rehren 2020, 350. For comments on the analyses I am indebted to Susanne Greiff (Tübingen), pers. comm. March 2022.

97 For the XRF-analysis of the cup with an elevated potash value, see Shi – Qu – Zhang et al. 1984, 450, 456 table 2 sample 11. Fan – Zhou 1991, 197 fig. 6, 200 table 1 sample 8. An 2004, 60. It has been speculated whether she was the wife of Longzhi (485–545 CE).

98 Lankton – Gratuze – Kim et al. 2010, fig. 1.2 and 1.6 (from Hwangnam Daechong, southern mound, with Central Asian glass composition). Szmoniewski 2018, 164–166 figs. 4.1, 5.4–7, 7.4, 10. 1–4 (from Korean tombs,

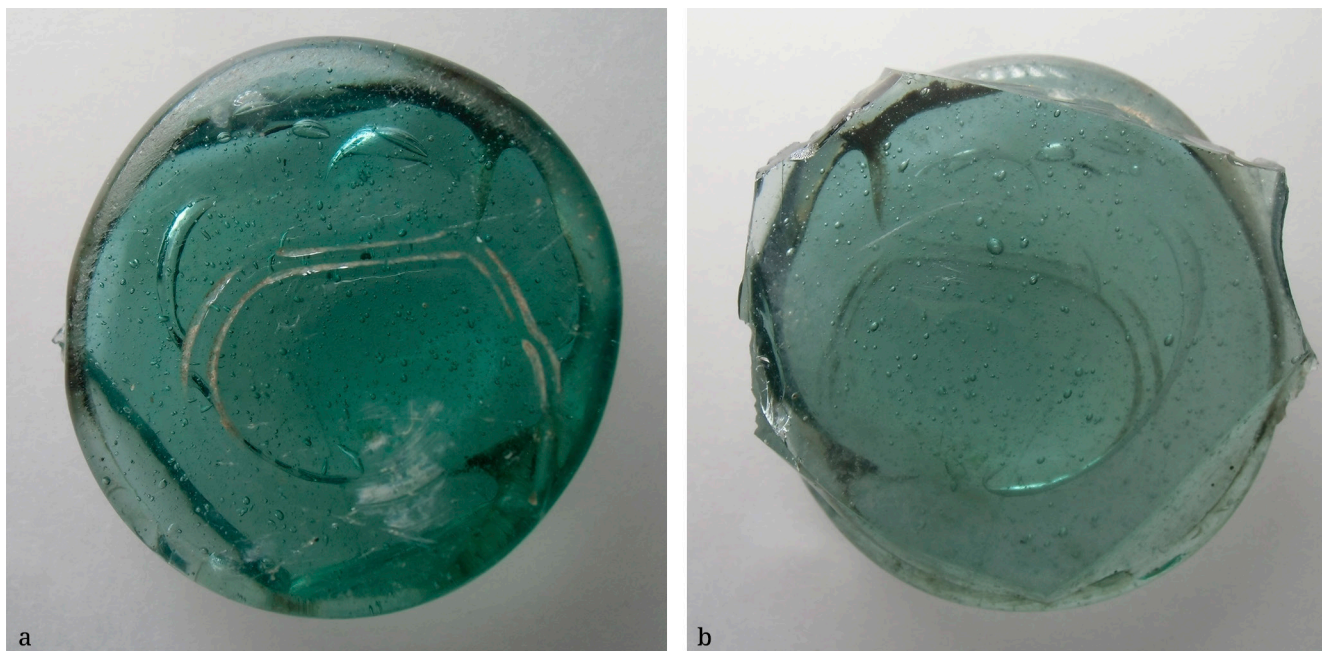


Fig. 25: a–b: Paris, Musée Guimet 23737 (Paul Pelliot collection P. 647d). Fragment with applied disc-shaped prunt (no. 71) from Duldur-Akhur, Kucha, D prunt 2.5–2.6 cm, a. Exterior side with prunt. b. Interior side of vessel wall.

glass cup with trailed decoration discovered at Hejjiacun, Xi'an (Shaanxi province), as part of the Hejjiacun hoard dated around the 8<sup>th</sup> century CE. The chemical composition of the glass cup has recently been analysed and identified as Central Asian (Lu – Liu – He et al. 1917; Lin Meicun 2017; Aihaiti – Seong-sil – Hao 2017).

<sup>76</sup> Special attention deserves the fragment with an applied circular prunt from Duldur-Akhur (no. 71 and Fig. 25) in the Kucha area. It may stem from a vessel like the gobelet from the Simsim caves (no. 72) decorated with two rows of applied roundels, impressed on their flat exterior with two concentric circular lines. Although not discernible in the published photograph, according to the detailed description by An Jiayao, the two fragments from Barchuk (no. 74) were also decorated with raised roundels applied in a hotworking process. The decoration of applied roundels seems to imitate the relief-cut decoration of Sasanian glass vessels, like the one from the tomb of Li Xian (died in 569 CE, buried in 570 CE) (An 2004, 61, 258 cat. no. 158), the fragment from Okinoshima Island and a bowl in the Okayama Orient Museum<sup>99</sup>.

#### 4. Sites, routes, and owners

<sup>77</sup> The following will briefly survey the contexts in which the glass vessels were found focusing on their geographical and chronological distribution, and – as far as available – the information they give about their owners. However, a fundamental difficulty for this undertaking lies in the disparity of the archaeological data. In China, the imported glass vessels discussed here come from well-defined and dated archaeological contexts, generally tombs, whereas in the Tarim Basin the vast majority of glass vessels

10.3 has been analysed and has a Central Asian glass composition), 10.6–7 (parallels from Central Asia); Zhao 2019, fig. 2.1–3. Abe – Murakushi – Kim 2019, 28–29 sample GL016 (from Gold Crown tomb) and GL002, 021, 023, 024 (from Wolseong tomb Ga-13, object no. 5865), both beakers with a Central Asian glass composition. Otani 2022, 34–37, 50–51 (analyses).

<sup>99</sup> The glass of the Okinoshima fragment has been assigned to type Sasanian 1b, that of the bowl Okayama Orient Museum 8–130 to type Sasanian 2, see Abe – Shikaku – Murakushi et al. 2021, 2–5 figs. 1, 2a, 4; supplementary data figs. S2.a and 3 and table S3; Abe – Shikaku 2021, 35, 58, 64.

or rather their fragments are stray finds, the three glass cups from burials contexts in Yingpan and Zhagunluke being the notable exception.

78 Last but not least, an attempt is made to come to a more nuanced understanding about possible or likely routes of transmission. A priori, finds in the Tarim Basin seem to indicate transport overland, whereas for foreign glass vessels imported into China land and maritime routes have to be considered. However, in the early periods, multiple networks were involved in long-distance trade, and it was common that route sections overland, including inland waterways, and sections by sea were used in combination.

## 4.1. China

79 The find contexts considered here fall within a time range from the 1<sup>st</sup> to the mid-5<sup>th</sup> century CE, most of them date from the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE. The collapse of the Han Dynasty was followed by three and a half centuries of disunion, first the disintegration of the former Han Empire into the Three Kingdoms, and after the brief reunification under the Western Jin (265–316 CE), the division in the Northern and Southern Dynasties<sup>100</sup>. The majority of the contexts are in the south, in the present-day provinces Guangdong, Jiangsu, Anhui and Hubei, either in close proximity to the sea like Guangzhou and the sites in the Yangzi delta region, or connected to the coast by inland waterways like Echeng and Ezhou farther inland on the Yangzi. Four sites only are situated in northern China, in the present-day provinces Henan, Hebei, Shanxi, and Liaoning (Fig. 26).

### 4.1.1. Contexts of the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE: Eastern Han (25–220)

80 In the Eastern Han period, imports of glass vessels are known from two elite tombs in southern China not far from the mouth of the Yangzi, in the area of Yangzhou, dating from the 1<sup>st</sup> and early 2<sup>nd</sup> centuries CE. With good reason, one of the tombs has been assigned to Liu Jing, a younger son of the Han emperor Guangwu, who was nominated King of Guangling in 58 CE and committed suicide in 67 CE (Psarras 2015, 8–9, 21, 143–144). In the looted tomb were found fragments of a Roman ribbed bowl made of translucent purple and opaque white mosaic glass (no. 1), skilfully tooled to simulate veined stone (Borell 2010, 128).

81 The other tomb is dated slightly later towards the end of the 1<sup>st</sup> century CE. A marquis of Guangling succeeding the deceased Liu Jing has been suggested as its owner. The glass fragments in this tomb indicate a less elaborate glass vessel, a blown Roman cup of greenish-blue glass dating from about the mid-1<sup>st</sup> century CE (no. 2).

82 In a tomb in the north, near the Eastern Han capital Luoyang, was found the blown glass bottle (no. 20). Its unknown owner would have been a person of some wealth and rank having access to such an exotic import, possibly a lady who valued the bottle's precious contents, presumably perfumed oil.

### 4.1.2. Contexts of the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE: Wu (222–280), Western Jin (265–316), and Eastern Jin (317–420)

83 20 glass vessels or their remains come from contexts dating to the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE, all except one found in southern provinces. After the fall of the Han dynasty in 220 CE, three different kingdoms formed in China, the Wei in the north, the Shu Han in the west, and the Wu in the south. In 265 CE, Sima Yan, enthroned as Emperor Wu of Jin, reunited the empire for a brief period known as the Western Jin (265–316 CE) with the capital in Luoyang. When nomadic tribes from the northern steppe invaded the northern part of the Jin empire, the dynastic family and other aristocratic families

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100 For a brief overview on this “Age of Division” between 220–589 CE, see Ebrey 2010, 86–107.

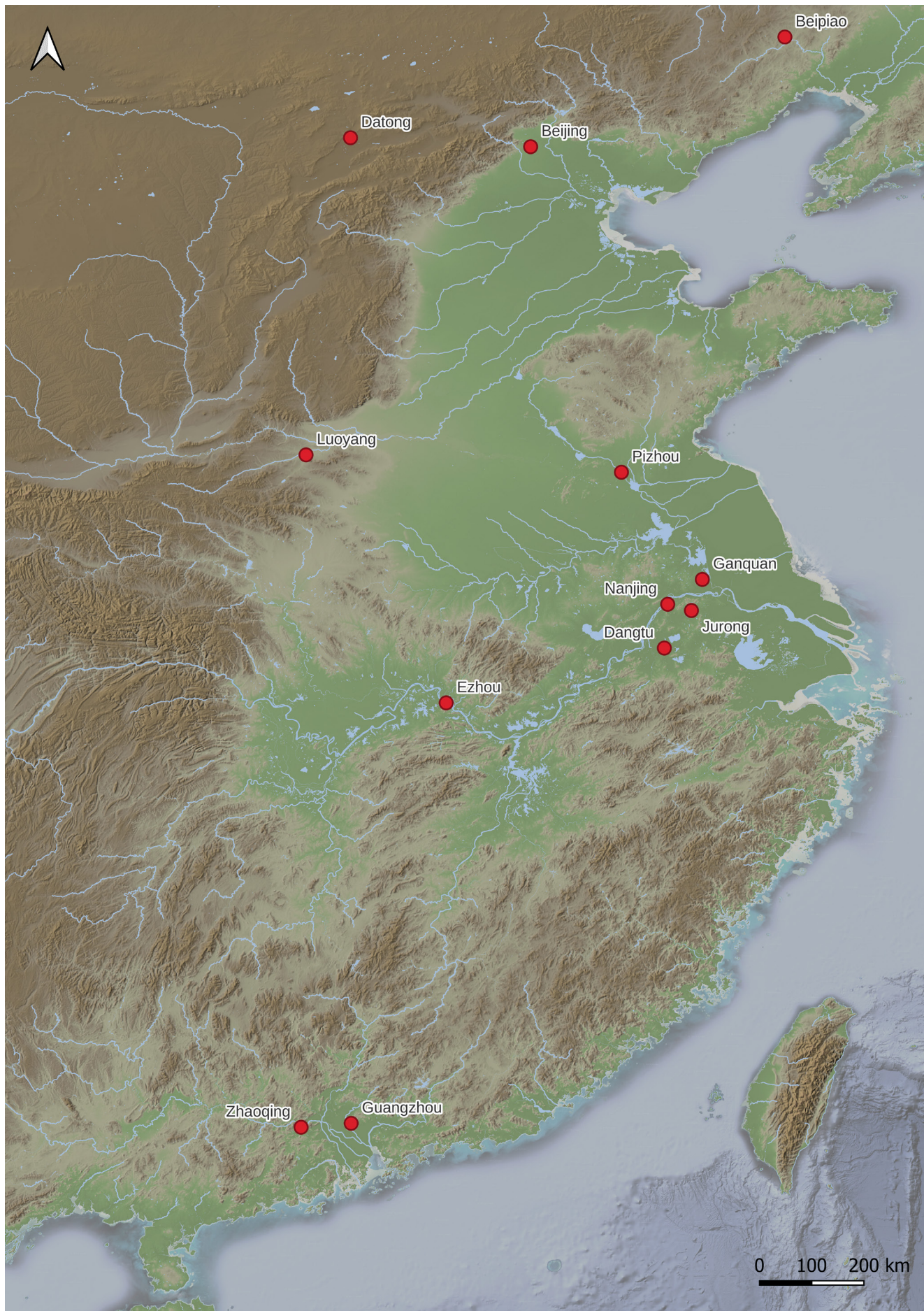


Fig. 26: Map showing the locations of the contexts with glass vessels in China mentioned in the text.

fled south where they re-established the dynasty, now with the capital Jiangkang in present-day Nanjing. The dynasty was in power in the south for about one hundred years, known as the Eastern Jin (317–420 CE).

84 A fragment of a colourless glass vessel has been reported from a tomb of the Wu Dynasty (here no. 21) at Ezhou on the Yangzi. The tomb was looted, however, an inscription on the crossbow mechanism discovered in the tomb gives the name of Sun Lin who died in 249 CE. Sun Lin was a member of the dynastic Sun family of the Wu kingdom<sup>101</sup>, and possibly it was his tomb. Currently, no further information is available about the glass vessel itself.

85 Four tombs with glass vessels date from the Western Jin period. The one in the north, in the western suburbs of Beijing, is the burial of Hua Feng, the wife of Wang Jun who was an army commander of Youzhou. The tomb contained an early Sasanian glass bowl (no. 24). In two other Western Jin burials in the south, one at Pizhou (no. 3), one at Echeng (nos. 22–23 and Fig. 17) on the Yangzi, likewise early Sasanian glass bowls were recovered. In a third burial in the south, Shidaigang Tomb 5, Guangzhou (no. 18), remains of a blue glass vessel were discovered. Since neither illustrations nor a chemical analysis of the glass fragments are available, at present, nothing definitive can be said about its origin. Generally, information about the owners of the glass vessels is lacking. However, Jianyaomiao tomb 1 at Pizhou stands out for its wealth, and with good reason a high-ranking aristocrat has been suggested. Grave goods included besides the Sasanian glass cup (no. 3) two exotic drinking cups made from nautilus shell with mountings made of gilded bronze as well as two smaller shell cups mounted in bronze in the style of eared cups (Nanjing – Xuzhou – Pizhoushi 2018, 27–28 fig. 14.5–6 pl. 4.1; 30–31 fig. 17.10).

86 Eight of the ten burial contexts of the Eastern Jin period are situated in the Yangzi delta, in the area of present-day Nanjing, that is in the vicinity of the Eastern Jin capital Jiangkang. Remains of twelve glass vessels were recovered from these eight tombs, all clearly elite burials. They have been assigned either to members of the dynastic Sima family or members of high-ranking and influential aristocratic families like the Wang family who had close contacts to the imperial family (Kieser 2002, 95–119, 163; Rhie 2002, 5–7, 23–25; Kieser 2011, 54–62). Predominantly, the burials are dated to the early and middle Eastern Jin period. For one tomb only, tomb 13 at Guojiashan, a later date has been suggested, in the late Eastern Jin or early Liu Song periods thus pointing to a date in the early 5<sup>th</sup> century CE. The glass vessels in this tomb (nos. 13–15) survived in tiny fragments only. Analyses of their chemical composition could provide more information about their origin.

87 The remaining two burials, each with a Sasanian glass bowl, are both dated to the early Eastern Jin period, one tomb located at Dangtu (Anhui) farther inland on the Yangzi (no. 17), the other at Pingshigang in Zhaoqing (Guangdong) (no. 19) and connected by the western tributary (Xijiang) of the Pearl River (Zhujiang) to Guangzhou. Information about the owner of the Dangtu burial is missing. Tomb 1 at Pingshigang is thought to be the burial of a high-ranking official with the title “Guangxin Marquis of Cangwu”.

88 Counting those that were tested for their chemical composition and adding those of the untested that can be assessed by their visual appearance, it appears that in the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE Roman glass vessels made of natron glass (nos. 5–11) and Sasanian glass vessels made of plant-ash soda glass (nos. 3–4, 17, 19, 20–22) are represented in equal numbers. Apart from at least two dark blue Roman glass vessels (nos. 9, 11), almost all the others are made of uncoloured glass, the two tested colourless

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101 Sun Lin's father was a cousin to the first ruler of Wu, Sun Quan. For this biographical information I am greatly indebted to Annette Kieser, pers. comm. May 2023.

Roman glass cups are made of intentionally decolourised glass, one antimony-decolourised (no. 8), the other manganese-decolourised (no. 10). Both are decorated with horizontal zones of cut facets in styles that were developed in the late 2<sup>nd</sup> and 3<sup>rd</sup> centuries CE.

#### 4.1.3. Contexts of the 5<sup>th</sup> century CE: Liu Song (420–479), Northern Wei (386–534), and Northern Yan (409–436)

89 Three contexts from China are dated to the early and mid-5<sup>th</sup> century CE. One is the tomb of Liu Zong in Jurong located in Jurong east of Nanjing, which contained the exceptionally well preserved bowl of colourless glass with facet-cut decoration of overlapping facets forming hexagons (no. 16), a design already known from Roman facet-cut glass cups of the late 1<sup>st</sup> and early 2<sup>nd</sup> centuries CE.

90 The other two contexts are in the north. One burial, probably dating not much later than the mid-5<sup>th</sup> century CE, was excavated in a large cemetery in the area of Datong, where at that time the capital Pingcheng of the Northern Wei (386–538) was located<sup>102</sup>. Tomb structure and grave goods suggest a non-Chinese origin for the persons buried in this cemetery (Müller 1998, 117–111). As indicated by the furnishings and grave goods in tomb M 107, its occupant certainly was a person of some wealth who had access to precious objects like the gilt silver bowl of Central Asian origin and the facet-cut glass bowl (no. 25) (Watt 2004, 155–156 cat. no. 64; Datong 2006, 229 fig. 105, pl. 22,1 (M 107: 16)). The glass bowl is usually addressed as Sasanian, although close parallels are lacking; alternatively, an import from the Black Sea area has recently been suggested (Ma 2014).

91 The other northern burial, the tomb of Feng Sufu is located even farther northeast, in Beipiao. Feng Sufu, who died in 415 CE, was the brother of Feng Ba (r. 409–430), the second ruler of the Northern Yan state (407–436), the last in a succession of short-lived northeastern Yan states of the Murong Xianbei. Feng Sufu's tomb and its contents display a blend of northern nomadic and Chinese traditions<sup>103</sup>. Five glass vessels were discovered in his tomb. One of them, the globular bowl, often addressed as an alms bowl (鉢 *bō*)<sup>104</sup>, has been assigned to Central Asian production on the basis of the chemical composition of its glass, and the same may apply to the other glass vessels in his tomb (nos. 26–30, see also above 3.3.3).

92 It seems plausible to assume that the glass vessels from Feng Sufu's tomb as well as the facet-cut bowl of the unknown deceased buried in tomb M 107 in Datong would have arrived along land routes. In the Northern Wei period, contacts to Central Asia were close as attested in the written sources (*Bei shi* 97.3226–3227). Of particular interest here is the account about immigrant glassmakers from the lands of the Yuezhi (Bactria) who arrived during the reign of Emperor Taiwu (r. 424–452 CE) at Pingcheng where they began locally to produce glass. As has been suggested by An Jiayao, they probably also introduced the blowing technique, since the first locally made glass vessels in China made by blowing are found in this area and date from this period<sup>105</sup>.

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102 An Jiayao in Watt 2004, 156 cat. no. 65, suggests a date for the tomb 107 not later than the mid-5<sup>th</sup> century. See also Müller 1998, 117–124, who places tomb M 107 in her first phase of the Pingcheng period (398–494). Based on the ceramics, the authors in Datong 2006 (pp. 471–472) distinguish five chronological groups; they assign tomb M 107 to their third group between 439 and 477 CE.

103 Werner 1981; Yang 2004, 321–323; Watt 2004, 14–16, 130–132 nos. 37–42; Holcombe 2019, 300; Liaoning 2015.

104 Li 1973, 6–7 fig. 9,3; Werner 1981, 148 (see also *ibid.*, 144 and fig. 9, for the gold sheet with a representation of the Buddha); Moore 1998, 80–81.

105 An 2002, 63–65 (with an English translation of the relevant text passage in the *Bei Shi*); An 2004, 62–63; An 2009; An – Liu 2015; Müller 2019, 394–395.

## 4.2. Tarim Basin

93 The sites in the Tarim Basin are located along the borders of the Taklamakan Desert where water was available, at the foot of the Tianshan Mountains in the north and the Kunlun Mountains in the south (Fig. 27). They were connected by a northern and a southern route that merged again at Dunhuang in the east and at Kashgar at the western end of the Tarim Basin. In the earlier part of the period of interest here, an additional third route still was favoured, the so-called central route, from the Jade Gate in the east across the Lop Desert via Loulan and further northeast, where it met the northern route in the region of Korla<sup>106</sup>. From Loulan also extended a subsidiary route southwest across the desert towards the southern route. However, after Loulan was abandoned by the end of the 4<sup>th</sup> century CE, the central route and its subsidiary were given up.

94 The history of the oasis states in the Tarim Basin and their struggle between the Chinese empire in the east and the Xiongnu in the north is rather complex, and it is not intended here to go into details. The sources and documents suggest an intermittent Chinese – at least nominal – dominance in parts of the Tarim Basin, however, the oasis states or kingdoms appear never to have completely lost their independence.

95 In the period of concern here, the Kroraina kingdom, called Shanshan by the Chinese, was one of the largest states. By the mid-1<sup>st</sup> century CE, it extended from Loulan in the east along the southern route to Niya in the west<sup>107</sup>. Loulan, before 77 BCE also site of the capital of the Loulan (=Kroraina) kingdom, had a strategic position on the central route. After 77 BCE, the Han empire exercised some sort of control and had a garrison established at Loulan. The Loulan site was abandoned by the end of the 4<sup>th</sup> century because of a decline in the availability of water<sup>108</sup>. At the western end of Shanshan, in the south-central Tarim basin, is the archaeological site of Niya, generally identified as the capital Cadota (in Karoshthi documents) of the oasis state Jingjue that by the mid-1<sup>st</sup> century CE was incorporated into Shanshan. By the end of the 4<sup>th</sup> century Niya also was abandoned, probably for similar reasons as Loulan<sup>109</sup>.

96 Two other sites, at the time apparently also part of the Shanshan kingdom, are Zhagunluke and Endere, both advantageously positioned on the route along the southern edge of the Taklamakan. The burial site Zhagunluke would be in the area of the oasis state Qiemo (as known in Chinese historical sources; Calmadana in Karoshthi documents; modern Cherchen), which became part of Shanshan by the mid-1<sup>st</sup> century CE (Selbitschka 2010, 16 with note 15; 31 with note 103). Endere, halfway between Qiemo and Niya in the western part of Shanshan, has tentatively been equated with Saca known from Kharoshthi documents (Rhie 1999, 367–368). Glass finds farther west come from the oasis state Yutian (Khotan), the other important kingdom on the southern route.

97 Yingpan, about 200 kilometres west-north-west from Loulan in the valley of the Peacock river (Kongque He), is thought to belong to Shanguo, one of the small oasis states known from the Chinese sources, bordering on its southeast the Shanshan kingdom. The Yingpan area is thought to be the site of Moshan, the capital of Shanguo<sup>110</sup>. Situated at the northern end of the central route from Loulan, it held a strategic position

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106 Bergman 1939, 50; Rhie 1999, 244–246, 394; Rhie 2002, 494; Baumer 2002, 9–10 fig. 6; 89–93.

107 For a brief overview on the oasis states in the Tarim Basin, see also Whitfield 1985, 7–15; on Shanshan/Kroraina, see Hansen 2017, 38–76. – On the sites mentioned here, see also Selbitschka 2010, 16 with note 15; 31 with note 103.

108 Xu – Gu – Qin et al. 2017; Mischke – Liu – Zhang et al. 2017, the latter arguing that it was not due to a deteriorating climate condition but a man-made environmental disaster caused by large-scale irrigation farming.

109 Apparently, Niya also experienced in the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE an expansion of its water management, though in contrast to Loulan of a different system, Bertrand 2012.

110 Shanguo being known from the history of the Western Han (*Han shu*), Selbitschka 2010, 56–57.

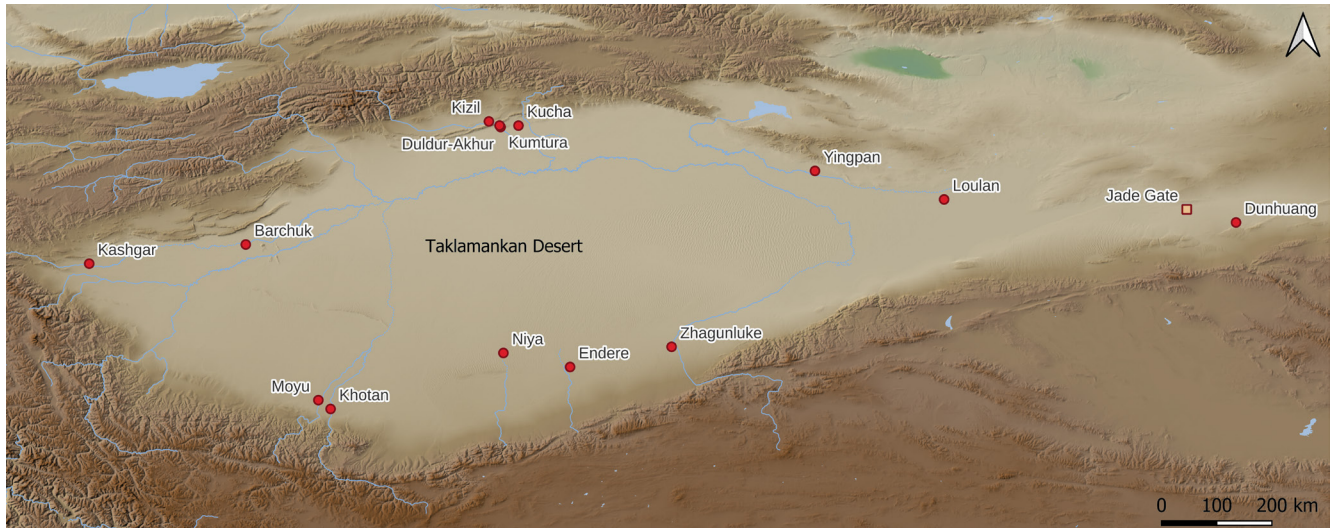


Fig. 27: Map showing locations with the glass finds in the Tarim Basin mentioned in the text.

at the intersection of routes in the northern part of the Tarim Basin giving it a great advantage for trade. Its importance and economic prosperity is reflected in the wealthy burials with silk and other precious textiles situated on the plateau above the northern bank of the Peacock river.

98 Glass finds listed here from sites on the northern route are concentrated in the area of the Kucha oasis, one of the largest and most prosperous kingdoms on the northern route. Although generally being stray finds, they were found in association with Buddhist sites. Other stray finds were collected at the western end of the Tarim Basin, in the region of Kashgar (Shule), the gateway across the Pamir Mountains into western Central Asia.

#### 4.2.1. Contexts, probably of the 3<sup>rd</sup> to 4<sup>th</sup> centuries CE

99 Three burial contexts are documented<sup>111</sup>. Two were discovered at Yingpan and one at Zhagunluke, each with a facet-cut glass cup or beaker.

100 The burial Yingpan Ying. III. 3 excavated by Aurel Stein in March 1915 was at the time already disturbed and partly eroded. Its surviving furnishings, which include some plain silks and a crimson head band adorned with three gold (or gilt) discs, still reflect the affluence of the deceased male. The glass beaker (no. 32 and Fig. 13) was placed to the right of the man's head; above his head were found some bones of a lamb and a small lacquer vessel. Tomb M 9 at Yingpan, excavated in 1995, held the skeletons of man and wife. The Chinese excavators assigned the majority of burials in the cemetery to a rather wide time frame from the Han to Jin periods. However, for the glass cup of Roman natron glass (no. 31 and Fig. 11) here a date in the mid-3<sup>rd</sup> century CE and an origin from the eastern Mediterranean has been proposed (see above 3.3.1.2). The cup was placed above the man's head, where also a rack of mutton was deposited. Organic materials like textiles had completely perished, but the eighteen small gold plaques located near the man's upper body indicate richly decorated clothing. In both Yingpan tombs, the owners of the glass cups were probably members of the Shanguo elite.

101 For tomb 49 at Zhagunluke a period corresponding to the Eastern Jin has been suggested by the Chinese excavators. A slightly earlier date, possibly still in the 3<sup>rd</sup> century CE has here been proposed for the facet-cut beaker (no. 52) that is likewise made of Roman natron glass. When excavated in 1996, the burial was no longer intact but

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111 The burial context of the Niya fragment (no. 57 and Fig. 18) is unpublished; so far the author only has knowledge of this one fragment.

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already looted. Nevertheless, the few surviving remains of grave goods, like the piece of embroidered silk or the lacquerware including an eared cup, signify a certain degree of wealth suggesting a burial of the local elite (Xinjiang et al. 2003, p. 129 fig. 39,1.5, pl. 15,2 and pl. 16,3).

#### 4.2.2. Stray finds

102 All the other fragments listed here from the Tarim Basin in Table 1, part 2 (Fig. 29) are stray finds. They come from specified sites but generally lack an archaeological context *sensu stricto*. This applies in particular to the old finds from the early 20th century. Some were picked up from the ground, others were purchased from locals. The latter applies, for example, to the two fragments from Hanguya Tati (here nos. 61–62) acquired by Stein from a local; the area was clearly that of an ancient settlement northeast of Khotan, but “nothing to indicate, when it ceased to be occupied”<sup>112</sup>. Similarly, the glass fragments from Hasa Tam and Saqual Tam were collected by Paul Pelliot’s workers at the site of an ancient settlement located near Khan-oi northeast of Kashgar that was apparently active up to the 12<sup>th</sup> century<sup>113</sup>.

103 The small size of many of the fragments does not allow assessing a date by typological analysis making the information gained from compositional analysis of the glass all the more important. Basically, three different groups can be discerned: Roman natron glass and two groups of plant-ash soda glasses, one assigned in current research to a Sasanian the other to a Central Asian origin. In a few cases only, the glass compositions in combination with sufficiently diagnostic features of the fragments provide a basis that permits to propose a narrower dating.

104 Eleven of the tested stray finds revealed a Roman natron glass. These are eight fragments from Loulan (nos. 33–34, 38–43 and Fig. 6), one from Endere (no. 53 Fig. 10), and two from sites in the Khotan area (nos. 59–60). Although two of the Loulan fragments (nos. 42, 43) might stem from the same vessel, each of the other would represent an individual glass vessel. All fragments are colourless glass, some intentionally decolourised. For three of them the use of antimony as decolouriser has been confirmed (nos. 33–34, 53 Fig. 6, Fig. 10). One of the fragments from the Khotan area (no. 59) may have been made of recycled decolourised glass on account of its concentrations of both antimony and manganese, usually interpreted as an indicator of recycling (see above 3.3.). At least five of the fragments preserve remains of cut facets. Two of the Loulan fragments with facet-cutting, nos. 34–35 and Fig. 1), may be dated to the late 1<sup>st</sup> to early 2<sup>nd</sup> centuries CE (see above 3.3.1), the facet-cut fragment from Endere (no. 53 Fig. 10) to the 3<sup>rd</sup> to early 4<sup>th</sup> centuries CE (see above 3.3.1.1).

105 Eight fragments of plant-ash soda glass were assigned to Sasanian production, the purple rim fragment from Loulan (no. 44 Fig. 17), two from Endere (nos. 54–55) and five from Buddhist sites in the area of Kucha (nos. 64–66, 68–70 and Fig. 15–Fig. 16), three from Kizil, one from Kumtura, and one from Duldur-Akhur). Most of them are colourless – or almost colourless – and decorated with cut facets. As far as shapes can be determined, those from the Kucha area – including also the untested but sufficiently diagnostic rim fragments from Kumtura and Hiçar (nos. 67, 69) – indicate the characteristic facet-cut hemispherical and shallow bowls of Late Sasanian production dating from the 5<sup>th</sup> to 6<sup>th</sup> centuries CE<sup>114</sup>. Two fragments (nos. 65, 66) were discovered in one of the Kizil caves, the

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112 Stein 1907, 471 and 473 H. 001. – On the effects of wind erosion and the problems of dating such eroded settlement sites, see Stein 1907, 107–109.

113 See Paul Pelliot’s ‘Notes de Voyage’, in Hambis 1964, 421–422, and Pelliot 2008, 48–50; the sites in the area of Khan-oi were active apparently in the early Islamic period up to the 12<sup>th</sup> century CE, Hambis 1964, 23–26; Di Castro – Vicziany – Xuan 2019, 148.

114 Pelliot mentions finds of glass at Hiçar made on 6 May 1907 (Pelliot 2008, 130), including one fragment of

so-called ‘New Cave’ below the Cave of the Sixteen Sword-Bearers<sup>115</sup>. The large fragment of a hemispherical facet-cut bowl (no. 64 and Fig. 15) is registered as being found in a workshop, presumably referring to the location at the foot of the western Kizil caves named “Werkstätten” in Grünwedel’s map (Grünwedel 1912, 38–39 figs. 78 and 80).

<sup>106</sup> The vast majority of the tested samples listed here falls into the group of plant-ash soda glasses that in current research are assigned to Central Asia and subdivided by Brill into four compositional subgroups. Seven fragments come from Loulan (nos. 45–51 and Fig. 19, Fig. 20, Fig. 21), one from Endere (no. 56 and Fig. 23), from Niya a blue fragment with applied glass threads (no. 57 and Fig. 18) and the rhyton (no. 58), three from the Khotan area (nos. 61–63 and Fig. 22), two from the area of Kucha (nos. 71, 73 and Fig. 24), and eight from the area of Kashgar (nos. 75–82). It is likely that a number of them post-date the time frame chosen here. As already mentioned, this may apply to some from the Buddhist sites in the Kucha area and, in particular, to those collected near Khan-oi in the Kashgar area, at the settlement sites Hasa Tam and Saqal Tam that were probably occupied until the early 2<sup>nd</sup> millennium CE<sup>116</sup>. However, the finds from early sites like Loulan and Niya that were abandoned around 400 CE are evidence for a flourishing glass production in western Central Asia already before the middle of the 1<sup>st</sup> millennium CE. Compositional analysis of glass objects from Niya, recovered in archaeological excavations between 1988 and 1997, revealed for the vast majority an origin in Central Asia (Lin Yixian 2010, 206–209). This also applies to the complete rhyton discovered at Niya in 2007 (Yu 2013, 108). Furthermore, tested glass vessels identified as Central Asian that were discovered in northern China and in Korean Silla tombs dating from the late 4<sup>th</sup> and 5<sup>th</sup> centuries CE testify to an already well established Central Asian production of glass vessels and their transmission farther east in this period<sup>117</sup>.

<sup>107</sup> According to a Chinese encyclopedia, in 331 CE, the King of Ferghana (Dayuan) offered glass to Shi Li, a ruler of the Later Zhao (319–351) in northern China<sup>118</sup>. Although the source gives no further specification, in the light of current knowledge, glass vessels of Central Asian production would be a likely possibility. About a hundred years later, in the second quarter of the 5<sup>th</sup> century CE, immigrants from the lands of the Yuezhi (Bactria) arrived at Pincheng (present-day Datong, Shanxi), the capital of the Northern Wei, and began locally to produce glass (see above 4.1.3).

#### 4.3. Different patterns of distribution, different routes of transmission?

<sup>108</sup> Of course, we do not know for certain – and probably never will – how and along which routes the glass vessels travelled. However, a closer look into possible or likely routes may help arriving at a more nuanced understanding.

<sup>109</sup> The date of the early Roman glass vessels found in China would be contemporaneous with the peak period of Roman maritime trade to India between the late 1<sup>st</sup> century BCE and about 200 CE. The extent of this trade is reflected not only

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high quality, which might possibly refer to the facet-cut rim fragment (here no. 69).

<sup>115</sup> For the situation of the caves, see the photograph taken in 1906 with Grünwedel standing in the entrance of the Cave of the Sixteen Sword-Bearers above, Gabsch 2012, 21 fig. 9.

<sup>116</sup> For the fragment from Qoch Toura (no. 73), Brill 2009, 144 considers even an possibly Islamic date for his sample 6121 Qoch homa (*sic*).

<sup>117</sup> This refers to the Wolseong-ro Tomb no. ga-13, the Hwangnam Daechong, south and north mound, and the Geumwanchong (= Gold Crown Tomb); for the dates of these tombs, see Ham 2013, 33, 38–41; for the compositional analyses, see Lankton – Lee – Kim et al. 2009; Lankton – Gratuze – Kim et al. 2010; Abe – Murakushi – Kim 2019.

<sup>118</sup> *Taiping yulan*, compiled by Li Fang (925–996 CE) et al., completed in 983 CE, ed. Beijing: Zhonghua shuju, *juan* 20, p. 3653; the entry is on cotton cloth, 石勒建平二年, 大宛獻珊瑚、琉璃、[駝]氈、白疊 see, <https://ctext.org/text.pl?node=402250&if=gb#n402255>. See also Trombert 1996, 212; Hansen 2017, 55.

in the presence of Roman silver and gold coins in India, but also finds of Roman glass along the sea routes starting from the Red Sea ports Myos Hormos and Berenike. Roman glass vessels or their fragments were excavated at various sites in southern Arabia and India. Particularly noteworthy are two sites in southern India, Pattanam (Kerala), a site associated with the famous port Muziris on the west coast, and Arikamedu on the east coast<sup>119</sup>. Farther east across the Gulf of Bengal, early Roman glass is also found on the Malay Peninsula, especially at sites that flourished around the turn of the millennia in the region of the Isthmus of Kra<sup>120</sup>. Frequently found in southern Arabia and southern India are Early Roman ribbed bowls dating to the 1<sup>st</sup> century CE. They are easily identified even as fragments. Most of them are monochrome but in a variety of colours. The few elaborate ones made of mosaic glass are rare in comparison. Being high-end products, they were costly and precious objects, like the one from Liu Jing's tomb (no. 1).

110 The geographical distribution of the find contexts in China as well as the political situation in the Wu state and later under the Eastern Jin suggest that most of the glass vessels arrived along maritime routes at the Chinese coast and were further distributed along inland waterways like the Yangzi. This would apply to both, Sasanian and Roman glass vessels (Kieser 2002, 112–113).

111 However, according to anecdotes and poems related to the Western Jin period (265–316 CE), foreign glass vessels arrived already in certain numbers in the 3<sup>rd</sup> century CE. With the Western Jin capital being in Luoyang, some of these might have been transmitted along overland routes as described by Pan Ni (see below 5)<sup>121</sup>. Despite the turbulent times towards the end of the Western Jin period, members of the imperial family and the nobility might have seen to it that their precious glass vessels came along with them when they moved to the south. In fact, a date in the third century, even in its earlier part, would be acceptable for some of the glass vessels discovered in Eastern Jin burials in the Nanjing area, and it is quite possible that a cherished older glass cup accompanied its owner into the tomb.

112 Despite some decline in Roman maritime trade to India after 200 CE, Red Sea trade was still active. With Sasanian glass production being centered in Mesopotamia, in particular near the capital at Veh-Ardashir on the Tigris in present-day Iraq, it is likely that Sasanian glass vessels produced there would have been shipped down the Tigris to the Persian Gulf and from there continued their journey to the Indian Ocean and farther east<sup>122</sup>. Finds of Sasanian origin on the Malay Peninsula and at Oc Eo, the latter a major urban centre of Funan in present-day southern Vietnam, testify to such transmission along maritime networks<sup>123</sup>.

113 Evidence for contacts to the southern seas in the Jin period is provided by other finds in Jiangsu like the cups made from the shell of nautilus which only thrives in tropical waters. Two such cups were discovered in the Western Jin tomb at Pizhou which also held the Sasanian glass vessel (no. 3) and another in the early Eastern Jin tomb of Wang Xingzhi at Nanjing who died in 340 CE (Kieser 2002, 105; Watt 2004, 212 no. 118). Likewise, the ring set with a natural diamond crystal from the tomb of Wang Yi that also contained the two facet-cut glass beakers (nos. 5–6 and Fig. 7–Fig. 8) suggests maritime contact, as a diamond in this period would exclusively come from India (Kieser 2002, 111–112, 214 fig. 3.21). Similar rings with a natural diamond were found at Khlong

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119 For southern Arabia, see Japp 2019, 172–178; for southern India, see Cherian 2014, Cherian 2015. Borell 2010.

120 Borell 2015, 51 fig. 8–9; Borell 2019, 63 fig. 5; Lankton – Gratuze 2019; Borell 2024b.

121 For example, two envoys of Da Qin are recorded in the time of Emperor Wu (reigned 266–290 CE), in the 2<sup>nd</sup> and 5<sup>th</sup> year of his Taikang era (280–289 CE), Leslie – Gardiner 1996, 82, 159.160, 205–206. Graf 2018, 478.

122 See for example, the finds of Sasanian glass vessels from sites in the Persian Gulf area, Andersen 2007, 17–18, and esp. 79–82 for the finds from Bahrain, which find parallels among the imports to China. – On the importance of the maritime routes for imports of Sasanian glass vessels into Japan, see Priestman 2016, 10–12, 25–26.

123 Borell 2021, 292. On finds of Sasanian type glass in Southeast Asia, see above 2.2.2.

Thom on the Malay Peninsula and at Oc Eo of the Funan kingdom.<sup>124</sup> Funan is known from the sources to have sent a number of missions to China between the 3<sup>rd</sup> and 6<sup>th</sup> centuries CE. Interestingly, it is also noted that in the fourth year of Huangwu [225 CE] and/or in the Huanglong era [229–231 CE]: “Funan and other foreign lands came to present tribute of glass (*liuli*)”<sup>125</sup>.

114 Recent archaeological discoveries have shed some new light on the various maritime networks that would have been involved in this exchange, foremost those of South Asian and Southeast Asian seafarers. Inscriptions in the Cave Hoq on Socotra Island testify to the activities of Indian seafarers in the Arabian Sea between the 2<sup>nd</sup> and 4<sup>th</sup> centuries CE, several of them being from Bharukaccha (present-day Bharuch in Gujarat, India), the Barygaza of Greek and Latin sources (Strauch 2012, nos. 11:11, 11:12, 11:17, 11:25, 14:2, 16:19, 17:1). East of India, across the Gulf of Bengal, Indian and Southeast Asian mariners would have been active. As the rich archaeological record demonstrates, the land barrier of the Malay Peninsula was also a contact zone where the networks of the Bay of Bengal and the South China Sea intersected. Connections between southern India and the southern Malay Peninsula were close as reflected in finds of personal seals inscribed in Indian Brahmi and a clay token inscribed in Sri Lankan Brahmi dating from about the late 3<sup>rd</sup> to 2<sup>nd</sup> centuries BCE onwards, as well as the 2<sup>nd</sup> century CE gold seal of an Indian mariner (*navika*)<sup>126</sup>. In the early period, continuing the journey farther east across the Gulf of Thailand to the South China Sea would have involved transpeninsular crossings and a change of ship. Remains of a ship, built in the characteristic Southeast Asian lashed-lug technique, were found on the west coast of the Malay Peninsula at Khlong Thom. Radiocarbon dates of its timbers give a range of 85–229 CE (Manguin 2019, 402–403 fig. 2. Pirotrak 2020. Komoot 2021, 163–165 fig. 4.33 table 4.1; 185, 206 fig. 5.31B). Wooden remains of another large ship, built in the mortise-and-tenon technique familiar from Mediterranean shipbuilding but of tropical woods, were recently discovered farther north on the west coast near the Kra Isthmus sites with radiocarbon dates pointing to the 2<sup>nd</sup> century BC<sup>127</sup>.

115 Clearly, glass vessels found in the Tarim Basin eventually arrived there on land routes, from wherever they initially started their journey. Owing to its geographical position, the Tarim Basin was a crossroads in the multiple route networks between Central and East Asia. The glass vessels originating in Central Asia would have come from lands west of the Pamirs. Some would have continued their travels east as far as Liaoning and Korea (see above 3.3.3). An exclusive transmission along networks of land routes starting in Roman Syria might be imagined for the facet-cut cups or beakers found at Yingpan and Zhagunluke in contexts of the 3<sup>rd</sup> to 4<sup>th</sup> centuries CE, involving on their long journey east a number of different intermediaries, traders and caravan operators, whose identities largely remain unknown for us. For the last section east they might already have included Sogdian traders (La Vaissière 2005, 34–41. Hansen 2017, 224).

116 In general, more complex combinations of sea and land routes have to be considered. Palmyrene merchants, for example, were active not only on overland routes to Central Asia but also in Indian Ocean trade networks in the early centuries

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124 Borell 2017, 34–36 figs. 19–20. The ring from Khlong Thom in southern Thailand is now kept in the Suthiratana Foundation Bangkok. – On Oc Eo in general, see most recently, Manguin – Stark 2022, 640–646.

125 *Yiwen leiju*, *juan* 84 (fourth year of Huangwu); see also *Taiping yulan*, *juan* 4, 808 (Huanglong Era), the entry on glass (*liuli*), <https://ctext.org/text.pl?node=548849&if=gb&show=parallel#pl624356> (accessed 21 April 2024); An 1984, 440; An 1987, 28. On embassies from Funan, see also Wheatley 1983, note 11 on p. 153.

126 Borell 2020, 94–97. For the gold seal from Bang Kluay Nok, see Borell 2015, 53 fig. 13.

127 The remains of the wreck, named Pak Khlong Kluay shipwreck, were revealed after a storm in 2016 and are currently under investigation by the Underwater Archaeology Division, Fine Arts Department, Thailand, see Ploymukda 2020.

CE, and are documented even at the Red Sea port Berenike and on Socotra Island<sup>128</sup>. In the early period, complex systems of route sections were in use, land and sea routes as well as inland waterways were combined. It was not unusual that sections of sea routes across the open sea were connected by overland passages. Land crossings of the Isthmian region of the Malay Peninsula have already been mentioned. Similarly, land routes between the southern Indian west and east coasts were in use in addition to small local crafts operating between the two coasts sailing around Cape Comorin (Casson 1989, 24–25, 230). Even the Roman glasses in the Begram hoard are thought to have started their eastward travel from one of the Red Sea ports to the mouth of the Indus and further along river and land routes to Afghanistan<sup>129</sup>. Such combinations of routes might finally have brought the two facet-cut glass vessels (nos. 34–35 and Fig. 1) that closely resemble some glasses in the Begram hoard, to Loulan. Small glass bottles like the one from Luoyang (no. 20) were certainly traded merely as containers for their precious contents, presumably perfumed oils, the Luoyang bottle being a particularly attractive one (Foy 2018, 268, 275–276). Given the sites where they were found, Tilia Tepe (Afghanistan), Taxila (Pakistan), and Ter (Maharashtra, India), as well as at Qaryat al-Faw in southern Arabia (Saudi Arabia) (see above 3.2), it appears that such bottles with their precious contents were transmitted along both, land and sea routes and presumably also combinations of both.

## 5. Why were the imported glass vessels cherished

<sup>117</sup> Predominantly, the glass vessels from the burial contexts in China belong to the category of prestigious tableware, more specifically drinking vessels such as bowls, cups, and beakers. As far as the fragments permit an identification, this also seems to apply to the finds from the Tarim Basin, certainly to the three known burial contexts of local elites, but also to a number of other fragments that are sufficiently diagnostic such as some of the Roman facet-cut fragments and the facet-cut Sasanian bowls. In contrast, closed containers are rare, and small ones like the bottle from a burial in Luoyang (no. 20) certainly travelled merely as package for their precious content, like perfumed oils.

<sup>118</sup> This preference for open shapes of tableware clearly indicates that the glass vessels as such were appreciated, for their own qualities and aesthetics as well as for being rare and exotic. Containers made of glass are not only easy to clean, they are also without an odour and do not adulterate the taste of the substances they hold, thus making them ideal drinking vessels for the consumption of beverages like grape wine, whose colour would remain visible through transparent colourless glass. The local elites living in the Tarim Basin polities obviously cherished the glass drinking cups, which accompanied their male owners into the grave.

<sup>119</sup> Chinese sources inform us in more detail about the high esteem in which the precious glass vessels were held. A mid-6<sup>th</sup> century CE source mentions the Northern Wei Prince Yuan Chen of Hejian (died in 529 CE) who was a most powerful and wealthy person and loved to show off his various treasures. At a banquet, he set out his huge collection of valuable vessels that included several dozens of wine vessels made from precious materials, such as rock crystal bowls (*bō* 鉢), bowls (*wan* 碗) of agate and of glass, and red jade cups (*zhi* 卮). All of them were exquisitely made and were procured

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<sup>128</sup> Gorea 2012. Żuchowska 2013. Graf 2018, 491–494; on the overland route from Roman Syria, 496–506. Seland 2024.

<sup>129</sup> Mairs 2012, esp. 10; on the port Barbarikon in the Indus delta, see also Seland 2010, 48–51, 72. – Fragments of similar facet-cut glass beakers of this type are well attested at the Red Sea ports, see Meyer 1992, 21 pl.5.76–85; Peacock 2011, 64 nos. 50–53, 56 fig. 7.5; Kucharczyk 2011, 86, 96 nos. 11–14 fig. 9–9; Kucharczyk 2017, 155 fig. 4:1.3–5, 157 fig. 5:7–9.

from Western Lands<sup>130</sup>. The use of precious glass bowls at high-ranking banquets is also illustrated by a number of anecdotes connected to the Jin period. Already in the times of Emperor Wu of Jin (r. 265–290 CE), glass vessels were available to some extent within circles of high-ranking court officials. At an extravagant and lavish banquet attended by Emperor Wu and hosted by his minister and son-in-law Wang Ji, the guests were to be impressed by the entire use of glass vessels, in this case even to serve food.<sup>131</sup> In other anecdotes, a single glass vessel is in the centre of attention. The preciousness of a glass bowl is illustrated by the anecdote about Cui Hong, a minister under the Jin and of such great integrity that he would never talk about money nor handle costly objects. When, at a banquet, Prince Liang of Runan served wine in a glass vessel (*zhong* 鍾), Hong refused thus ensuring that he did not touch the precious glass vessel (*Jin shu* 45, 1288, Thierry 1993, 128). In another Jin period anecdote, Wang Dao (276–339 CE), a prominent member of the Wang clan of Langye at the Jin court, when drinking with other courtiers, raised a glass bowl (*liuli wan*) and asked Zhou Yi (269–322 CE): “Why is this empty bowl called a treasure?”, Zhou Yi answered: “This bowl is lustrous and luminous, genuinely clear and transparent. That’s why it is a treasure!”<sup>132</sup>.

120 The majority of the drinking vessels found clearly represents the upper market segment of luxury ware, as already the ribbed bowl made of mosaic glass and the later colourless cups and bowls embellished by facet-cutting. The Roman colourless glasses had been further refined by the addition of decolourising agents, either antimony or manganese, to achieve an unblemished colourless glass. The high-quality glass in combination with facet-cutting made the glasses sparkle in the light as if they were made of rock crystal.

121 The clean purity of a transparent glass vessel was highly valued. The poem on a dirty glass cup (*Wu zhi fu* 污卮賦) by Fu Xian (239–294 CE), describes the emotions of the author when his cherished wine cup (*zhi* 卮) of transparent glass, which had been given to him as a gift, accidentally fell in the dirt. He compared its appearance to the light of a spring day, and its clearness to the winter ice, and praised its exotic foreign shape. But he was devastated, because being soiled it was no treasure any more, like a gentleman corrupted by wrong conduct, is no longer a gentleman<sup>133</sup>.

122 The poem by Pan Ni (c. 250–311 CE), entitled “Rhapsody on a Glass Bowl” (*Liuli wan fu* 琉璃碗賦), praises in particular the clarity and sparkle of such a glass bowl that arrived as a tributary gift and was used as a drinking cup during an imperial banquet<sup>134</sup>. The first part of the poem is devoted to the imagined journey of the glass bowl crossing high mountains and “shifting sands” that clearly describes its travelling along land routes crossing the Pamirs and the Taklamakan Desert with the peaks of the Kunlun Mountains in view along its southern edge. It is followed by praising first the craftsmen of the faraway country who excelled in the skill of making such a superb glass bowl, and next the astonishing qualities of the bowl itself are praised. The last lines of the poem give us a glimpse of its use at a banquet.

"To raise this bowl to toast the guests

Is to add luster to the imperial’s banquet’s close-packed ranks.

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130 Yuan Chen, Prince of Hejian. Yang Xuanzhi (fl. 6<sup>th</sup> century CE), *Luoyang qielanji* [Record of Buddhist Monasteries in Luoyang] (written about 547 CE), 207 *juan* 4, p. 85; for an English translation, see Jenner 1981, 243; An 2002, 57–58; An 2004, 59; An 2021; Dien 2007, 284.

131 *Jin shu* 42, 1206; *Shishuo xinyu* 30, 26A, for a translation, see Mather 1976, 459 no. 3; Liu 1990, 60. For other uses in the Jin period, see Mather 1976, 479 no. 1.

132 Translation partly borrowed from Mather 1976, 408 no. 14; see also Liu 1990, 60–61; Thierry 1993, 128.

133 *Yiwen leiju* [Collection of Art and Literature], *juan* 73 p. 1259–1260 (entry on *zhi* wine vessel), compiled by Ouyang Xun (557–641 CE) et al. (first published in 624 CE). Shanghai 1965: Zhonghua shuju; see also <https://ctext.org/text.pl?node=547503&if=gb&show=parallel> (accessed 19 May 2024); see also, Harada 1962, 62; An 2002, 57; An 2021, 312.

134 Dien 2007, 291–292. Pan Ni was the nephew of the poet Pan Yue (247–300 CE), Chennault 2019, 635.

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Its flowing luminosity is bright and brilliant so as to discern what is inside,  
The clear wind's glitter and gleam can be seen from without."<sup>135</sup>

## 6. Concluding Remarks

<sup>123</sup> Over the centuries, the glass vessels arriving in the east came from very different regions. The two-fold approach outlined at the beginning provided a basis for a more nuanced view, when assessing glass vessels of Mediterranean production dating from the Roman Imperial period, the earliest from the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE, and of Middle Eastern production of the Sasanian period. One of the most important results is the awareness of a substantial Central Asian production of glass vessels already in the first half of the 1<sup>st</sup> millennium CE, the finds from Niya and Loulan presumably belonging to the period of the late flourish of the sites in the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE.

<sup>124</sup> From the find contexts – in the majority high status burials – we may conclude that glass vessels were costly goods available to few only. Even in their countries of origin many of them would have belonged to the category of luxury ware. In particular, those embellished by facet-cutting represent the upper market segment of Roman and Sasanian glass. Predominantly, the glass vessels that travelled east were prestigious tableware, especially drinking vessels. Judging from the Chinese sources, they were associated with the drinking of wine and displayed as prestige objects at high-profile banquets.

<sup>125</sup> These results also help to a more nuanced approach in tracing patterns of exchange and trade as well as possible routes, overland or by sea. Whereas it seems plausible to assume that the Central Asian glass vessels travelled along land routes across the Pamir Mountains and the Tarim Basin to northern China and even farther to Korea, for the Roman and Sasanian glasses both land and sea routes as well as combinations of both have to be considered.

<sup>126</sup> It is hoped that this review not only gives a new perspective on the potential value of chemical analysis of glasses, but that it may also inspire future research.

## Acknowledgements

<sup>127</sup> It is more than two decades ago that I first became interested in glass in East Asia and in the topic of imported glass vessels discovered in archaeological contexts in the Far East. The person who in the late 1990s sparked my interest in this topic and greatly encouraged me to take up research in glass vessels was Sabine Werner (1935–2023), many years active as consultant and senior researcher for Chinese Archaeology of the German Archaeological Institute, at the time at the Kommission für Allgemeine und Vergleichende Archäologie in Bonn. The other person who encouraged my interest in East Asian glass was Robert H. Brill (1929–2021) of The Corning Museum of Glass, whom I met for the first time in 2001 at Corning during the Congress of the International Association for the History of Glass. His scientific work on glass in the Far East is one of the pillars of this overview. To the memory of these two eminent scholars I dedicate my contribution with deep-felt gratitude.

<sup>128</sup> After a few related papers that I presented at conferences, some of them subsequently published, it needed the special lock-down situation of the recent pandemic

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<sup>135</sup> Translation borrowed from Albert E. Dien 2007, 291–292.

to get me back to work on this topic. In a private online meeting during the pandemic, Annette Kieser, for many years my friend and colleague, expressed great interest in the intended project and pointed out to me how useful it would be to others. This finally triggered the decision to prepare this overview.

129 The work on this overview could not have been done without the generous support of a number of museums and institutions. This applies in particular to the British Museum (London), the Musée Guimet (Paris), the Museum of Ethnography (Stockholm), the Museum für Asiatische Kunst, Staatliche Museen zu Berlin (Berlin), and the National Museum of India (New Delhi) with their collections of glass fragments from the Tarim Basin, collected by European expeditions in the early nineteenth century, as well as The Corning Museum of Glass (Corning, N.Y.), where samples of some of these fragments had been analysed since the 1990s by Robert Brill. To all of them go my sincere thanks for their assistance and generosity in supplying me with photographs and other information.

130 With gratitude and appreciation I acknowledge the gracious support of the numerous colleagues and friends who not only helped with providing photographs or supplying publications difficult to access, but also had an open ear for questions or special problems to discuss. Especially I thank Abe Yoshinari (Tokyo), An Jiayao (Beijing), Laure Dussubieux (Chicago), Ian Freestone (London), Sylvia Fünfschilling (Basel), Susanne Greiff (Tübingen), Alok Kanungo (Ahmedabad), Annette Kieser (Münster), James Lankton (London), Katherine A. Larson (Corning), Li Qinghui (Shanghai), Lin Yixian (Beijing), Liu Song (Shanghai), Andrew Meeks (London), Shing Müller (Munich), Ikue Otani (Kanazawa), René Ployer (Wien), Marga Prüch (Heidelberg), Lilla Russell-Smith (Berlin), Arnim Selbitschka (Munich), Marianne Stern (Amsterdam), Wang Zhigao (Nanjing), and Valérie Zaleski (Paris). My heart-felt thanks go to all of them as well as the unnamed ones who assisted in the numerous libraries and other institutions. Last but not least, special thanks are due to Liu Xiaowo (Heidelberg) who took care of the Chinese characters.

Table 1, part 1

131 Imported glass vessels found in China in contexts dating from the 1<sup>st</sup> to early 5<sup>th</sup> century CE.


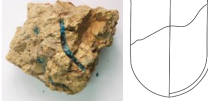
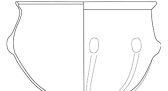



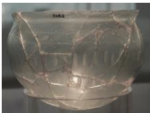
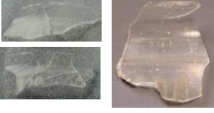
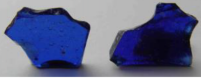
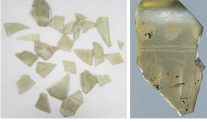
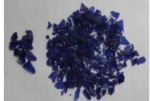




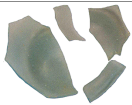
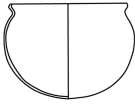

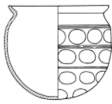
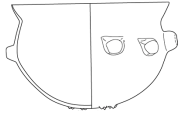
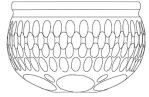

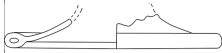

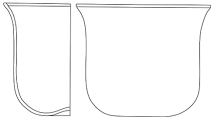

Archaeological context	Period / Date	References	Description of glass vessel	Chemical composition of glass	
<b>Jiangsu</b>					
1 <b>Ganquanshan Tomb 2, Hanjiang, Yangzhou</b> excav. 1981; probably tomb of Liu Jing, King of Guangling (died in CE 67); fragments of ribbed bowl M2:15 found in the looters' fill Nanjing Museum CBMA 1984 sample 3	Eastern Han (25–220) tomb dated to CE 67	<i>Wenwu</i> 1981 (11), 8 fig. 21; An 1984, 415 pl. 3.5; Shi et al. 1984, 455 CBMA sample 3 (analysis); An 1987 2–3 fig. 1, 44 sample 3 (analysis); An 2004, 58 fig. 47; Borell 2010, 127–128 fig.1, table 1; Psarras 2015, 8–9, 21, 143–144.	fragments of ribbed bowl (Isings form 3); mosaic glass, translucent purple and opaque white	m-Na-Ca  Roman natron glass	 Photo courtesy of An Jiayao
2 <b>Laohudun Tomb, Ganquan, Hanjiang, Yangzhou</b> excav. 1984; probably the burial of a high-ranking official (the Marquis of Guangling has been suggested who succeeded the deceased Liu Jing)	Eastern Han (25–220) Early / Middle Eastern Han	<i>Wenwu</i> 1991 (10), 66 fig. 10.8, 70 (analysis); Psarras 2015, 21, 151; Borell 2016, 47–48 fig. 3.1.	fragmented cup with rounded base; pres. H 9.2 cm, estimated D rim 7.8 cm; transparent greenish blue glass	m-Na-Ca  Roman natron glass	 Photo courtesy of Wang Zhigao Right: after <i>Wenwu</i> 1991-2, drawing L. Kreuzburg
3 <b>Jianyaomiao Tomb 1, Pizhou</b> excav. 2015–2016; the glass cup M1:79 was discovered in the western rear chamber close to the left shoulder of the deceased (presumably male)	Western Jin (265–316)	Ma 2017, 32 illustration top centre; Nanjing bowuyuan et al. <i>Dongnan wenhua</i> 2018-2, 30 fig. 17.11 pl. 4.6; <i>Kaogu xuebao</i> 2019-2, 278 fig. 29.3 pl. 24.3; Otani 2022, 28 and 30 cat. no. II-3.	cup with everted rim; around maximum diameter a row of prunts, below each prunt a vertical rib; on the base a circle of small pointed prunts, which serve as tiny feet; H 7.6 cm, D rim 10.6 cm; transparent colourless glass with a pale bluish tint	no chemical analysis available	 After <i>Dongnan wenhua</i> 2018-2, drawing L. Kreuzburg
4 <b>Fuguishan Tomb 4, Nanjing</b> excav. 1997; possibly the burial of a member of the imperial Sima family; glass bowl M4:23 placed in a silver dish	Early Eastern Jin (317–420)	<i>Kaogu</i> 1998 (8), 42 fig. 11.5 pl. 5.5; Kieser 2002, 113, 301–302 no. 3.24; Wang 2011, 57 no. 5 fig. 3; Wang 2015, 424 fig. 4; Borell 2016, 55.	glass bowl of globular shape with everted rim; base with 20 radiating ribs; H 7.8 cm, D rim 8.5 cm; clear glass with a pale bluish tint	no chemical analysis available	 Photo courtesy of Wang Zhigao Right: after Kaogu 1998-8
5 <b>Xiangshan Tomb 7, Nanjing</b> excav. 1970; burial of a high-ranking member of the Wang family, presumably Wang Yi (died in CE 322); glass beaker M7:23 found at head end in man's coffin Nanjing Municipal Museum	Early Eastern Jin (317–420)	<i>Wenwu</i> 1972 (11), 27–36, 29 fig. 8 no. 23, 31 no. 4 pl. 5.1; An 1984, 415–416 pl. 3.3; An 1987, 3 fig. 3; Luo 1994, 217; Kieser 2001, 251; Kieser 2002, 92–93, 114–115, 288–289 no. 3.7; An 2002, 48–49 fig. 8; Watt 2004, 210 cat. no. 116; Kieser 2011 Wang 2015, 424 fig. 2 (left); Borell 2016, 50–51 figs. 3.4 and 3.5.	beaker, reassembled from fragments; H 10.4 cm; D rim 9.4 cm; th. 0.5–0.9 cm; facet-cut; transparent colourless glass with pale yellowish-greenish tint	no chemical analysis available	 Photo courtesy of Ikue Otani
6 <b>Xiangshan Tomb 7, Nanjing</b> excav. 1970; burial of a high-ranking member of the Wang family, presumably Wang Yi (died in CE 322); fragmented glass beaker M7:31 found underneath a bronze wine warmer ( <i>jiao dou</i> ) at head end in coffin of the wife buried to the right Nanjing Municipal Museum	Early Eastern Jin (317–420)	<i>Wenwu</i> 1972 (11), 27–36, 29 fig. 8 no. 31 (mentioned), 31 no. 4; An 1984, 415; An 1987, 3; Luo 1994, 217; Kieser 2001, 251; Kieser 2002, 92–93, 114–115, 288–289 no. 3.7; Watt 2004, 210 cat. no. 116; Kieser 2011; Wang 2015, 424 fig. 2 (right); Borell 2016, 50–51 figs. 3.4 and 3.5.	fragmented beaker, similar to the one above; facet-cut; broken, but reassembled and restored; transparent colourless glass with darker yellowish-brown tint; dark brownish corrosion	no chemical analysis available	 Photo courtesy of Ikue Otani

Fig. 28: Table 1, part 1.

7	<b>Xianheguan Tomb 6, Nanjing.</b> excav. 1998; possibly tomb of Gao Song's parents, Gao Li and his wife; glass bowl M6:83 in the wife's coffin (apparently placed on a lacquer saucer of which only traces remained) Nanjing Municipal Museum	Early Eastern Jin (317–420)	<i>Wenwu</i> 2001 (3), 8 fig. 9, 21 figs. 67, 69; <i>Chinese Archaeology</i> 2,1, 2002, 245–246 fig. 14; An 2002, 55 note 29; Wang 2015, 424 fig. 3; Borell 2016, 54 fig. 3.8.	glass bowl, reassembled from fragments; globular shape with everted rim; H 7 cm; D rim 7 cm; facet-cut; transparent colourless glass	no chemical analysis available	 Photo: B. Borell
8	<b>Nanjing Daxue Beiyuan Tomb, Nanjing University, Nanjing</b> excav. 1972; possibly imperial burial; the fragments of the cup were found in the entrance area of the side chamber M:44 CBMA 1984 sample 6	Early Eastern Jin (317–420)	<i>Wenwu</i> 1973 (4), 39 fig. 25, 44, 47 fig.3; An 1984, 416; <i>Kaogu xuebao</i> 1984 (4), 455 CBMA sample 6 (analysis); An 1987, 3, 40, 44 sample 6 (analysis); An 1991, 15 no. 14 (analysis); Luo 1994, 218–219 table 7–9; An 2002, 49 note 10; Kieser 2002, 297–299 no. 3.21; Wang 2015, 45 fig. 5; Borell 2016, 46 table 3.1 (analysis no. 3), 52 fig. 3.6.	fragments of a cup; everted rim, convex side wall; D rim 10 cm; th. 0.1 cm; facet-cut, decoration of horizontal grooves and vertical oblong facets; transparent colourless	m-Na-Ca Roman natron glass decolourised with antimony (Sb <sub>2</sub> O <sub>3</sub> )	 Left: from Wenwu 1973-4. Right: Photo courtesy of Wang Zhigao
9	<b>Tomb at south slope of Yanshan, Licun, Shangfang, Jiangning, Nanjing.</b> excav. 2007; IRAMAT-CEB sample no. NJ01-1 0	Early Eastern Jin (317–420)	IRAMAT analysis by J. Lankton and B. Gratuze, pers. comm. 2008; Wang 2011, 57 no.7, 59 table (analysis); Wang 2015, 425 fig. 6; Borell 2016, 46 table 3.1 (analysis no. 6).	numerous fragments of vessel of undetermined shape, probably a bowl; left: 2.3 x 1.8 cm, Th 0.2–0.4 cm; transparent dark blue	m-Na-Ca Roman natron glass	 Photo courtesy of Wang Zhigao
10	<b>Mufushan, Great Tomb, Nanjing</b> (aka Qilun Dianjichang Great Tomb / Beigushan Great Tomb), excav. 1981; possibly the burial of a member of the imperial Sima family Nanjing Municipal Museum CBMA 1984 sample 7 NIGM 1983 table 1	Middle Eastern Jin (317–420)	Zhu 1983, 321 tables 1 and 2 (NIGM and CBMA analyses); An 1984, 416; Shi et al. 1984, 455 sample 7 (analysis); An 1987, 3, 40, 44 sample 7 (analysis); Kwan 2001, 59 fig.1; Kieser 2002, 303–304 no. 3.26; Gan 2009, 89; Wang 2015, 426 no. 12 fig. 9 (right), Borell 2016, 46 table 3.1 (analyses nos. 4a.b), 53 fig. 3.7.	25 fragments of a beaker, largest fragment 5.5 x 3.0 cm, thickness 0.2–0.5 cm; below the rim a row of ground roundels; two horizontal ground lines row of vertical facet-cut; transparent colourless with a pale yellowish tint (not clear whether the fragments are of one or possibly two beakers?)	m-Na-Ca Roman natron glass, decolourised with manganese (MnO)	 Photo courtesy of Wang Zhigao Right: from Kwan 2001
11	<b>Mufushan, Great Tomb, Nanjing</b> (aka Qilun Dianjichang Great Tomb / Beigushan Great Tomb), excav. 1981; possibly the burial of a member of the imperial Sima family CBMA 1984 sample 8 NIGM 1983 table 1	Middle Eastern Jin (317–420)	Zhu 1983, 321 tables 1 and 2 (NIGM and CBMA analyses); Shi et al. 1984, 455 CBMA sample 8 (analysis); An 1987, 40, 44 sample 8 (analysis); Kieser 2002, 303–304 no. 3.26; Wang 2015, 426 no. 12 fig. 9 (left); Borell 2016, 46 table 3.1 (analyses nos. 5a.b), 53.	numerous fragments of vessel (shape undetermined); transparent dark blue	m-Na-Ca Roman natron glass	 Photo courtesy of Wang Zhigao
12	<b>Hongmaoshan Tomb, Shimenkan, Nanjing.</b> excav. 1955	Eastern Jin (317–420)	<i>Kaogu tongxun</i> 1958 (9), 69; An 1984, 416 note 2; An 1987 p. 3 with note 4; An 2002, 49 note 10; Kieser 2002, 118, 321–322 no. 3.59; Wang 2011, 57 no. 8.	fragments, probably of a cup; facet-cut	no chemical analysis available	no illustration available
13	<b>Guojiashan Tomb 13, Nanjing.</b> excav. 2001; possibly the tomb of Wen Songzhi	Late Eastern Jin (317–420) / Early Liu Song (420–479) early 5 <sup>th</sup> c.	<i>Kaogu</i> 2008 (6), 17–22, esp. 22; Kieser 2011, 67–68 table 4–6; Wang 2015, 426 no. 13 fig. 10.	small fragments of glass vessel (shape undetermined); transparent colourless glass	no chemical analysis available	 Photo courtesy of Wang Zhigao

14	<b>Guojiaoshan Tomb 13, Nanjing,</b> excav. 2001; possibly the tomb of Wen Songzhi	Late Eastern Jin (317–420) / Early Liu Song (420–479) early 5 <sup>th</sup> c.	<i>Kaogu</i> 2008 (6), 17–22, esp. 22; Kieser 2011, 67–68 table 4–6; Wang 2015, 426 no. 13 fig. 10.	small fragments of glass vessel (shape undetermined); transparent colourless and transparent greenish blue glass	no chemical analysis available	 Photo courtesy of Wang Zhigao
15	<b>Guojiaoshan Tomb 13, Nanjing,</b> excav. 2001; possibly the tomb of Wen Songzhi	Late Eastern Jin (317–420) / Early Liu Song (420–479) early 5 <sup>th</sup> c.	<i>Kaogu</i> 2008 (6), 17–22, esp. 22; Kieser 2011, 67–68 table 4–6; Wang 2015, 426 no. 13 fig. 10.	small fragments of glass vessel (shape undetermined); transparent dark blue glass	no chemical analysis available	 Photo courtesy of Wang Zhigao
16	<b>Chuncheng Tomb, Jurong, Zhenjiang</b> excav. 1985; tomb of Liu Zong (died in CE 439), glass bowl found in wood coffin	Liu Song (420–479) tomb dated to CE 439	An 1986b; An 2002, 54; Watt 2004, 211 cat. 117; Wang 2007, 14 pl. 4.1; Wang 2015, 426–427 no. 14 fig. 11.	glass bowl of globular shape with everted rim (complete, unbroken); thin-walled; H 6.3 cm; D rim 8.5 cm; facet-cut: 6 rows of overlapping circular facets appearing as hexagons; transparent colourless glass	no chemical analysis available	 After Wang 2015, drawing L. Kreuzburg
<b>Anhui</b>						
17	<b>Dangtu, Tomb,</b> excav. 2005;  fragments of glass bowl discovered in rear chamber	Early Eastern Jin (317–420)	<i>Dongnan wenhua</i> 2006 (2), 33–39 (analysis); Wang 2015, 425 fig. 7; Otani 2022, 24 fig. 1. III-2.	four fragments of glass bowl with everted rim; largest fragment 7.0 x 4.2 cm; Th wall 0.08–0.15 cm; est. D rim 13 cm; transparent pale greenish glass	v-Na-Ca plant-ash soda glass  probably Sasanian	 From Wang 2015
<b>Guangdong</b>						
18	<b>Shidaigang Tomb 5, Xiatang, Guangzhou;</b> excav. 1986; glass bowl M5:18 found broken in back part of rear chamber	Late Western Jin (265–316)	<i>Kaogu</i> 1996 (1), 37 fig. 2; 43 (analysis); Kieser 2004, 106–107; Borell 2016, 55.	fragments of vessel of undetermined shape (a bowl?), thin-walled (th. 0.1–0.2 cm); remains of a rib on exterior; blue glass	inconclusive chemical analysis	no illustration available
19	<b>Pingshigang Tomb 1, Zhaoqing,</b> excav. 2001; assumed to be the tomb of the “Guangxin Marquis of Cangwu” glass bowl M1:29 SIOFM sample GD05	Eastern Jin (317–420) tomb dated to CE 325	<i>Huanan kaogu</i> 2004, 259 fig. 13,4, pl. 16,5; Li et al. 2003, 77, 81 table 1 sample GD05 (analysis); Li 2005, 296 table 2 no. 199 (analysis); Gan 2009, 85 fig. photo 2.25, 93 table 2.8 (analysis); Wang 2015, 425–426 no. 11 fig. 8; Borell 2016, 55; Huang 2021, 545–546 fig. 14.14.	glass bowl of globular shape with everted rim; H 7 cm, D rim 8.8 cm, weight 54 g; transparent colourless with a bluish-greenish tint	v-Na-Ca plant-ash soda glass  Sasanian	 After <i>Huanan kaogu</i> 2004, drawing L. Kreuzburg
<b>Henan</b>						
20	<b>Luoyang, Tomb,</b> excav. 1987  Luoyang Museum	Eastern Han (25–220)	Luoyang Cultural Relics Work Team 1990, 72, cat.no. 50; Watt 2004, 113 cat. 13.	piriform bottle, blown, intact apart from small chip on rim; rim folded outward and upward towards interior; H 13.6 cm, D rim 3.7 cm; translucent green glass with a spiralling opaque white glass thread applied during the blowing process	no chemical analysis available	 From Luoyang Cultural Relics Work Team 1990, drawing L. Kreuzburg
<b>Hubei</b>						
21	<b>Xishan Tomb 1, Ezhou,</b> excav. 1991; glass vessel fragment M1:5 found in rear chamber; possibly the tomb of Sun Lin who died in CE 249	Wu (222–280) tomb possibly about mid-3 <sup>rd</sup> century CE	<i>Kaogu xuebao</i> 1998 (1), 122, 130–131; Wang 2011, 56 no. 1.	fragment of a glass vessel, transparent colourless	no chemical analysis available	no illustration available
22	<b>Wulidun Tomb 4021, Echeng, Ezhou,</b> excav. 1978 (then named tomb 121); glass bowl M4021:3  Echeng Municipal Museum  CBMA 1984 sample 5	Western Jin (265–316)	An 1984, 419; Shi et al. 1984, 455 sample 5 (analysis); An 1986, 173 fig. 1.,2; An 1987, 7, 44 sample 5 (analysis); An 2004, 61 fig. 51 (mirror-inverted); <i>Echeng Liu Chao mu</i> 2007, 303–304 fig. 219.3, colour pl.15.14, 305 table 1 (analysis); Wang 2011, 55 no. 2, 59 table 2 (analysis no. 3).	glass bowl of globular shape with everted rim and round base, restored from fragments; H 9.4 cm, D rim 10.2 cm; Th. 0.3 cm; decorated with four rows of shallow-cut roundels, the upper two rows between multiple horizontal cut lines; transparent colourless glass with a pale bluish-greenish tint.	v-Na-Ca plant-ash soda glass  Sasanian	 After <i>Echeng Liu Chao mu</i> 2007, drawing L. Kreuzburg

23	<b>Wulidun Tomb 4021, Echeng.</b> excav. 1978 (then named tomb 121); fragment of glass bowl M4021:4	Western Jin (265–316)	<i>Echeng Liu Chao mu</i> 2007, 303–304.	wall fragment of a glass bowl similar to M4021:3, but with smaller max. diameter; th. of wall 0.25 cm; remains of two rows of shallow-cut roundels, four in the upper row (between multiple horizontal cut lines) and three in the row below; transparent colourless glass with a pale bluish-greenish tint	no chemical analysis available	no illustration available
<b>Hebei</b>						
24	<b>Tomb of Hua Fang, Babaoshan, Beijing</b> (western suburbs), excav. 1965; Hua Fang, the wife of Wang Jun, army commander of Youzhou  Beijing, Capital Museum	Western Jin (265–316) tomb dated to CE 307	<i>Wenwu</i> 1965 (12), 21–26; An 1986a, fig. 2, 180 (analysis); An 2002, 51–52; An 2004, 60–61 fig. 50; Shen – Li 2005, no. 49; Gan 2009, 93 table 2.8 (analysis).	bowl with everted rim, reassembled from fragments and restored; 10 prunts around maximum diameter; on the rounded base an oval of 7 small prunts (each with two peaks), which serve as tiny feet; H 7.2 cm, D rim 10.7 cm; clear bubbly glass with a pale bluish-greenish tint	v-Na-Ca plant-ash soda glass  Sasanian	 After An 1986a, drawing L. Kreuzburg
<b>Shanxi</b>						
25	<b>Datong, southern suburb Tomb 107</b> excav. 1988 glass bowl M107:17 Datong Municipal Museum	Northern Wei (386–534) tomb dates no later than the mid-5 <sup>th</sup> c.	<i>Wenwu</i> 1992 (8), 1–11; Müller 1998, VI.7–8 pl. VI.2; Watt 2004, 156 cat. 65; <i>Datong</i> 2006, 230 fig. 105E, pl. 11.2; An and Liu 2015, 350–351. Zhao Yong 2019, 23 fig. 1.4.	bowl with upright offset rim; thick-walled; facet-cut; D rim 10.3 cm, H 7.5 cm; transparent colourless glass with a pale yellowish-greenish tint	no chemical analysis available	 After Datong 2006, drawing L. Kreuzburg
<b>Liaoning</b>						
26	<b>Xiguanyingzi Tomb 1, Beipiao, excav. 1965;</b> tomb of Feng Sufu (died in CE 415), younger brother of Feng Ba (= Emperor Wencheng of Northern Yan)  Shenyang, Liaoning Provincial Museum  CBMA sample 9 glass bowl M1:71	Northern Yan (409–436)	<i>Wenwu</i> 1973 (3), 6 fig. 9,3; Li 1974, 116–117 fig. 9,3; Werner 1981, 148–149 fig. 10,2; An 1984, 417 pl.4,3; <i>Shi et al.</i> 1984, 450, 455 sample 9 (analysis); Lankton et al. 2009, 583, 704 pl. 128; Liaoning 2015, 35 fig. 23.3, pl. 32; Żuchowska/Szmoniewski 2017, 169 fig. 5; Aihaiti 2018.	bowl of globular shape (alms bowl <i>bo</i> ), reassembled from fragments, folded upright rim; blown; D rim 9.5 cm, H as restored 9.2 cm; transparent pale green glass	v-Na-Ca plant-ash soda glass  Central Asian (high K)	 After Werner 1981, drawing L. Kreuzburg
27	<b>Xiguanyingzi Tomb 1, Beipiao, excav. 1965;</b> tomb of Feng Sufu (died in CE 415) glass foot fragment M1:72  Shenyang, Liaoning Provincial Museum	Northern Yan (409–436)	<i>Wenwu</i> 1973 (3), 6 fig. 9,2; Li 1974, 116–117 fig. 9,2; Werner 1981, 148–149 fig. 10,4 An 1984, 417; An 1987, 4–5; Liaoning 2015, 35 fig. 23,4; Żuchowska/Szmoniewski 2017, 169 fig. 5.	stemmed foot (broken, reassembled from fragments); blown; D 7.6 cm; transparent pale green glass (the foot of the bowl above ?)	no chemical analysis available	 After Werner 1981, drawing L. Kreuzburg
28	<b>Xiguanyingzi Tomb 1, Beipiao, excav. 1965;</b> tomb of Feng Sufu (died in CE 415) shallow glass bowl M1:68  Shenyang, Liaoning Provincial Museum	Northern Yan (409–436)	<i>Wenwu</i> 1973 (3), 6 fig. 9,1 colour pl. 1; Li 1974, 116 fig. 9,1; Werner 1981, 148–149 fig. 10,1; An 1984, 417; An 1987, 4–5; Watt 2004, 132 cat. 42; Liaoning 2015, 35 fig. 23.1, pl. 29, 264 table (analysis); Żuchowska/Szmoniewski 2017, 169 fig. 5; Aihaiti 2018.	shallow bowl (complete, undamaged), rim folded inward; applied ring foot; blown, pontil mark; H 4.1 cm, D rim 13 cm; Th 0.2 cm; transparent pale green glass	chemical analysis not fully conclusive	 Photo courtesy of An Jiayao
29	<b>Xiguanyingzi Tomb 1, Beipiao, excav. 1965;</b> tomb of Feng Sufu (died in CE 415) glass cup M1: 69  Shenyang, Liaoning Provincial Museum	Northern Yan (409–436)	<i>Wenwu</i> 1973 (3), 6 fig. 9,4 pl. 4,2; Li 1974, 116 fig. 9,4; Werner 1981, 148–149 fig. 10,3; An 1984, 417; An 1987, 4–5; Kwan 2001, 59 fig. 65,5; Liaoning 2015, 35 fig. 23.2, pl. 31, 264 table (analysis); Żuchowska/Szmoniewski 2017, 169 fig. 5; ; Aihaiti 2018.	cup of almost cylindrical shape with everted rim, concave base; blown, pontil mark; H 7.7 cm, D 9.3 cm; transparent emerald-green glass	chemical analysis not fully conclusive	 After Werner 1981, drawing L. Kreuzburg
30	<b>Xiguanyingzi Tomb 1, Beipiao, excav. 1965;</b> tomb of Feng Sufu (died in CE 415) animal-shaped glass vessel M1:70  Shenyang, Liaoning Provincial Museum	Northern Yan (409–436)	<i>Wenwu</i> 1973 (3), 7 fig. 10 pl. 3,1; Li 1974, 116–117 fig. 10; La Baume 1974, 126–127; Werner 1981, 148–149 fig. 10,6; An 1984, pl. IV,1; An 1987, 4–5 fig. 5; An 2004, 59 fig. 48; Gan 2009, 90 photo 2.29; Liaoning 2015, 36 fig. 24, pl. 30, 264 table (analysis); Żuchowska/Szmoniewski 2017, 169 fig. 5; Aihaiti 2018.	duck-shaped or snail-shaped vessel; applied glass threads; blown; L 20.5 cm, D 5.2 cm; transparent pale green glass (in quality and colour similar to the shallow bowl above)	chemical analysis not fully conclusive	 After Werner 1981, drawing L. Kreuzburg

## Table 1, part 2

132 Imported glass vessels found in Xinjiang Uygur Autonomous Region dating from about the first half of the 1<sup>st</sup> millennium CE.

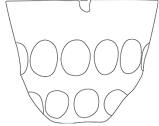




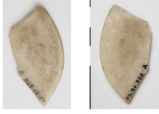




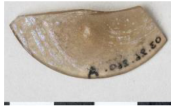






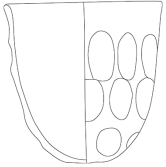

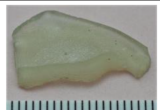
Archaeological context	Period / Date	References	Description of glass vessel	Chemical composition of glass	Illustration
<b>Xinjiang Uygur Autonomous Region</b>					
<b>31</b> <b>Yingpan Tomb 9, Yuli</b> , excav. 1995 burial of man and wife, glass cup 95BYYM9:1 found above the man's head; cup probably dating from the mid to second half of the 3 <sup>rd</sup> c. CE Urumqi, Xinjiang Uygur Autonomous Region Museum CMG sample 7015	period of tombs mainly 3 <sup>rd</sup> -4 <sup>th</sup> c. CE	Xinjiang 1999, 199 no. 0531; <i>Wenwu</i> 2002 (6), 11- 12, 22 fig. 33, 36 fig. 59, 41 fig. 66,7*; Brill 1999, sample 7015: vol. 1, 148; vol. 2, 344 (analysis); An 2002, 62-63 note 59, fig. 11; Gan 2009, 59 photo 2.12; Brill 2009, sample 7015: 124 table 3.2; 131-132 table 3.3.4 (analysis). Selbitschka 2010, 206-207, 551 colour ill. 1.	cup, H. 8.8 cm, D rim 10.8 cm; facet-cut; transparent colourless glass	m-Na-Ca  Roman natron glass, decolourised with antimony (Sb <sub>2</sub> O <sub>3</sub> )	 After <i>Wenwu</i> 2002-6, drawing L. Kreuzburg
<b>32</b> <b>Yingpan Tomb Ying.III.3, Yuli</b> , excav. by Sir Aurel Stein in 1915, glass beaker, Ying.III.3.06 burial of a man; the beaker was placed to the right of his head  New Delhi, Nat. Mus. of India, Accession No. 2002/3/533	period of tombs mainly 3 <sup>rd</sup> -4 <sup>th</sup> c. CE	Stein 1928, 756, 760-761 pl. 110; Andrews 1935, 317. Selbitschka 2010, 124, 274- 275.	cup, with flat base and thickened rim; complete, though broken and mended; H 5.7 cm, D rim 6.8 cm, D base 2.2 cm; facet-cut, two rows of ovals and below a row with seven disks; transparent colourless glass with a pale greenish tint	no chemical analysis available	 Left: from Stein 1928 Right: photo courtesy of National Museum of India, New Delhi
<b>33</b> <b>Loulan, Site L.B., from stupa</b> collected by Sir Aurel Stein, 1906, L.B. 0015,  London BM, MAS 697  CMG sample 8501	2 <sup>nd</sup> c. BCE-4 <sup>th</sup> c. CE	Stein 1921, 441 L.B.0015; Moore 1998, 79 fig. 19.3 (left); Brill 2009, sample 8501: 124 table 3.2, 135-136 table 3.3.6 (analysis), 146; Brill and Stapleton 2012, sample 8501: 77 and 167 (analysis). Also analysed in the British Museum Laboratories, Department of Scientific Research in 2002, Ian Freestone, pers.comm. Sept. 2022. <a href="https://www.britishmuseum.org/collection/object/A_MAS-697">https://www.britishmuseum.org/collection/object/A_MAS-697</a>	fragment of vessel; 4.9 x 3.3 cm, Th 0.9 cm; facet-cut; on convex exterior, remains of four circular facets, indicating three rows of spaced facets, alternatingly arranged; D of the most complete facet (here below) c. 2.5 cm, the other well preserved facet above larger; colourless glass	m-Na-Ca  Roman natron glass, decolourised with antimony (Sb <sub>2</sub> O <sub>3</sub> )	 Photo courtesy of <b>BM</b>
<b>34</b> <b>Loulan 80LBC, Ruoqiang county</b> collected 1980 cup fragment C:180A  SIOFM sample XJ-45	2 <sup>nd</sup> c. BCE-4 <sup>th</sup> c. CE	<i>Wenwu</i> 1988 (7), 17-18, figs. 71.1 and 81; Li et al. 2005, 5-6 sample XJ-45 (analysis); Li et al. 2009, 338, 353, 80LBC:180A sample XJ-45 (analysis); Yu 2010, 191 fig.1 (right).	rim fragment of cup; max. W of fragment at rim 5.6 cm, Th at rim 0.4 cm, Th wall 1-2 cm; facet-cut; transparent colourless glass	m-Na-Ca  Roman natron glass, decolourised with antimony (Sb <sub>2</sub> O <sub>3</sub> )	 Left: from <i>Wenwu</i> 1988-7. Right: after Yu 2010.
<b>35</b> <b>Loulan</b> , area collected 1980	2 <sup>nd</sup> c. BCE-4 <sup>th</sup> c. CE	Xinjiang 1985, pl. 232; Taniichi 1990, fig. 1; An 2002, 62.	fragment of cup; 4.5 x 2.2 cm; facet-cut; transparent colourless	no chemical analysis available	 After Xinjiang 1985, drawing L. Kreuzburg
<b>36</b> <b>Loulan</b> , area collected after 1949, Urumqi, Xinjiang Museum	2 <sup>nd</sup> c. BCE-4 <sup>th</sup> c. CE	An 1984, 438-439; An 1987, 26; An 2002, 61.	wall fragment; facet-cut, long oval facets; transparent colourless with a pale yellow- greenish tint	no chemical analysis available	no illustration available
<b>37</b> <b>Loulan</b> , collected after 1949, Urumqi, Xinjiang Museum	2 <sup>nd</sup> c. BCE-4 <sup>th</sup> c. CE	An 1984, 438-439; An 1987, 26; An 2002, 61.	rim fragment of cup; relief band, oval facets; transparent colourless with a pale yellowish tint	no chemical analysis available	no illustration available

Fig. 29: Table 1, part 2.






38	<b>Loulan</b> , area collected after 1949, Urumqi, Xinjiang Museum CBMA sample 47	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	An 1984, 438–439; Shi et al. 1984, 452, 455 table 1, sample 47 (analysis); An 1987, 26, 42, 44 sample 47 (analysis); An 2002, 61.	wall fragment; transparent greenish	m-Na-Ca Roman natron glass	no illustration available
39	<b>Loulan</b> , area collected after 1949, Urumqi, Xinjiang Museum CBMA sample 48	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	An 1984, 438–439; Shi et al. 1984, 452, 455 table 1, sample 48 (analysis); An 1987, 26, 42, 44 sample 48 (analysis); An 2002, 61.	rim fragment; transparent colourless	m-Na-Ca Roman natron glass	no illustration available
40	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0259.A; CMG sample 6810	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Conrady 1920, pl. III, 34; Brill 1999, sample 6810: vol. 1, 147; Brill 2009, sample 6810: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 142; Brill and Stapleton 2012, 517.	fragment of base and part of the wall of a thin-walled blown vessel; base diameter about 6.5 cm; colourless glass	m-Na-Ca Roman natron glass	 Photo courtesy of MoE, Stockholm
41	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm, MoE 1903.26.0260.D; CMG sample 6814	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6814: vol. 1, 147; Brill 2009, sample 6814: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517.	vessel fragment; colourless glass	m-Na-Ca Roman natron glass	 Photo courtesy of MoE, Stockholm
42	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.I; CMG sample 6815	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6815: vol. 1, 147; Brill 2009, sample 6815: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517.	vessel fragment; thick-walled; remains of a circular or oval ground facet; colourless glass (possibly from same vessel as CMG sample 6816)	m-Na-Ca Roman natron glass	 Photo courtesy of MoE, Stockholm
43	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.J; CMG sample 6816	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6816: vol. 1, 147; Brill 2009, sample 6816: 119 fig. 3.6, 125–126 table 3.3.1, 143; Brill and Stapleton 2012, 517.	vessel fragment; thick-walled; remains of facet-cutting (two different motifs?); colourless glass (possibly from same vessel as CMG sample 6815)	m-Na-Ca Roman natron glass	 Photo courtesy of MoE, Stockholm
44	<b>Loulan, vicinity of Site L.K., ruined fort</b> collected by Sir Aurel Stein, 1914, L.K. 060, found in the vicinity of L.K. site London BM 1928,1022.10 CMG sample 8502	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE, date suggested by Stein for the ruined fort : 3 <sup>rd</sup> to first third of 4 <sup>th</sup> c. CE	Stein 1928, 190 L.K. 060 pl. XXIV; Brill 2009, sample 8502: 124 table 3.2, 135–136 table 3.3.6 (analysis), 146; Brill and Stapleton 2012, sample 8502: 77 167 (analysis), 517. <a href="https://www.britishmuseum.org/collection/object/A_1928-1022-10">https://www.britishmuseum.org/collection/object/A_1928-1022-10</a>	rim fragment of thin-walled cup; est. D rim c. 9 cm, pres. H 2.6 cm, W 2.9 cm; Th at rim 0.2 cm; facet-cut; translucent purple glass	v-Na-Ca plant-ash soda glass	 Photo courtesy of BM
45	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.A; CMG sample 6811	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6811: vol. 1, 147; Brill 2009, sample 6811: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 142; Brill and Stapleton 2012, 517, 638 (Sr).	foot fragment; steep rise; colourless glass	v-Na-Ca Central Asian (high K <sub>2</sub> O)	 Photo courtesy of MoE, Stockholm
46	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.K; CMG sample 6819	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE, flourishing mainly 3 <sup>rd</sup> –4 <sup>th</sup> c. CE	Brill 1999, sample 6819: vol. 1, 147; Brill 2009, sample 6819: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517.	wall (?) fragment; thin-walled; possibly with threaded decoration; colourless glass	v-Na-Ca Central Asian (high K <sub>2</sub> O)	 Photo courtesy of MoE, Stockholm

47	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.C;  CMG sample 6813	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6813: vol. 1, 147; Brill 2009, sample 6813: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517.	foot fragment; flat; colourless glass with olive green tint	v-Na-Ca  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> )	  Photo courtesy of <b>MoE, Stockholm</b>
48	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.B;  CMG sample 6812	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6812: vol. 1, 147; Brill 2009, sample 6812: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517, 638 (Sr).	foot fragment; colourless glass	v-Na-Ca  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	  Photo courtesy of <b>MoE, Stockholm</b>
49	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.E;  CMG sample 6817	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE,	Brill 1999, sample 6817: vol. 1, 147; Brill 2009, sample 6817: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517, 638 (Sr).	wall fragment; thickly applied threads apparently forming a net pattern; colourless glass	v-Na-Ca  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	  Photo courtesy of <b>MoE, Stockholm</b>
50	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0260.G;  CMG sample 6818	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Brill 1999, sample 6818: vol. 1, 147; Brill 2009, sample 6818: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517, 638 (Sr).	neck fragment of vessel; translucent pale green glass	v-Na-Ca  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	  Photo courtesy of <b>MoE, Stockholm</b>
51	<b>Loulan</b> , collected by Sven Hedin 1900–1901, Stockholm MoE 1903.26.0257.A;  CMG sample 6827	2 <sup>nd</sup> c. BCE–4 <sup>th</sup> c. CE	Conrady 1920, pl. III, 33; Brill 1999, sample 6827: vol. 1, 147; Brill 2009, sample 6827: 119 fig. 3.6, 125–126 table 3.3.1 (analysis), 143; Brill and Stapleton 2012, 517, 638 (Sr).	fragment; transparent pale blue glass	v-Na-Ca  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	  Photo courtesy of <b>MoE, Stockholm</b>
52	<b>Zhagunluke Tomb 49 of cemetery No.1, Qiemo</b> , excav. 1996 glass cup 96QZIM49:4  Urumsqi, Xinjiang Uygur Auronomoius Region Museum	third cultural phase, 3 <sup>rd</sup> –6 <sup>th</sup> c. CE	Ma and Yue 1998 no. 124. <i>Kaogu xuebao</i> 2003 (1), 126–127, 129 fig. 38,2 and pl. 16,4; Gan 2009, 59 photo 2.11; Wang and Lu 2009, 301; Selbitschka 2010, 363– 365, 551 colour ill. 2; Zhao 2014, figs. 1 and 2.1; Cheng et al. 2011 (analysis); Cheng et al. 2016, fig. 10.2, 199 table 10.2 (analysis).	cup; H 6.7 cm, D rim 6.8 cm; Th 0.3–0.34 cm; facet-cut with three rows of oval facets; transparent colourless glass	m-Na-Ca  Roman natron glass, decolourised with manganese (MnO)	  After <i>Kaogu xuebao</i> 2003-1, drawing L. Kreuzburg
53	<b>Endere Fort</b> , Post south of Endere Fort, collected by Sir Aurel Stein, 1906, E. Ft. 0011  London BM, MAS 576 CMG sample 8500	Han to Tang	Stein 1921, 282–283, 291– 292 E.Fort 011, pl. XXXVI; Moore 1998, 79 fig. 19.3 (right); Brill 2009, sample 8500: 124 table 3.2, 135–136 table 3.3.6 (analysis), 146; Brill and Stapleton 2012, sample 8500: 77 and 167 (analysis). Also analysed in the British Museum Laboratories, Department of Scientific Research in 2002, Ian Freestone, pers.comm. Sept. 2022. <a href="https://www.britishmuseum.org/collection/object/A_MAS-576">https://www.britishmuseum.org/collection/object/A_MAS-576</a>	fragment of a beaker; pres. H 4.6, W 5.1 cm, est. D at the horizontal band with vertical strokes c. 8.0 cm; Th 0.4 cm. facet-cut; colourless glass	m-Na-Ca  Roman natron glass, decolourised with antimony (Sb <sub>2</sub> O <sub>3</sub> )	  Photo courtesy of <b>BM</b>
54	<b>Endere city site/An-Di'er city site, Khotan/Hetian</b> , collected after 1949  SIOFM sample XJ-43A SIOFM sample XJ-43-2	Han (202 BCE–CE 220) to Jin (265– 420)	Analyses: Li et al. 2005, sample XJ-43A; Li et al. 2009, sample XJ-43A : 339, 347, 353; Liu et al. 2011, sample XJ-43-2: 368 table 2, 369 table 3 (analysis), 374.	vessel fragment; wall th. c. 3 mm; facet-cut; transparent colourless with pale green-yellow tint	v-Na-Ca plant-ash soda glass  Sasanian	  Photo courtesy of Liu Song and Li Qinghui

55	<b>Endere city site/An-Di'er city site, Khotan/Hetian,</b> collected after 1949  SIOFM sample XJ-43-1	Han (202 BCE–CE 220) to Jin (265–420)	Liu et al. 2011, sample XJ-43-1: 368 table 2, fig. 3c, 369 table 3 (analysis), 374.	vessel fragment; wall th. c. 3 mm; facet-cut (remains of three facets); transparent colourless with pale green-yellow tint	v-Na-Ca plant-ash soda glass  Sasanian	 Photo courtesy of Liu Song and Li Qinghui
56	<b>Endere city site/An-Di'er city site, Khotan/Hetian,</b> collected after 1949  SIOFM sample XJ-43-3	Han (202 BCE–CE 220) to Jin (265–420)	Liu et al. 2011, sample XJ-43-3: 368 table 2, fig. 3j, 369 table 3 (analysis), 374.	vessel fragment; wall th. c. 1 mm; decorated with applied glass threads; transparent pale yellowish glass	v-Na-Ca plant-ash soda glass  Central Asian (high K <sub>2</sub> O)	 Photo courtesy of Liu Song and Li Qinghui
57	<b>Niya, cemetery 93MNII, burial 4, Khotan,</b> excav. 1993  sample IOA UCL G 33 (2007)	flourished mainly 1 <sup>st</sup> c. BCE to 4 <sup>th</sup> c. CE	Lin, pers. comm. April 2009, sample G33.	vessel fragment; c. 2.0 x 1.8 cm; decorated with applied glass threads; transparent blue glass	v-Na-Ca plant-ash soda glass  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	 Photo courtesy of Lin Yixian
58	<b>Niya, Settlement Site N8, Khotan</b> collected 2007  Urumqi, Xinjiang Uygur Aeronomiouis Region Museum	flourished mainly 1 <sup>st</sup> c. BCE to 4 <sup>th</sup> c. CE	Yu 2010, 194, 195–196 fig. 9, 198; Lin Yixian n.d. (analysis); Yu 2013, 108 with note 16; An 2021, 341.	'rhyton' or drinking horn; L 19.8 cm; D rim 4.3 cm; applied threads; transparent colourless glass with a pale yellowish-greenish tint	v-Na-Ca plant-ash soda glass  Central Asian	 From Yu 2010
59	<b>Bu-Gai-Wu-Yi-Li-Ke stupa site, Moyu county, Khotan</b> collected after 1949  SIOFM sample XJ-25	stupa site 5 <sup>th</sup> –8 <sup>th</sup> c. CE	Analyses: Li et al. 2005, sample XJ-25; Li et al. 2009, sample XJ-25: 339 table 16.1, 347, 354; Liu et al. 2011, sample XJ-25: 367 table 1, 371 table 4, 373.	vessel fragment; transparent colourless with pale yellowish tint	m-Na-Ca  Roman natron glass, antimony (Sb <sub>2</sub> O <sub>3</sub> ) and manganese (MnO) as decolourants	 Photo courtesy of Liu Song and Li Qinghui
60	<b>Mai'e-Pur mausoleum site, Khotan/Hetian,</b> collected /after 1949  SIOFM sample XJ-14A	Tang to Northern Song	Li et al. 2009, sample XJ-14A: 338 table 16.1 (analysis), 347, 353.	vessel fragment; transparent colourless glass	m-Na-Ca  Roman natron glass	 Photo courtesy of Liu Song and Li Qinghui
61	<b>Hanguya Tati, Khotan</b> collected by Sir Aurel Stein, 1900–1901, H. 001 settlement area (purchased from Hanguya villager)  London BM 1907,1111.240 CMG sample 8503	settlement site flourished up to the early 2 <sup>nd</sup> millennium CE	Stein 1907, 471, 473 H.001; Brill 2009, sample 8503: 124 table 3.2, 135–136 table 3.3.6 (analysis), 146; Brill and Stapleton 2012, sample 8503: 77 and 167 (analysis), 638 (Sr). <a href="https://www.britishmuseum.org/collection/object/A_1907-1111-240">https://www.britishmuseum.org/collection/object/A_1907-1111-240</a>	fragment of vessel; 1.7 x 2.1 cm; Th wall 0.2–0.3 cm; possibly mould-blown; amber glass	v-Na-Ca Central Asian plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> )	 Photo courtesy of BM
62	<b>Hanguya Tati, Khotan,</b> collected by Sir Aurel Stein, 1900–1901, H. 001 settlement area (purchased from Hanguya villager)  London BM 1907,1111.243 CMG sample 8504	settlement site flourished up to the early 2 <sup>nd</sup> millennium CE	Stein 1907, 471, 473 H.001; Brill 2009, sample 8504: 124 table 3.2, 135–136 table 3.3.6 (analysis), 146; Brill and Stapleton 2012, sample 8504: 77 and 167 (analysis). <a href="https://www.britishmuseum.org/collection/object/A_1907-1111-243">https://www.britishmuseum.org/collection/object/A_1907-1111-243</a>	fragment of vessel; 0.9 x 1.2 cm bluish aqua glass	v-Na-Ca Central Asian plant-ash soda glass  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	 Photo courtesy of BM
63	<b>Togujai, Moji, Khotan,</b> collected by Sir Aurel Stein, 1900–1901, T. M. 001. e,  London BM 1907,1111.14 CMG sample 8505	settlement site, flourished probably up to the early 2 <sup>nd</sup> millennium CE	Stein 1907, 113 T.M.001.e pl. LII; Brill 2009, sample 8505: 124 table 3.2, 135–136 table 3.3.6 (analysis), 146; Brill and Stapleton 2012, sample 8505: 77 and 167 (analysis), 638 (Sr). Lin Meicun 2017, fig. 4 left; Aihaiti et al. 2017, fig. 1,2. <a href="https://www.britishmuseum.org/collection/object/A_1907-1111-14">https://www.britishmuseum.org/collection/object/A_1907-1111-14</a>	fragment of vessel; thin-walled; 1.6 x 0.6 cm; Th wall 0.1 cm; applied glass thread, apparently forming a circle; colourless glass	v-Na-Ca Central Asian plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> )	 Photo courtesy of BM

<p><b>64 Kizil/Qizil, Kucha</b> collected by A. von Le Coq, Third Turfan Expedition, 1905–1907; found in workshop.</p> <p>Berlin MfAK III 7101; CMG sample 6130</p>	<p>Buddhist caves site, 3<sup>rd</sup>–8<sup>th</sup> c. CE workshop</p>	<p>Brill 1999, sample 6130: vol. 1, 146; vol. 2, 344 (analysis); Brill 2009, sample 6130: 117 fig. 3.3; 123 table 3.2; 131–132 table 3.3.4 (analysis), 144. Brill and Stapleton 2012, 637 (Sr).</p>	<p>fragment of hemispherical bowl; D rim c. 10 cm; pres. H c. 8.7 cm; Th. max. 1 cm; remains of four registers of facet-cut disks; transparent colourless glass with very pale greenish tint</p>	<p>v-Na-Ca SAS plant-ash soda glass</p> <p>glass composition, shape and decoration characteristic of Sasanian type</p>	 <p>Left: after Brill 2009, drawing A. Seidel Right: Photo Brigitte Borell</p>
<p><b>65 Kizil/Qizil, Kucha</b> collected by A. von Le Coq, Fourth Turfan Expedition 1913–1914; found in 'New Cave' below the 'Cave of the Sixteen Sword-Bearers'.</p> <p>Berlin MfAK III 7686a; CMG sample 6131</p>	<p>Buddhist caves site 3<sup>rd</sup>–8<sup>th</sup> c. CE</p>	<p>Brill 1999, sample 6131: vol. 1, 146; vol. 2, 344 (analysis); Brill 2009, sample 6131: 123 table 3.2; 131–132 table 3.3.4 (analysis), 144–145.</p>	<p>rim fragment of bowl; pres. H 4.5 cm; pres. W 0.9 cm; Th 0.5 cm; remains of the two top registers of facet-cut disks; transparent colourless glass</p>	<p>v-Na-Ca SAS plant-ash soda glass</p> <p>glass composition, shape and decoration characteristic of Sasanian type</p>	 <p>© Museum für Asiatische Kunst, Staatliche Museen zu Berlin</p>
<p><b>66 Kizil/Qizil, Kucha</b> collected by A. von Le Coq, Fourth Turfan Expedition 1913–1914; found in 'New Cave' below the 'Cave of the Sixteen Sword-Bearers'.</p> <p>Berlin MfAK III 7686b; CMG sample 6132</p>	<p>Buddhist caves site 3<sup>rd</sup>–8<sup>th</sup> c. CE</p>	<p>Brill 1999, sample 6132: vol. 1, 146; vol. 2, 344 (analysis); Brill 2009, sample 6132: 123 table 3.2; 131–132 table 3.3.4 (analysis), 145.</p>	<p>rim fragment probably of shallow bowl; est. D rim c. 18 cm; 1.8 cm x 3.3 cm; Th 0.4 cm; remains of top register of facet-cut disks; transparent colourless glass with very pale greenish tint</p>	<p>v-Na-Ca SAS plant-ash soda glass</p> <p>glass composition, shape and decoration characteristic of Sasanian type</p>	 <p>© Museum für Asiatische Kunst, Staatliche Museen zu Berlin</p>
<p><b>67 Kumtura, Kucha</b> collected by A. von Le Coq, Fourth Turfan Expedition 1913–1914.</p> <p>Berlin MfAK III 7687a</p>	<p>Buddhist caves site 4<sup>th</sup>–11<sup>th</sup> c. CE</p>	<p>Unpublished</p>	<p>rim fragment probably of shallow bowl; est. D rim c. 16 cm; 1.8 cm x 2.5 cm; Th 0.5 cm; remains of top register of facet-cut disks; transparent colourless glass with very pale greenish tint</p>	<p>no chemical analysis available</p>	 <p>Photo Brigitte Borell</p>
<p><b>68 Kumtura/Ku-Mu-Tu-La site, Kucha</b> collected after 1949</p> <p>SIOFM sample XJ-35</p>	<p>Buddhist caves site 4<sup>th</sup>–11<sup>th</sup> c. CE</p>	<p>Li et al. 2005, sample XJ-35; Li et al. 2009, sample XJ-35: 339 table 16.1 (analysis), 347, 354; Liu et al. 2011, sample XJ-35: 368 table 2, fig. 3o, 371 table 3 (type Ia).</p>	<p>vessel fragment; light blue glass</p>	<p>v-Na-Ca plant-ash soda glass</p> <p>Sasanian / Islamic</p>	 <p>Photo courtesy of Liu Song and Li Qinghui</p>
<p><b>69 Hiçar, Kucha</b> collected by P. Pelliot, 1907</p> <p>Paris, MG 23893 (P. 528a)</p>	<p>Buddhist site most active phase of the site 4<sup>th</sup>–8<sup>th</sup> c. CE</p>	<p>Gaulier 1987, 47 pl. XXXIII,4; Borell 2024a, 113 fig. 1 (oben).</p>	<p>rim fragment probably of hemispherical bowl; D c. 10 cm; pres. H 3.3 cm; Th 0.45–0.5 cm; facet-cut; remains of the three top rows of facets, the uppermost row with tear-shaped facets rounded on top, the others of rhomboid hexagonal shape; transparent colourless glass with pale yellowish tint</p>	<p>no chemical analysis available</p>	 <p>Photo Brigitte Borell</p>
<p><b>70 Duldur-Akhur, Kucha,</b> collected by P. Pelliot, 1907</p> <p>Paris, MG 23736 (P. 595d); CMG sample 6119</p>	<p>most active phase of the site from 4<sup>th</sup>–8<sup>th</sup> c. CE</p>	<p>Hallade et al. 1982, 388, 416–417 U 40; Brill 1999, sample 6119: vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6119: 123 table 3.2, 127–128 table 3.3.2 (analysis), 143; Brill and Stapleton 2012, 517 table 2, 522–523 table 3; 631 (Sr); Borell 2024a, 113 fig. 1 (unten links).</p>	<p>wall fragment of vessel, possibly from a hemispherical bowl (large fragment and small joining fragment), facet-cut; large fragment 3.7 x 2.1 cm; Th wall 0.4 cm; transparent greenish glass</p>	<p>v-Na-Ca SAS plant-ash soda glass</p> <p>Sasanian / Islamic</p>	 <p>Images licensed by The Corning Museum of Glass under CC BY-NC-SA 4.0</p>

71	<b>Duldur-Akhur, Kucha</b> , collected by P. Pelliot, 1907  Paris, MG 23737 (P. 647d);  CMG sample 6120	most active phase of the site from 4 <sup>th</sup> -8 <sup>th</sup> c. CE	Hallade et al. 1982, d, 416–417 U 53; Brill 1999, sample 6120: vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6120: 118 fig. 3.4; 123 table 3.2, 127–128 table 3.3.2 (analysis), 143; Brill and Stapleton 2012, 517 table 2, 522–523 table 3; 636 (Sr); Borell 2024a, 113 fig. 1 (unten rechts).	wall fragment of vessel with large applied disc-shaped prunt; the prunt pressed flat with a tool leaving double lines on exterior of disc, and causing a softly rounded protrusion on interior; D of prunt 2.5–2.6 cm; Th wall 0.2 cm; transparent slightly bluish-green glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O)	  Left: interior; photo Brigitte Borell Right: exterior, © Musée Guimet
72	<b>Simsim caves (= Senmusaimo caves), Kucha</b> , excav. 1989  Urumqi, Xinjiang Uygur Aironomoius Region Museum	Buddhist caves site 6 <sup>th</sup> to 7 <sup>th</sup> c. CE	Ma and Yue 1998, 120 no. 125, 311; Watt 2004, 189 cat. 96; Gan 2009, 59, 60 fig. 2.13.	goblet on stemmed foot, two rows of applied disc-shaped prunts, six in each row, with impressed double circles on exterior (visible at least in the upper row); D rim 12.1 cm; H 9.7 cm; transparent clear glass with greenish tint	no chemical analysis available	  After Ma and Yue 1998, drawing L. Kreuzburg
73	<b>Qoch Toura, near Laisu, east of Kucha</b> , collected by P. Pelliot, 1907  Paris, MG 24048 (P. 460)  CMG sample 6121 Qoch homa (sic)		Gaulier 1987, 36, 50–51 no. 2; Brill 1999, sample 6121 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6121: 118 fig. 3.4; 123 table 3.2, 127–128 table 3.3.2 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 522–523 table 3.	rim fragment of bowl (?), pattern-moulded in a dip mould and further inflated out of the mould ('optic moulding'); D rim c. 12–13 cm; pres. H 2.1 cm, Th wall 0.2 cm; transparent slightly bluish-green glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O)	  Photo Brigitte Borell
74	<b>Tuokuzisalai, Barchuk (Maralbeshi), Kashgar</b> , excav. before 1984	4 <sup>th</sup> -5 <sup>th</sup> c. CE	An 1984, 437 pl. 5,3; An 1987, 26–27 fig. 48 (site transcribed as Tuokumusanlai); An 2002, 63.	two fragments of glass vessel with applied protruding roundels; larger fragment 6 x 4 cm, Th 0.3–0.4 cm, with two roundels of D 3.5 cm and D 0.7 cm, respectively, rising 0.3 cm from the wall; smaller fragment with two small roundels rising 0.6–0.7 cm; colourless glass with a pale yellowish tint	no chemical analysis available	  After An 1984, drawing L. Kreuzburg
75	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906,  Paris, MG 23803 (P. 885, 25/9/1906); CMG sample 6122	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Gaulier and Lotiron 1964, 412, 415 pl. V5; Brill 1999, sample 6122 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6122: 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 522–523 table 3, 636, 637 (Sr).	tiny fragment of thin-walled vessel; dimensions 0.8 x 0.65 cm; Th wall 0.1 cm; transparent clear glass with slight greenish tinge	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> ; based on major and minor oxides and trace elements)	  Photo Brigitte Borell
76	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG n.n.; CMG sample 6123	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Brill 1999, sample 6123 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6123: 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 522–523 table 3, 637 (Sr).	rim fragment of thin-walled vessel, rim folded inward; D rim c. 9 cm; pres. H 1.0 cm, pres. W 2.0 cm; Th wall 0.1 cm; translucent bluish-green glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> ; based on trace elements)	  Photo Brigitte Borell
77	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG n.n.; CMG sample 6125	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Brill 1999, sample 6125 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6125: 118 fig. 3.4; 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 522–523 table 3, 637 (Sr).	wall fragment of vessel (or lamp); applied and trailed prunt, possibly the remains of a loop handle; dimensions 2.3 x 2.1 cm; Th wall 0.2 cm; transparent glass with an olive green tinge	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> ; based on trace elements)	  Photo Brigitte Borell
78	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG 23806 (P. 889); CMG sample 6128	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Gaulier and Lotiron 1964, 414, 408 pl. V2; Brill 1999, sample 6128 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6128: 118 fig. 3.4; 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 523 table 3, 638 (Sr).	fragment of stemmed goblet, made by the 'pushed-in base' method; cylindrical stem (and the lost foot) made by folding, the end pushed up through the then still hollow stem forming a projecting bulb in the centre of chalice; pres. H 1.6 cm; D stem 0.7–0.8 cm transparent orangy-amber glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> ; based on trace elements)	  Photo Brigitte Borell

79	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG n.n.; CMG sample 6129	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Brill 1999, sample 6129 vol. 1, 146; vol. 2, 346 (analysis); Brill 2009, sample 6129: 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 522–523 table 3, 638 (Sr).	fragment of solid stem of stemmed wine glass (see above); pres. H 1.7 cm; D stem 0.8 cm (thin end); transparent green glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O, high Al <sub>2</sub> O <sub>3</sub> based on trace elements)	 <p>Photo Brigitte Borell</p>
80	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG 23803 (P.885); CMG sample 6124	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Gaulier and Lotiron 1964, 412, 415 pl. V5; Brill 1999, sample 6124 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6124: 118 fig. 3.4; 123, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2.	fragment of thin-walled vessel, mould-blown; H 1.9 cm, W 2.3 cm; Th wall 0.15 cm translucent pale pink glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high K <sub>2</sub> O, moderate Al <sub>2</sub> O <sub>3</sub> )	 <p>Photo Brigitte Borell</p>
81	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG n.n.; CMG samples 6126 and 6126a	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Brill 1999, samples 6126 and 6126a vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, samples 6126: and 6126a: 118 fig. 3.4; 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 637 (Sr).	wall fragment with threaded decoration; pale olive with orangy-amber threads	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high Al <sub>2</sub> O <sub>3</sub> , mixed alkali based on major and minor oxides)	  <p>Left: From Brill 2009, © 2009 World Scientific Publishing Co. Right: after Brill 2009, drawing L. Kreuzburg</p>
82	<b>Hasa Tam or Saqal Tam, Khan-Oi, Kashgar</b> collected by P. Pelliot, 1906  Paris, MG n.n.; CMG sample 6127	settlement site, probably occupied up to the early 2 <sup>nd</sup> millennium CE	Brill 1999, sample 6127 vol. 1, 146; vol. 2, 345 (analysis); Brill 2009, sample 6127: 123 table 3.2, 129–130 table 3.3.3 (analysis), 144; Brill and Stapleton 2012, 517 table 2, 637 (Sr).	rim fragment with multiple foldings (?); 1.0 x 0.7 cm; transparent olive glass	v-Na-Ca Central Asia plant-ash soda glass  Central Asian (high Al <sub>2</sub> O <sub>3</sub> , mixed alkali based on major and minor oxides)	 <p>Photo Brigitte Borell</p>

## Table 2, part 1

133 Chemical analyses of imported glass vessels found in China in contexts dating from the 1<sup>st</sup> to early 5<sup>th</sup> century CE (wt %).

	1	2	3	4	5	6	7	8	9
	Table 1 no. 1	Table 1 no. 2	Table 1 no. 8	Table 1 no. 9	Table 1 no. 10	Table 1 no. 10	Table 1 no. 11	Table 1 no. 11	Table 1 no. 17
	Ganquanshan T. 2 E.Han  CBMA 1984 sample 3	Laohudun E.Han	Nanjing Daxue E.Jin  CBMA 1984 sample 6	Yanshan, Shangfang, Jiangning E.Jin  IRAMAT-CEB 2008 sample NJ01-1	Mufushan colourless E.Jin CBMA 1984 sample 7	Mufushan colourless E.Jin NIGM 1983	Mufushan blue E.Jin CBMA 1984 sample 8	Mufushan blue E.Jin NIGM 1983	Dangtu T.1 E. Jin
SiO <sub>2</sub>	64.79	68.37	69.39	72.04	67.70	68.41	69.15	69.95	61.86
Na <sub>2</sub> O	18.18	16.01	19.60	14.76	19.23	18.82	15.84	16.10	19.17
CaO	7.66	4.62	6.81	6.29	6.05	5.80	5.79	5.72	8.92
K <sub>2</sub> O	0.88	0.48	0.49	0.32	0.45	0.38	0.33	0.27	3.97
MgO	0.61	0.79	0.27	0.61	0.94	1.00	0.55	0.63	4.38
Al <sub>2</sub> O <sub>3</sub>	3.44	1.76	1.89	2.30	3.43	2.20	2.09	2.09	0.71
Fe <sub>2</sub> O <sub>3</sub>	1.30	0.61		1.34	0.58	0.63	1.22	1.17	0.50
TiO <sub>2</sub>				0.09		0.080		0.099	0.06
Sb <sub>2</sub> O <sub>3</sub>			0.29						
MnO	2.45	0.58		0.03	1.63	1.34	0.03	0.002	0.04
CuO	0.03	2.88		0.25	0.02		0.27	0.22	0.00
CoO				0.12			traces	0.084	
SnO <sub>2</sub>				0.003					
PbO				0.21				0.24	0.00
P <sub>2</sub> O <sub>5</sub>				0.05		0.09		0.07	0.26
BaO									0.00
Sr									

1 Tomb 2 at Ganquanshan, Hanjiang, Jiangsu. CBMA sample 3, Shi et al. 1984, 455 table 1.

2 Tomb at Laohudun, Hanjiang, Jiangsu; Yangzhou Bowuguan 1991, 70 table 3 (Chemical analysis by Zhang Fukang, Shanghai Institute of Ceramics, Chinese Academy of Sciences).

3 Tomb at Nanjing Daxue Beiyuan, Nanjing, Jiangsu (An 1984). CBMA sample 6, Shi et al. 1984, 455 table 1.

4 Tomb at Yanshan, Licun, Shangfang, Nanjing, Jiangsu (Wang Zhigao 2011; 2015). IRAMAT-CEB sample NJ01 (LA-ICP-MS) (James Lankton and Bernard Gratuze, 2008).

5 and 6 Great tomb at Mufushan, Nanjing, Jiangsu ('pale yellowish' cup fragment): 5 CBMA sample 7, Shi et al. 1984, 455 table 1; 6 NIGM, Zhu Lanxia 1983, 321 table 1.

7 and 8 Great tomb at Mufushan, Nanjing, Jiangsu (fragment of thin-walled dark blue glass vessel): 7 CBMA sample 8, Shi et al. 1984, 455 table 1; 8 NIGM, Zhu Lanxia 1983, 321 table 1.

9 Dangtu (Anhui), Li Jun / Luo Haiming 2006 (2), 36 table 1 (Chemical analysis by Prof. Feng Min, University of Science and Technology of China, Hefei, Anhui).

Fig. 30: Table 2, part 1.

	10	11	12	13	14	15	16
	Table 1 no. 18	Table 1 no. 18	Table 1 no. 18	Table 1 no. 22	Table 1 no. 24	Table 1 no. 24	Table 1 no. 26
	Shidaigang T. 5 Late W. Jin  EPMA EDM-810 EDAX point measurement	Shidaigang T. 5 Late W. Jin  EPMA EDM-810 EDAX scanning measurement	Pingshigang T. 1, Zhaoqing E. Jin SIOFM sample GD05	Wulidun T. 4021  CBMA 1984 sample 5	Tomb of Hua Feng, Beijing  'old measurement'	Tomb of Hua Feng, Beijing  CBMA 1986 analysis	Beipiao Tomb 1, Feng Sufu (died 415) globular bowl M1:71 CBMA 1984 sample 9
SiO <sub>2</sub>	65.99	65.82	80.33	64.22	64.33	65.36	64.82
Na <sub>2</sub> O	17.63	17.11		17.51	16.03	17.05	16.02
CaO	1.24	0.47	11.68	9.19	7.25	7.1	6.14
K <sub>2</sub> O	0.74	0.21	4.13	3.59	4.19	4.13	4.43
MgO	9.22	9.17		3.21	2.45	3.56	2.35
Al <sub>2</sub> O <sub>3</sub>	5.18	7.22	1.87	1.64	1.24	1.76	2.71
Fe <sub>2</sub> O <sub>3</sub>			1.13	0.57	0.26	0.18	0.82
TiO <sub>2</sub>			0.10				
Sb <sub>2</sub> O <sub>3</sub>							
MnO			0.03	0.04			0.08
CuO			0.02	0.02			0.02
CoO							
SnO <sub>2</sub>							
PbO			0.00				
P <sub>2</sub> O <sub>5</sub>			0.19				
BaO			0.00				
Sr							

**10 and 11** Tomb 5 at Shidaigang, Xiatang, Guangzhou; *Kaogu* 1996 (19), 43, 45 table 3 (EDM-810 EDAX: **10** point measurement; **11** scanning; however, the resulting analyses are inconclusive, probably owing to lack of sample preparation resulting in measuring of weathered surface.

**12** Tomb 1 at Pingshigang, Zhaoqing, Guangdong; SIOFM sample GD05, Li Qinghui et al. 2003, 81 table 1 (PIXE) = Li Qinghui 2005, 296 table 2 no. 199.

**13** Wulidun, CBMA sample 5, Shi et al. 1984, 455 table 1.

**14 and 15** Tomb of Hua Fang, Beijing: **14** 'old measurement', *Kaogu* 1986 (2), 180 table 2, top; Gan 2009, 93 table 2.8; **15** CBMA 1986, *Kaogu* 1986 (2), 180 table 2, second from top.

**16** Beipiao Tomb 1, Feng Sufu; CBMA sample 9, Shi et al. 1984, 455 table 1.

Fig. 31: Table 2, part 1, continued.

## Table 2, part 2

134 Chemical analyses of imported glass vessels found in Xinjiang Uygur Autonomous Region dating from about the first half of the 1<sup>st</sup> millennium CE (wt %, otherwise stated as ppm).

	17	18	19	20	21	22	23	24	25	26
	Table 1 no. 31	Table 1 no. 33	Table 1 no. 33	Table 1 no. 34	Table 1 no. 38	Table 1 no. 39	Table 1 no. 40	Table 1 no. 41	Table 1 no. 42	Table 1 no. 43
	Yingpan Tomb 9 CMG sample 7015	Loulan, BM MAS 697 CMG sample 8501	Loulan, BM MAS 697 Brit.Mus. Lab.	Loulan, Ruoqiang C180:A SIOFM sample XJ-45	Loulan CBMA sample 47	Loulan CBMA sample 48	Loulan CMG sample 6810	Loulan CMG sample 6814	Loulan CMG sample 6815	Loulan CMG sample 6816
SiO <sub>2</sub>	68.70	71.62	71.3	72.39	67.24	69.89	74.98	77.30	76.08	75.48
Na <sub>2</sub> O	19.30	21.10	18.2	18.91	18.31	19.18	18.81	20.57	16.99	15.06
CaO	5.58	5.83	5.2	5.35	9.18	5.77	5.22	5.56	5.79	5.39
K <sub>2</sub> O	0.58	0.33	0.4	0.40	0.85	0.48	0.38	0.41	0.54	0.57
MgO	0.65	0.37	0.4	0.41	0.54	0.52	0.33	0.36	0.41	0.48
Al <sub>2</sub> O <sub>3</sub>	2.03	1.62	1.7	1.57	2.58	1.98	1.72	1.65	1.91	1.94
Fe <sub>2</sub> O <sub>3</sub>	1.20	0.29	0.3	0.28	0.30	0.31	0.14	0.26	0.38	0.30
TiO <sub>2</sub>	0.072	0.07		0.05			0.074	0.11	0.071	0.050
Sb <sub>2</sub> O <sub>3</sub>	1.2		1.0	0.49						
MnO	0.10	0.02	<0.1	0.01	0.12	0.03	0.00	0.09	0.05	0.08
CuO	0.01				0.02	0.02	0.12	0.021	0.13	0.17
CoO										
SnO <sub>2</sub>										
PbO	0.21						0.17	0.091	0.031	0.22
P <sub>2</sub> O <sub>5</sub>	0.09	0.09	0.09	0.05				0.07	0.09	0.06
BaO	0.05	0.05	0.03	0.02				0.033	0.044	0.063
Sr										

17 Yingpan Tomb 9, Brill 2009, CMG sample 7015.

18 and 19 Loulan, Sir Aurel Stein, MAS 697; 18 Brill 2009, CMG sample 8501; 19 Brit. Mus. Lab. 2002, Ian Freestone (pers. comm. September 2022).

20 Loulan, Ruoqiang county, Tomb 80LBC:180A, SIOFM sample XJ-45 Li et al 2009 (ICP).

21 Loulan, CBMA sample 47, Shi et al. 1984, 455 table 1.

22 Loulan, CBMA sample 48, Shi et al. 1984, 455 table 1.

23 Loulan, Sven Hedin, Brill 2009, CMG sample 6810.

24 Loulan, Sven Hedin, Brill 2009, CMG sample 6814.

25 Loulan, Sven Hedin, Brill 2009, CMG sample 6815.

26 Loulan, Sven Hedin, Brill 2009, CMG sample 6816.

Fig. 32: Table 2, part 2.

	27	28	29	30	31	32	33	34	35
	Table 1 no. 44	Table 1 no. 45	Table 1 no. 46	Table 1 no. 47	Table 1 no. 48	Table 1 no. 49	Table 1 no. 50	Table 1 no. 51	Table 1 no. 52
	Loulan, BM 1928,1922.10 CMG sample 8502	Loulan CMG sample 6811	Loulan CMG sample 6819	Loulan CMG sample 6813	Loulan CMG sample 6812	Loulan CMG sample 6817	Loulan CMG sample 6818	Loulan CMG sample 6827	Zhagunluke T.49 M49:4
SiO <sub>2</sub>	63.89	65.62	64.94	59.22	60.55	66.00	60.40	58.86	66.20
Na <sub>2</sub> O	20.01	13.00	16.24	15.74	15.63	12.55	15.90	21.16	20.50
CaO	6.89	6.68	6.36	6.53	7.02	6.36	6.96	3.83	7.40
K <sub>2</sub> O	2.14	4.41	4.40	5.48	4.93	5.57	5.49	5.08	0.42
MgO	3.19	4.10	3.33	4.53	4.31	2.71	5.33	3.26	0.66
Al <sub>2</sub> O <sub>3</sub>	2.26	2.47	1.89	4.78	3.21	3.09	3.09	2.35	2.26
Fe <sub>2</sub> O <sub>3</sub>	0.48	0.79	0.36	0.92	0.69	0.71	0.45	1.09	0.63
TiO <sub>2</sub>	0.080	0.11	0.033	0.11	0.10	0.082	0.073	0.13	n.d.
Sb <sub>2</sub> O <sub>3</sub>									21ppm
MnO	1.43	1.33	0.30	1.22	1.28	0.56	0.10	0.198	1.42
CuO		0.078	0.025	0.074	0.074	0.12	0.070	1.91	n.d.
CoO									10ppm
SnO <sub>2</sub>									20ppm
PbO		0.080	0.040		0.023		0.093	0.001	n.d.
P <sub>2</sub> O <sub>5</sub>	0.33	0.49	0.42	0.64	0.44	0.55	0.40	0.56	n.d.
BaO	0.03	0.032	0.041	0.048	0.050	0.026	0.11		0.07
Sr									660ppm

27 Loulan, Sir Aurel Stein, Brill 2009, CMG sample 8502.

28 Loulan, Sven Hedin, Brill 2009, CMG sample 6811.

29 Loulan, Sven Hedin, Brill 2009, CMG sample 6819.

30 Loulan, Sven Hedin, Brill 2009, CMG sample 6813.

31 Loulan, Sven Hedin, Brill 2009, CMG sample 6812.

32 Loulan, Sven Hedin, Brill 2009, CMG sample 6817.

33 Loulan, Sven Hedin, Brill 2009, CMG sample 6818.

34 Loulan, Sven Hedin, Brill 2009, CMG sample 6827.

35 Zhagunluke, Cheng et al. 2016, 199 table 10.2 (LA-ICP-AES).

Fig. 33: Table 2, part 2, continued.

	36	37	38	39	40	41	42	43	44	45
	Table 1 no. 53	Table 1 no. 53	Table 1 no. 54	Table 1 no. 54	Table 1 no. 54	Table 1 no. 55	Table 1 no. 56	Table 1 no. 57	Table 1 no. 59	Table 1 no. 59
	Enderer Fort, BM, MAS 576 CMG sample 8500	Enderer Fort, BM, MAS 576 Brit.Mus. Lab.	Enderer Fort / An-Di'er Castle, Minfeng SIOFM sample XJ-43A	Enderer Fort / An-Di'er Castle, Minfeng SIOFM sample XJ-43A	Enderer city site / An-Di'er site, Minfeng SIOFM sample XJ-43-2	Enderer city site / An-Di'er site, Minfeng SIOFM sample XJ-43-1	Enderer city site / An-Di'er site, Minfeng SIOFM sample XJ-43-3	Niya cemetery 93IIM4 sample IOA UCL G 33	Bu-Gai-Wu-Yi-Li-Ke, Moyu County SIOFM sample XJ-25	Bu-Gai-Wu-Yi-Li-Ke, Moyu County SIOFM sample XJ-25
SiO <sub>2</sub>	71.27	70.9	68.00	67.77	62.54	63.79	60.23	60.6	69.75	66.29
Na <sub>2</sub> O	18.89	16.7	15.55	15.57	16.47	17.10	12.28	18.4	19.35	19.79
CaO	6.41	6.0	8.43	8.12	8.26	8.52	5.26	5.61	6.15	5.92
K <sub>2</sub> O	0.63	0.6	3.30	3.41	3.39	3.48	4.89	4.15	0.50	0.45
MgO	0.71	0.7	3.21	3.30	3.17	3.39	2.99	3.46	0.70	0.63
Al <sub>2</sub> O <sub>3</sub>	2.27	2.2	1.02	0.96	0.67	0.71	1.75	2.82	2.15	1.98
Fe <sub>2</sub> O <sub>3</sub>	0.70	0.6	0.48	0.46	0.62	0.64	0.81	1.34	0.63	0.75
TiO <sub>2</sub>	0.14			0.03	n.d.	n.d.	n.d.	0.16	0.10	0.03
Sb <sub>2</sub> O <sub>3</sub>		0.6						0.02	0.32	
MnO	0.08	0.1		0.03	0.05	0.06	0.06	0.13	0.22	0.28
CuO								1.15		
CoO								0.01		
SnO <sub>2</sub>								0.00		
PbO								0.00		
P <sub>2</sub> O <sub>5</sub>	0.04			0.14	0.08	n.d.	n.d.	0.57	0.07	n.d.
BaO				0.02	0.06	0.16	n.d.	0.04	0.02	0.21
Sr					0.08	0.08	0.06	0.07		

36 and 37 Enderer Fort, Sir Aurel Stein, MAS 576; 36 Brill 2009, CMG sample 8500; 37 Brit. Mus. Lab. 2002, Ian Freestone (pers. comm. September 2022).

38, 39, and 40 Enderer Fort / An-Di'er Castle, Minfeng, Khotan; 38-39: SIOFM sample XJ-43A, Li et al. 2009 (RBS); Li et al. 2009 (ICP); 40: SIOFM sample XJ-43-2 Liu et al. 2011 (pXRF).

41 Enderer / An-Di'er city site, Khotan, SIOFM sample XJ-43-1, Liu et al 2011 (pXRF).

42 Enderer / An-Di'er city site, Khotan, SIOFM sample XJ-43-3, Liu et al 2011 (pXRF).

43 Niya, cemetery 2, Khotan, IOA UCL sample G 33 (2007), Lin Yixian (pers. comm. April 2009 and February 2022) (EPMA).

44 and 45 Bu-Gai-Wu-Yi-Li-Ke: 44 SIOFM sample XJ-25, Li et al. 2005; Li et al. 2009 (ICP); 45 Bu-Gai-Wu-Yi-Li-Ke, SIOFM sample XJ-25, Liu et al. 2011 (pXRF).

Fig. 34: Table 2, part 2, continued.

	46	47	48	49	50	51	52
	Table 1 no. 60	Table 1 no. 61	Table 1 no. 62	Table 1 no. 63	Table 1 no. 64	Table 1 no. 65	Table 1 no. 66
	Mai'e-Pur, Hetian / Khotan SIOFM sample XJ-14A	Hanguya Tati, Khotan CMG sample 8503	Hanguya Tati, Khotan CMG sample 8504	Togujai, Moji Khotan CMG sample 8505	Kizil, Kucha CMG sample 6130	Kizil, Kucha CMG sample 6131	Kizil, Kucha CMG sample 6132
SiO <sub>2</sub>	70.15	52.60	66.16	61.40	65.51	65.93	66.15
Na <sub>2</sub> O	17.98	18.71	15.25	16.05	16.95	15.90	16.04
CaO	7.70	7.70	5.99	7.11	7.18	8.06	8.10
K <sub>2</sub> O	0.53	5.89	4.04	5.18	2.86	2.68	2.66
MgO	0.46	4.37	2.92	3.67	5.29	4.62	4.59
Al <sub>2</sub> O <sub>3</sub>	1.66	8.82	4.41	4.97	1.01	1.05	1.06
Fe <sub>2</sub> O <sub>3</sub>	0.59	1.24	0.71	0.67	0.43	0.45	0.44
TiO <sub>2</sub>	0.12	0.10	0.16	0.080			
Sb <sub>2</sub> O <sub>3</sub>					0.03	0.02	0.03
MnO	0.63	0.91	0.04	0.71	0.14	0.19	0.19
CuO						0.020	
CoO							
SnO <sub>2</sub>							
PbO	0.01				0.07		0.03
P <sub>2</sub> O <sub>5</sub>	0.09	0.46	0.54	0.42	0.20	0.27	0.23
BaO	0.04	0.06	0.11	0.05			
SrO							

46 Mai'e-Pur, SIOFM sample XJ-14A, Li et al. 2009 (ICP).  
47 Hanguya Tati, Khotan, Sir Aurel Stein, Brill 2009, CMG sample 8503.  
48 Hanguya Tati, Khotan, Sir Aurel Stein, Brill 2009, CMG sample 8504.  
49 Togujai Moji, Khotan, Sir Aurel Stein, Brill 2009, CMG sample 8505.  
50 Kizil, le Coq, Brill 2009, CMG sample 6130.  
51 Kizil, le Coq, Brill 2009, CMG sample 6131.  
52 Kizil, le Coq, Brill 2009, CMG sample 6132.

Fig. 35: Table 2, part 2, continued.

	53	54	55	56	57	58	59	60	61
	Table 1 no. 68	Table 1 no. 68	Table 1 no. 68	Table 1 no. 70	Table 1 no. 71	Table 1 no. 73	Table 1 no. 75	Table 1 no. 76	Table 1 no. 77
	Kumtura / Ku-Mu-Tu-La, Kucha SIOFM sample XJ-35	Kumtura / Ku-Mu-Tu-La, Kucha SIOFM sample XJ-35	Kumtura / Ku-Mu-Tu-La, Kucha SIOFM sample XJ-35	Duldur-Akhur, Kucha CMG sample 6119	Duldur-Akhur, Kucha CMG sample 6120	Qoch Toura, Kucha CMG sample 6121	Hasa Tam / Saqal Tam Kashgar CMG sample 6122	Hasa Tam / Saqal Tam Kashgar CMG sample 6123	Hasa Tam / Saqal Tam Kashgar CMG sample 6125
SiO <sub>2</sub>	66.67	67.18	60.50	68.76	60.44	60.56	61.59	54.85	54.01
Na <sub>2</sub> O	16.19	16.27	16.67	12.49	17.45	14.31	16.31	14.15	15.32
CaO	5.94	6.21	5.99	7.89	7.72	10.20	5.78	7.74	7.48
K <sub>2</sub> O	3.79	3.79	3.91	2.15	4.59	3.62	4.80	6.38	6.30
MgO	3.56	3.63	3.54	3.79	5.00	5.42	2.79	4.21	4.72
Al <sub>2</sub> O <sub>3</sub>	2.21	2.06	1.68	2.96	2.60	3.54	10.08	8.55	9.06
Fe <sub>2</sub> O <sub>3</sub>	0.97	0.84	1.37	1.43	1.19	1.37	1.94	1.49	1.54
TiO <sub>2</sub>	0.08		0.03	0.13	0.090	0.13	0.15	0.11	0.11
Sb <sub>2</sub> O <sub>3</sub>									
MnO	0.08		0.13	0.04	0.05	0.05	0.06	0.05	0.86
CuO	0.28		0.30				0.010	1.87	
CoO			0.16						
SnO <sub>2</sub>									
PbO	0.04		0.06	0.03	0.02	0.04	0.02	0.05	
P <sub>2</sub> O <sub>5</sub>			n.d.	0.29	0.81	0.71	0.55	0.51	0.52
BaO	0.01		0.14	0.04	0.04	0.05	0.08	0.04	0.08
Sr			0.06						

53, 54, and 55 Kumtura / Ku-Mu-Tu-La, Kucha, SIOFM sample XJ-35: 53 Li et al. 2009 (ICP); 54 Li et al. 2005; Li et al. 2009 (RBS); 55 Liu et al. 2011 (pXRF).  
56 Duldur-Akhur, Kucha, Paul Pelliot, Brill 2009, CMG sample 6119.  
57 Duldur-Akhur, Kucha, Paul Pelliot, Brill 2009, CMG sample 6120.  
58 Qoch Toura, Kucha, Paul Pelliot, Brill 2009, CMG sample 6121.  
59 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6122.  
60 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6123.  
61 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6125.

Fig. 36: Table 2, part 2, continued.

	62	63	64	65	66	67
	Table 1 no. 78	Table 1 no. 79	Table 1 no. 80	Table 1 no. 81	Table 1 no. 81	Table 1 no. 82
	Hasa Tam / Saqal Tam Kashgar CMG sample 6128	Hasa Tam / Saqal Tam Kashgar CMG sample 6129	Hasa Tam / Saqal Tam Kashgar CMG sample 6124	Hasa Tam / Saqal Tam Kashgar CMG sample 6126	Hasa Tam / Saqal Tam Kashgar CMG sample 6126a	Hasa Tam / Saqal Tam Kashgar CMG sample 6127
SiO <sub>2</sub>	55.34	56.41	61.59	54.42	54.39	54.24
Na <sub>2</sub> O	16.38	15.67	14.65	14.15	14.14	17.88
CaO	7.18	5.54	6.75	7.65	7.67	7.21
K <sub>2</sub> O	7.25	6.60	5.76	7.23	7.42	6.12
MgO	3.69	3.01	4.49	4.14	4.04	4.96
Al <sub>2</sub> O <sub>3</sub>	7.91	9.88	4.33	8.83	8.96	7.22
Fe <sub>2</sub> O <sub>3</sub>	1.20	1.56	0.97	1.67	1.68	0.86
TiO <sub>2</sub>	0.090	0.12	0.060	0.11	0.12	0.050
Sb <sub>2</sub> O <sub>3</sub>						
MnO	0.87	0.06	0.75	0.95	0.98	0.08
CuO	0.010	0.010	0.010	0.030	0.010	
CoO						
SnO <sub>2</sub>						
PbO	0.04	0.01	0.01	0.03	0.02	
P <sub>2</sub> O <sub>5</sub>	0.55	0.53	0.57	0.51	0.50	0.48
BaO	0.04	0.05	0.06	0.08	0.07	0.05
Sr						

62 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6128.

63 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6129.

64 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6124.

65 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6126

66 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6126a.

67 Hasa Tam / Saqal Tam, Kashgar, Brill 2009, CMG sample 6127.

Fig. 37: Table 2, part 2, continued.

## Abbreviations

### Measurements:

H	Height
L	Length
W	Width
Th	Thickness
D	Diameter

### Museums:

BM	British Museum, London (UK)
MfAK	Museum für Asiatische Kunst, Berlin (Germany)
MG	Musée Guimet, Paris (France)
MoE	Museum of Ethnography, Stockholm (Sweden)

### Institutions where the chemical analyses were performed:

CBMA	China Building Material Academy, Beijing (China)
CMG	Corning Museum of Glass, Corning, N.Y. (USA)
IOA UCL	Institute of Archaeology, University College London (UK)
IRAMAT-CEB	Institut de Recherches sur les Archéomatériaux Centre Ernest-Babelon, Orléans (France)
NIGM	Nanjing Institute of Geology and Mining, Nanjing (China)
SIOFM	Shanghai Institute of Optics and Fine Mechanics, Shanghai (China)

### Analysing Methods:

EDAX	Energy Dispersive X-ray Analysis
EDXRF	Energy Dispersive X-ray Fluorescence Spectrometry
EPMA	Electron Probe Micro Analysis
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectrometry
LA-ICP-AES	Laser Ablation-Inductively Coupled Plasma-Atomic Emission Spectrometry
LA-ICP-MS	Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry
PIXE	Proton Induced X-ray Emission
pXRF	Portable X-ray Fluorescence Spectrometer
RBS	Rutherford Backscattering Spectroscopy
SEM-EDS	Scanning Electron Microscopy coupled Energy-dispersive X-ray Spectroscopy

### Other:

n.d.	not detected
ppm	parts per million

Fig. 38: Abbreviations used in Table 1 and Table 2.

## References

- Abdurazakov, A. A. 2001** La production artisanale en Bactriane-Tokharestan (Résultats des études chimiques et de restauration). In: Leriche, P. – Pidaev, C. – Gelin, M. – Abdoullaev, K. (eds.), *La Bactriane au carrefour des routes et des civilisations de l'Asie centrale. Termez et les villes de Bactriane-Tokharestan. Actes du colloque de Termez 1997*. Paris: Maisonneuve et Larosse, 399–403.
- Abdurazakov, A. A. 2009** Central Asian Glassmaking During the Ancient and Medieval Periods. In: Gan Fuxi – Brill, R. H. – Tian Shouyun (eds.), *Ancient Glass Research along the Silk Road*. Singapore: World Scientific Publishing, 201–219.
- Abe, Y. – Shikaku, R. – Yamamoto, M. et al. 2018** Ancient Glassware Travelled the Silk Road: Nondestructive X-ray Fluorescence Analysis of a Fragment of a Facet-Cut Glass Vessel Collected at Kamigamo Shrine in Kyoto, Japan. *Journal of Archaeological Science: Reports* 20, 362–368.
- Abe, Y. – Murakushi, M. – Kim, D. 2019** Analytical Results of Glass Objects Stored in Gyeongju National Museum. *Silla Munmul Yeongu – Journal of the Gyeongju National Museum* 12, 25–38. [In Korean]
- Abe, Y. – Shikaku, R. 2021** Re-examination of “Persian Glass” – From a Scientific Point of View by Means of Nondestructive X-ray Fluorescence Analysis of Sasanian Glass Objects Said to be from North Iran. *Bulletin of the Okayama Orient Museum* 32, 29–68.
- Abe, Y. – Shikaku, R. – Murakushi, M. et al. 2021** Did Ancient Glassware Travel the Silk Road? X-ray Fluorescence Analysis of a Sasanian Glass Vessel from Okinoshima Island, Japan. *Journal of Archaeological Science: Reports* 40 (part A): 10319. <https://doi.org/10.1016/j.jasrep.2021.103195>
- Aihaiti, M. 马利亚 艾海提 – Seong-sil Kim 金诚实 – Hao Chunyang 郝春阳 2017** Sichouzhilu shangde Zhongya boliqi. Jianlun Zhongya boliqi xiang Zhongguo, Chaoxian Bandao he Riben zhi chuanbo 丝绸之路上的中亚玻璃器——兼论中亚玻璃器向中国、朝鲜半岛和日本之传播 [Central Asian Glassware on the Ancient Silk Roads and Its Spread to China, Korean Peninsula and Japan]. *Kaogu yu wenwu* 2017 (6), 104–110.
- Aihaiti, M. 2018** L'avènement des hephtalites et la première diffusion des étriers en fer vers l'Asie centrale [嚙嗶的興起鐵馬鐙初傳中亞]. Paper presented at the conferences Arkhéol PSL. <https://chartes.hypotheses.org/5854> (accessed January 2023).
- Al-Ghabban, A. I. – André-Salvini, B. – Demange, F. et al. 2010** Routes d'Arabie. Archéologie et histoire du Royaume d'Arabie Saoudite. Paris: Smogy – Louvre éditions.
- An Jiayao 安家瑶 1984** Zhongguo de zaoqi boli qimin 中国的早期玻璃器皿 [Early Chinese Glassware]. *Kaogu xuebao* 1984 (4), 413–448.
- An Jiayao 安家瑶 1986a** Bei Zhou Li Xian mu chutu de boli wan – Sashan boli qi de faxian yu yanjiu 北周李贤墓出土的玻璃碗——萨珊玻璃器的发现与研究 [A Glass Bowl from Li Xian's Tomb of the Northern Zhou Dynasty – Discovery and Research of the Sassanian Glassware]. *Kaogu* 1986 (2), 173–181.
- An Jiayao 安家瑶 1986b** Boliqi 玻璃器 [Glassware]. *Zhongguo lishi bowuguan guankan / Journal of the Museum of Chinese History* 9, 28–29.
- An Jiayao 安家瑶 1987** Early Chinese Glassware [English translation of An 1984 by M. Henderson]. *Oriental Ceramic Society Translations* No.12.
- An Jiayao 安家瑶 2002** Glass Vessels and Ornaments of the Wei, Jin and Northern and Southern Dynasties Periods. In: Braghin, C. (ed.), *Chinese Glass. Archaeological Studies on the Uses and Social Context of Glass Artefacts from the Warring States to the Northern Song Period (Fifth century B.C. to Twelfth Century A.D.)*. Florence: Leo S. Olschki, 45–70.
- An Jiayao 安家瑶 2004** The Art of Glass along the Silk Road. In: Watt, J. C. Y. (ed.), *China – Dawn of a Golden Age 200 – 750 AD*. New York: The Metropolitan Museum of Art, 57–65.
- An Jiayao 安家瑶 – Liu Junxi 刘俊喜 2006** Datong diqu de Bei Wei boliqi 大同地区的北魏玻璃器 [Northern Wei Glassware in the Datong Region]. In: Zhang Qingjie 张庆捷 – Li Shuji 李书吉 – Li Gang 李钢 (eds.), *4–6 Shiji de bei Zhongguo yu Ouya Dalu 4–6世纪的北中国与欧亚大陆* [4th–6th centuries North China and Eurasia]. Beijing: Kexue chubanshe, 37–46.
- An Jiayao 安家瑶 2009** Glasses of the Northern Wei Dynasty Found at Datong. In: Gan Fuxi – Brill, R. H. – Tian Shouyun (eds.), *Ancient Glass Research along the Silk Road*. Singapore: World Scientific Publishing, 379–386.
- An Jiayao 安家瑶 – Liu Junxi 刘俊喜 2015** Datong diqu de Bei Wei boliqi 大同地区的北魏玻璃器 [Northern Wei Glassware in the Datong Region]. In: Yungang Shiku Yanjiuyuan 云冈石窟研究院 (ed.), *Pingcheng Silu 平城丝路* [Pingcheng and the Silk Road]. Qingdao: Qingdao chubanshe, 349–360.
- An Jiayao 安家瑶 2021** Glass Technology of the Wei, Jin, and Southern and Northern Dynasties in the Middle and Lower Reaches of the Yellow River and Yangtze River of China. In: Gan Fuxi (ed.), *Development History of Ancient Chinese Glass Technology. Series on Archaeology and History of Science in China vol. 3*. Singapore: World Scientific, 300–352.
- Andersen, S. F. 2007** The Tylos Period Burials in Bahrain, Volume 1: The Glass and Pottery Vessels. *Manama: Kingdom of Bahrain, Culture & National Heritage / Aarhus: University Press*.
- Andersen, S. F. 2022** The Dating of Sasanian Glass in the Light of Excavated Finds from Bahrain. In: Simpson, St. J. (ed.), *Sasanian Archaeology. Settlements, Environments and Material Culture*. Oxford: Archaeopress, 420–430.
- Andrews, F. H. 1935** Descriptive Catalogue of Antiquities Recovered by Sir Aurel Stein during his Explorations in Central Asia, Kansu and Eastern Iran. Central Asian Antiquities Museum, New Delhi. Delhi: Government of India Publication.
- Arveiller-Dulong, V. – Nenna, M.-D. 2005** Vaisselle et contenants du Ier siècle au début du VIIe

siècle après J.-C. Les verres antiques, Musée du Louvre, vol. 2. Paris: Réunion des Musées Nationaux.

**Bailey, D. 2007** The Glass Vessels. In: Maxfield, V. – Peacock, D. (ed.), The Roman Imperial Quarries. Survey and Excavation at Mons Porphyrites, 1994 – 1998, vol. 2: The Excavations. London: Egypt Exploration Society, 233–266.

**Barber, A. – Jagendorf, M. (eds.) 2005** The Israel Museum Jerusalem. New York: Abrams.

**Barford, G. H. – Freestone, I. – Lichtenberger, A. et al. 2018** Geochemistry of Byzantine and Early Islamic Glass from Jerash, Jordan: Typology, Recycling, and Provenance. *Geoarchaeology* 2018, 33: 623–640. <https://doi.org/10.1002/gea.21684>

**Barford, G. H. – Freestone, I. C. – Leshner, C. E. et al. 2020** 'Alexandrian' Glass Confirmed by Hafnium Isotopes. *Scientific Reports* 10: 11322 (2020). <https://doi.org/10.1038/s41598-020-68089-w>

**Barkóczy, L. 1988** Pannonische Glasfunde in Ungarn. Budapest: Verlag der Ungarischen Akademie der Wissenschaften.

**Barnett, R. D. – Curtis, J. E. 1973** A Review of Acquisitions 1963–1970 of Western Asiatic Antiquities (2). *British Museum Quarterly* 37 (3–4), 119–137.

**Baumer, C. 2002** Die Südliche Seidenstrasse – Inseln im Sandmeer. Versunkene Kulturen der Wüste Taklamakan. Mainz: Philipp von Zabern.

**Baypakov, K. (ed.) 2011** The Artistic Culture of Central Asia and Azerbaidjan in the 9th–15th Centuries, vol. II: Glass. Samarkand – Taschkent: International Institute for Central Asian Studies (IICAS) under the auspices of UNESCO.

**Beretta, M. – Di Pasquale, G. (eds.) 2004** Vitrum. Il vetro fra arte e scienza nel mondo romano. Firenze: Giunti.

**Bergman, F. 1939** Archaeological Researches in Sinkiang, especially the Lop-Nor Region. Stockholm: Thule.

**Bertrand, A. 2012** Water Management in Jingjue 精絕 Kingdom: The Transfer of a Water Tank System from Gandhara to Southern Xinjiang in the Third to Fourth Centuries C.E. *Sino-Platonic Papers* 223.

**Borell, B. 2010** Trade and Glass Vessels along the Maritime Silk Road. In: Zorn, B. – Hilgner, A. (eds.), Glass along the Silk Road, from 200 BC to AD 1000. International conference within the scope of the "Sino-German project on cultural heritage preservation" of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 127–142.

**Borell, B. 2011** Han Period Glass Vessels in the Early Tongking Gulf Region. In: Cooke, N. – Li, T. – Anderson, J. A. (eds.), The Tongking Gulf Through History. Philadelphia: University of Pennsylvania Press, 53–66, 172–179.

**Borell, B. 2015** Isthmus von Kra: Im Schnittpunkt maritimer Routen. In: Tjoa-Bonatz, M. L. – Reinecke, A. (eds.), Im Schatten von Angkor. *Archäologie und*

*Geschichte Südostasiens*. Darmstadt: Philipp von Zabern, 45–54.

**Borell, B. 2016** Travels of Glass Vessels along the Maritime Silk Road. In: Gan, Fuxi – Li, Q. – Henderson, J. (eds.), Recent Advances in the Scientific Research on Ancient Glass and Glaze. Singapore: World Scientific, 43–71.

**Borell, B. 2017** Gemstones in Southeast Asia and Beyond: Trade along the Maritime Networks. In: Hilgner, A. – Greiff, S. – Quast, D. (eds.), Gemstones in the First Millenium AD: Mines, Trade, Workshops and Symbolism. Mainz: Römisch-Germanisches Zentralmuseum, 21–44.

**Borell, B. 2019** A Roman Gold Coin Found in Peninsular Thailand. In: Pongpanich, B. – Thinapong, S. (eds.), Suvarnabhumi: The Golden Land. The New Finding for Suvarnabhumi terra incognita. Bangkok: GISTDA and BIA, 57–66.

**Borell, B. 2020** The Materiality of Writing: Script on Artefacts from Early Sites in Southern Thailand and in Southern Myanmar. In: Tan, N. (ed.), Advancing Southeast Asian Archaeology 2019. Selected Papers from the Third SEAMEO SPAFA International Conference on Southeast Asian Archaeology, Bangkok, Thailand 2019. Bangkok: SEAMEO SPAFA Regional Centre for Archaeology and Fine Arts, 93–102.

**Borell, B. 2021** Coins from Western Lands Found in Southeast Asia. In: Günther, S. – Li Qiang – Lin Ying – Sode, C. (eds.), From Constantinople to Chang'an. Byzantine Gold Coins in the World of Late Antiquity. Papers Read at the International Conference in Changchun, China, 23–26 June, 2017. Changchun: The Institute for the History of Ancient Civilizations, Northeast Normal University, 277–314.

**Borell, B. 2024a** Le verre. In: Zaleski, V. (ed.), Les routes de la soie entre vestiges et imaginaire. Gent: Snoeck Publishers, 112–117.

**Borell, B. 2024b** Early Roman Glass in Indian Ocean Trade: Finds from the Region of the Isthmus of Kra (Malay Peninsula). *Annales du 22e Congrès de l'Association Internationale pour l'Histoire du Verre*, Lisbon: AIHV, 37–43.

**Borell, B. – Dussubieux, L. 2022** Exceptional Potash Glass Artefacts Excavated at Tissamaharama (Sri Lanka). *Journal of Glass Studies* 64, 33–57.

**Brill, Robert H. 1999** Chemical Analyses of Early Glasses. Vol. 1: Catalogue of Samples. Vol. 2: Tables of Analyses. Corning, N. Y.: The Corning Museum of Glass.

**Brill, R. H. 2005** Chemical Analyses of Some Sasanian Glasses from Iraq. In: Whitehouse, D., Sasanian and Post-Sasanian Glass in The Corning Museum of Glass, Corning, N.Y.: The Corning Museum of Glass, 65–88.

**Brill, R. H. 2009** Opening Remarks and Setting the Stage: Lecture at the 2005 Shanghai International Workshop on the Archaeology of Glass Along the Silk Road. In: Gan Fuxi – Brill, R. H. – Tian Shouyun (eds.), Ancient Glass Research along the Silk Road. Singapore: World Scientific Publishing, 109–147.

**Brill, R. H. 2012** The Silk Road. In: Brill, R. H. – Stapleton, C. P., Chemical Analyses of Early Glasses. Vol.

3: The Years 2000–2011, Reports, and Essays. Corning, N. Y.: The Corning Museum of Glass, 511–533.

**Brill, R. H. – Stapleton, C. P. 2012** Chemical Analyses of Early Glasses. Vol. 3: The Years 2000–2011, Reports, and Essays. Corning, N.Y.: The Corning Museum of Glass.

**Brosseder, U. B. 2015** A Study on the Complexity and Dynamics of Interaction and Exchange in Late Iron Age Eurasia. In: Bemmann, J. – Schmauder, M. (eds.), Complexity and Interaction along the Eurasian Steppe Zone in the First Millennium CE. Bonn: Vor- und Frühgeschichtliche Archäologie, Rheinische Friedrich-Wilhelms-Universität Bonn, 199–332.

**Brun, J.-P. 2011** Les objets en verre. In: Cuvigny, H. (ed.), Didymoi. Une garnison romaine dans le Désert Oriental d'Égypte. Praesidia du désert de Bérénice IV. Vol. 1: Les fouilles et le matériel. Caire: Institut Français d'Archéologie Orientale, 215–241.

**Cambon, P. (ed.) 2006** Afghanistan: les trésors retrouvés. Paris: Guimet-Musée national des arts asiatiques.

**Carter, A. – Lankton, J. 2012** Analysis and Comparison of Glass Beads from Ban Non Wat and Noen U-Loke. In: C. Higham, C. – Kijngam, A. (eds.), The Origins of Angkor, vol. 6: The Iron Age: Summary and Conclusions. Bangkok: Fine Arts Department of Thailand, 91–114.

**Casson, L. 1989** The Periplus Maris Erythraei. Text with Introduction, Translation, and Commentary. Princeton: Princeton University Press.

**Cheng Qian 成倩 – Wang Bo 王博 – Guo Jinlong 郭金龙 2011** Xinjiang Qiemo Zhagunluke mudi chutu boli bei yanjiu [Research on the glass cup unearthed from the cemetery at Zhagunluke, Qiemo, Xinjiang]. Wenwu 2011 (7), 88–92.

**Cheng Qian – Guo Jinlong – Wang Bo et al. 2016** Scientific Analysis of a Glass Vessel and an Eye Bead from the Zhagunluke and the Shanpula Sites from the Overland Southern Line of the Silk Road. In: Gan Fuxi – Li Qinghui – Henderson, J. (eds.), Recent Advances in the Scientific Research on Ancient Glass and Glaze. Singapore: World Scientific Publishing, 193–205.

**Cheng Qian – Zhang Xueyan – Guo Jinlong et al. 2019** Application of Computed Tomography in the Analysis of Glass Beads Unearthed in Shanpula Cemetery (Khotan), Xinjiang Uyghur Autonomous Region. Archaeological and Anthropological Sciences 11 (3), 937–945.

**Cheng Zhuhai – Zhou Changyuan 1991** A “Glass Garment” from a Western Han Tomb in Jiangsu Province. In: Brill, R. H. – Martin, J. H. (eds.), Scientific Research in Early Chinese Glass. Corning (NY): The Corning Museum of Glass, 21–25.

**Chennault, C. L. 2019** The World of Poetry. In: Dien, A. E. – Knapp, K. N. (eds.), The Cambridge History of China, vol. 2: The Six Dynasties, 220–589. Cambridge: Cambridge University Press, 623–661.

**Cherian, P. J. 2014** Unearthing Pattanam: Histories, Cultures, Crossings. New Delhi: National Museum.

**Cherian, P. J. (ed.) 2015** 9th Season Pattanam Excavation Report 2015. Thiruvananthapuram: Kerala Council for Historical Research.

**Clairmont, C. W. 1963** The Glass Vessels. The Excavations at Dura-Europos, Final Report IV part V. New Haven: The Dura-Europos Excavations.

**Conrady, A. 1920** Die chinesischen Handschriften und sonstigen Kleinfunde Sven Hedins in Lou-Lan. Stockholm: Generalstabens Litografiska Anstalt.

**Cottam, S. – Jackson, C. M. 2018** Things that Travelled: Precious Things for Special People? In: Rosenow, D. – Phelps, M. – Meek, A. – Freestone, I. (eds.), Things that Travelled. Mediterranean Glass in the First Millennium CE. London: University College London Press, 92–106.

**Cui, Jianfeng – Wu Xiaohong – Huang Baoling 2011** Chemical and Lead Isotope Analysis of Some Lead-barium Glass Wares from the Warring States Period, Unearthed from Chu Tombs in Changde City, Hunan Province, China. Journal of Archaeological Science 38, 1671–1679.

**Datong 2006** Datong = Shanxi daxue lishi wenhua xue yuan 山西大学历史文化学院 – Shanxi Sheng kaogu yan jiu suo 山西省考古研究所 – Datong Shi bowuguan 大同市博物馆 (eds.), Datong nan jiao Bei Wei mu qun 大同南郊北魏墓群 [The Northern Wei Period Necropolis in South Suburb of Datong City]. Beijing: Kexue chubanshe.

**Degryse, P. (ed.) 2014** Glass Making in the Greco-Roman World. Results of the ARCHGLASS Project. Leuven: Leuven University Press.

**Delacour, C. 1993** Redécouvrir les verres du trésor de Begram. Arts Asiatiques 48, 53–71.

**Di Castro, A. A. – Vicziany, M. – Xuan Zhu 2019** The Kashgar Oasis in Buddhist and Pre-Buddhist Times: The Archaeological and Environmental Record. In: Betts, A. V. G. – Vicziany, M. – Jia, P. – Di Castro, A. A. (eds.), The Cultures of Ancient Xinjiang, Western China: Crossroads of the Silk Roads. Oxford: Archaeopress, 143–170.

**Dien, A. E. 2007** Six Dynasties Civilization. New Haven / London: Yale University Press.

**Dissanayake, S. – Perera, N. 2017** Recent Excavations of Some Significant Stupas in Sri Lanka. In: Garg, S. (ed.), Archaeology of Buddhism. Recent Discoveries in South Asia. New Delhi: Manohar, 271–281.

**Dong Junqing – Li Qinghui – Liu Song 2015** The Native Development of Ancient Chinese Glassmaking: A Case Study on Some Early Lead-barium-silicate Glasses Using a Portable XRF Spectrometer. X-ray Spectrometry 44, 458–467.

**Dorna Metzger, F. 2000** I vetri di Hatra. Topoi 10 (2), 253–265.

**During Caspers, E. C. L. 1980** The Bahrain Tumuli. Istanbul: Nederlands Historisch-Archaeologisch Instituut.

**Dussubieux, L. 2016** A Proficiency Test for LA-ICP-MS Laboratories Analyzing Ancient Glass. In: Dussubieux, L. – Golitko, M. – Gratuze, B. (eds.), Recent

Advances in Laser Ablation ICP-MS for Archaeology. Berlin / Heidelberg: Springer, 197–212.

**Dussubieux, L. 2021** Indian Glass in Southeast Asia. In: Kanungo, A. K. – Dussubieux, L. (eds.), *Ancient Glass in South Asia. Archaeology, Ethnography and Global Connections*. Singapore: Springer Nature, 489–510.

**Dussubieux, L. – Gratuze, B. 2001** Analyse quantitative de fragments de verre provenant de Begram. *Topoi* 11 (1): 451–472.

**Dussubieux, L. – Gratuze, B. 2003** Nature et origine des objets en verre retrouvés à Begram (Afghanistan) et à Bara (Pakistan). In: Boepearachchi, O. – Landes, C. – Sachs, C. (eds.), *De l'Indus à l'Oxus : Archéologie de l'Asie Centrale*. Lattes: Association Imago / Musée de Lattes, 315–323.

**Dussubieux, L. – Gratuze, B. 2013** Glass in South Asia. In: Janssens, K. (ed.), *Modern Methods for Analysing Archaeological and Historical Glass*, vol. 2. Chichester: Wiley & Sons, 399–413.

**Dussubieux, L. – Lankton, J. W. – Bellina, B. et al. 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: Tjoa-Bonatz, M. L. – Reinecke, A. – Bonatz, D. (eds.), *Crossing Borders. Selected Papers from the 13th International Conference of the European Association of Southeast Asian Archaeologists* vol. 1. Singapore: NUS Press, 307–328.

**Ebrey, P. B. 2010** *The Cambridge Illustrated History of China*. Cambridge: Cambridge University Press.

**Echeng Liu Chao mu 2007** Echeng Liu Chao mu = Nanjing Daxue lishi kaogu zhuan ye 南京大学历史考古专业 et al. (eds.), *Echeng Liu Chao mu 鄂城六朝墓 [Tombs of the Six Dynasties at Echeng]*. Beijing: Kexue chubanshe.

**Ėrdėnėbaatar, D. C. (ed.) 2015** Balgasyn Tal dach' Gol Mod-2-yn chünnügijn jazuurtny bulšny sudalgaa [Investigation of Xiongnu Elite Burials, Gol mod-2 at Balgasyn Tal]. Ulaanbaatar: “Mönchijn-Üsėg” ChChK.

**Erdenebaatar, D. – Iderkhangai, T.-O. – Galbadrakh, B. et al. 2011** Excavations of Satellite Burial 30, Tomb 1 Complex Gol Mod 2 Necropolis. In: Brosseder, U. – Miller, B. K. (eds.), *Xiongnu Archaeology. Multidisciplinary Perspectives of the First Steppe Empire in Inner Asia*. Bonn: Vor- und Frühgeschichtliche Archäologie, Rheinische Friedrich-Wilhelms-Universität Bonn, 303–314.

**Eregzen, G. (ed.) 2011** *Treasures of the Xiongnu*. Ulaanbaatar: Institute of Archaeology.

**Fan Shimin – Zhou Baozhong 1991** Some Glass in the Museum of Chinese History. In: Brill, R. H. – Martin, J. H. (eds.), *Scientific Research in Early Chinese Glass*. Corning (NY): The Corning Museum of Glass, 193–200.

**Foy, D. 2018** An Overview of the Circulation of Glass in Antiquity. In: Wilson, A. – Bowman, A. (eds.), *Trade, Commerce, and the State in the Roman World*. Oxford: Oxford University Press, 265–299.

**Foy, D. – Labaune-Jean, F. – Leblond, C. et al. 2018** *Verres incolores de l'Antiquité romaine en Gaule et aux marges de la Gaul*, 2 vols. Oxford: Archaeopress.

**Freestone, I. C. 2006** Glass Production in Late Antiquity and the Early Islamic Period: A Geochemical Perspective. In: Maggetti, M. – Messiga, B. (eds.), *Geomaterials in Cultural Heritage*. London: The Geological Society of London, 201–216.

**Freestone, I. C. 2021** Glass Production in the First Millennium CE: A Compositional Perspective. In: Klimscha, F. – Karlsen, H.-J. – Hansen, S. – Renn, J. (eds.), *Vom Künstlichen Stein zum durchsichtigen Massenprodukt / From Artificial Stone to Translucent Mass-Product*. Berlin: Edition Topoi, 245–263.

**Freestone, I. C. – Degryse, P. – Lankton, J. et al. 2018** HIMT, glass composition and commodity in the primary glass industry. In: Rosenow, D. – Phelps, M. – Meek, A. – Freestone, I. (eds.), *Things that Travelled. Mediterranean Glass in the First Millennium CE*. London: University College London Press, 159–190.

**Fremersdorf, F. 1967** *Die römischen Gläser mit Schliff, Bemalung und Goldauflagen aus Köln*, 2 vols. Cologne: Reykers.

**Fukai, S. 1977** *Persian Glass*. New York / Tokyo / Kyoto: Weatherhill / Tankosha.

**Fünfschilling, S. 2015** *Die römischen Gläser aus Augst und Kaiseraugst*, 2 vols. Augst: Augusta Raurica.

**Fünfschilling, S. – Laflı, E. 2013** *Hadrianopolis II: Glasfunde des 6. und 7. Jahrhunderts aus Hadrianopolis, Paphlagonien (Türkei)*. Rahden/Westf.: Marie Leidorf.

**Gabsch, T. (ed.) 2012** *Auf Grünwedels Spuren. Restaurierung und Forschung an zentralasiatischen Wandmalereien*. Berlin / Leipzig: Koehler & Amelang.

**Gan Fuxi 2009** The Silk Road and Ancient Chinese Glass. In: Gan Fuxi – Brill, R. H. – Tian Shouyun (eds.), *Ancient Glass Research along the Silk Road*. Singapore: World Scientific Publishing, 41–108.

**Ganio, M. – Gulmini, M. – Latruwe, K. et al. 2013** *Sasanian Glass from Veh Ardasir Investigated by Strontium and Neodymium Isotopic Analysis*. *Journal of Archaeological Science* 40, 4264–4270.

**Gaulier, S. 1987** *Catalogue complémentaire des objets de la région de Koutcha*. In: Chao Huashan – Gaulier, S. – Maillard, M. – Pinault, G., *Sites divers de la région de Koutcha. Épigraphe Koutchéenne*. Mission Paul Pelliot VIII. Paris: Collège de France, Institut d'Asie, Centre de Recherche sur l'Asie Centrale et la Haute Asie, 31–60.

**Gaulier, S. – Lotiron, M.-R. 1964** *Catalogue descriptif*. In: Hambis, L. (ed.), *Toumchouq. Mission Paul Pelliot vol. II*. Paris: L'Académie des Inscriptions et Belles-Lettres, 337–418.

**Gavritukhin, I. 2011** Cut Glass Beakers within the Context of Studies in the Collections between the South of Eastern Europe and Scandinavia in the Late Period of Roman Influence and the Great Migrations Periods. In: Khrapunov, I. N. (ed.), *Inter Ambo Maria. Contacts between Scandinavia and the Crimea in the Roman Period*. Kristiansand / Simferopol: Dolya Publishing House, 39–69.

- Gennett, A. V. 2013** Glass Beads. Selections from the Corning Museum of Glass. Corning (N. Y.): The Corning Museum of Glass.
- Gliozzo, E. 2017** The Composition of Colourless Glass: A Review. *Archaeological and Anthropological Sciences* 9, 455–483.
- Gorea, M. 2012** Palmyra and Socotra. In: Strauch, I., Foreign Sailors on Socotra. The Inscriptions and Drawings from the Cave Hoq. Bremen: Hempen, 447–492.
- Gorin-Rosen, Y. 2021** Glass Finds. In: Weksler-Bdolah, S. – Onn, A. (eds.), Jerusalem, Western Wall Plaza Excavations vol. III, The Roman and Byzantine Periods: Small Finds from the Roman Refuse Dump and Other Contexts. Jerusalem: Israel Antiquities Authority, 27–67.
- Graf, D. F. 2018** The Silk Road between Syria and China. In: Wilson, A. – Bowman, A. (eds.), Trade, Commerce, and the State in the Roman World. Oxford: Oxford University Press, 443–529.
- Grane, T. 2013** Roman Imports in Scandinavia: Their Purpose and Meaning? In: Wells, P. S. (ed.), Rome Beyond Its Frontiers: Imports, Attitudes and Practices. Portsmouth, Rhode Islands: Journal of Roman Archaeology, 29–44.
- Gratuze, B. 2013** Glass Characterisation Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry Methods. In: Janssens, K. (ed.), Modern Methods for Analysing Archaeological and Historical Glass, vol. 1. Chichester: Wiley & Sons, 201–234.
- Gratuze, B. 2018** Contribution à l'étude des verres décolorés à l'antimoine produits entre le Ier s. et la fin du IIIe s. de notre ère: nouvelles données analytiques. In: Foy, D. et al., Verres incolores de l'Antiquité romaine en Gaule et aux marges de la Gaul, vol. 2. Oxford: Archaeopress, 349–360.
- Grossmann, R. A. 2013** Glass. In: Aylward, W. (ed.), Excavations at Zeugma, vol. 2. Los Altos (CA): The Packard Humanities Institute, 218–258.
- Grünwedel, A. 1912** Alt buddhistische Kultstätten in Chinesisch-Turkestan. Bericht über archäologische Arbeiten von 1906–1907 bei Kuča, Qarašahr und in der Oase Turfan. Berlin: Georg Reimer.
- Guangzhou Shi wenwu guanli weiyuanhui 广州市文物管理委员会 1996** Guangzhoushi Xiatang Shidaigang Jin mu fajue jianbao 广州市下塘狮带岗晋墓发掘简报 [Brief Excavation Report on Jin Dynasty Tombs at Shidaigang in Xiatang, Guangzhou], Kaogu 1996 (1), 36–45.
- Gudenrath, W. 2012** Techniques of Glassmaking and Decoration. In: Tait, H. (ed.), Five Thousand Years to Glass. London: The British Museum Press, 237–265.
- Hallade, M. – Gaulier, S. – Courtois, L. 1982** Douldour-Âqour et Soubachi. Mission Paul Pelliot IV. Paris: Éditions Recherche sur les civilisations.
- Ham Soon-seop 2013** Gold Culture of the Silla Kingdom and Maripgan. In: Lee, S. – Leidy, D. P. (eds.), Silla. Korea's Golden Kingdom. New York: The Metropolitan Museum of Art, 31–67.
- Hambis, L. (ed.) 1964** Toumchouq. Mission Paul Pelliot II. Paris: L'Académie des Inscriptions et Belles-Lettres.
- Hansen, V. 2017** The Silk Road. A New History with Documents. Oxford: Oxford University Press.
- Harada, Y. 1962** Ancient Glass in the History of Cultural Exchange between East and West. *Acta Asiatica* 3, 57–69.
- Harden, D. B. 1936** Roman Glass from Karanis. Ann Arbor: University of Michigan Press.
- Hedin, S. 1903** Im Herzen von Asien. Zehntausend Kilometer auf unbekanntem Pfaden, 2 vols. Leipzig: F.A. Brockhaus.
- Henderson, J. – An Jiayao – Ma Hongjiao 2018** The Archaeometry and Archaeology of Ancient Chinese Glass: A Review. *Archaeometry* 60 (1), 88–104.
- Hiebert, F. – Cambon, P. (eds.) 2008** Afghanistan. Hidden Treasures from the National Museum, Kabul. Washington: National Geographic Society.
- Holcombe, C. 2019** Foreign Relations. In: Dien, A. E. – Knapp, K. N. (eds.), The Cambridge History of China vol. 2: The Six Dynasties, 220–589. Cambridge: Cambridge University Press, 297–208.
- Huanan kaogu 2004 = Guangdongsheng wenwu kaogu yanjiusuo 广东省文物考古研究所 – Zhaoqingshi Bowuguan 肇庆市博物馆, Guangdong Zhaoqingshi Pingshigang Dong Jin mu 广东肇庆市坪石岗东晋墓 [An Eastern Jin Tomb at Pingshigang of Zhaoqing City]. In: Guangdongsheng wenwu kaogu yanjiusuo et al. (eds.), Huanan kaogu 华南考古 / South China Archaeology, vol. 1. Beijing: Wenwu chubanshe, 248–264.**
- Huang 2021** Huang Qishan, Ancient Glass Technology in South and Southwest China, In: Gan Fuxi (ed.), Development History of Ancient Chinese Glass Technology. Series on Archaeology and History of Science in China vol. 3. Singapore: World Scientific Publishing, 509–557.
- Isings, C. 1957** Roman Glass from Dated Finds. Groningen/Djakarta: J.B. Wolters.
- Jackson, C. M. 2005** Making Colourless Glass in the Roman Period. *Archaeometry* 47,4, 763–780.
- Jackson, C. – Cottam, S. 2015** 'A Green Thought in a Green Shade': Compositional and Typological Observations Concerning the Production of Emerald Green Glass Vessels in the 1st century AD. *Journal of Archaeological Science* 61, 139–148.
- Jackson, C. M. – Paynter, S. 2016** A Great Big Melting Pot: Exploring Patterns of Glass Supply, Consumption and Recycling in Roman Coppergate, York. *Archaeometry* 58 (1), 68–95.
- Jackson-Tal, R. 2016** Nabataean Cultural Habits: The Glass Finds at Oboda. *Israel Exploration Journal* 66 (1), 70–95.
- Janse, O. R. T. 1951** Archaeological Research in Indo-China vol. 2: The District of Chiu-Chên during the Han Dynasty. Description and Comparative Study of the Finds. Cambridge (Mass.): Harvard University Press.
- Japp, S. 2019** Imports of Pottery and Glass Vessels in First Millennium CE South Arabia: Signs of

- Commercial and Cultural Contacts via the Red Sea Trade Routes. In: Manzo, A. – Zazzaro, C. – Joyce de Falco, D. (eds.), *Stories of Globalisation: The Red Sea and the Persian Gulf from Late Prehistoric to Early Modernity*. Leiden/Boston: Brill, 154–179.
- Jenner, W. J. F. 1981** Memories of Loyang. Yang Hsüan-chih and the Lost Capital (493–534). Oxford: Clarendon Press.
- Keller, D. 2010** Functional and Economic Aspects of Late Sasanian and Early Islamic Glass from Kush, United Arab Emirates. In: Zorn, B. – Hilgner, A. (eds.), *Glass along the Silk Road, from 200 BC to AD 1000*. International conference within the scope of the “Sino-German project on cultural heritage preservation” of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 71–80.
- Kieser, A. 2001** Northern Influence in Tombs in Southern China after 317 CE? – A re-evaluation. In: Wu Hung (ed.), *Han Tang zhi jian wenhua yishu de hudong yu jiaorong/Between Han and Tang. Cultural and Artistic Interaction in a Transformative Period*. Beijing: Wenwu chubanshe, 231–272.
- Kieser, A. 2002** Landadel – Emigranten – Emporkömmlinge: Familienfriedhöfe des 3.–6. Jahrhunderts n. Chr. in Südchina. Wiesbaden: Harrassowitz.
- Kieser, A. 2004** “Nur Guangzhou ist ruhig und friedlich”. Grabkult und Migration während der Sechs Dynastien im heutigen Guangdong. In: Müller, S. – Höllmann, T. O. – Gui Putao (eds.), *Guangdong: Archaeology and Early Texts (Zhou – Tang)*. Wiesbaden: Harrassowitz, 101–124.
- Kieser, A. 2011** New Insight on Émigré Tombs of the Eastern Jin in Jiankang. In: Rošker, J. S. – Suhadolnik, N. V. (eds.), *The Yields of Transition: Literature, Art and Philosophy in Early Medieval China*. Newcastle upon Tyne: Cambridge Scholars Publishing, 53–73.
- Kim, C. F. 2012** Early Chinese Lead-Barium Glass. Its Production and Use from the Warring States to Han Period (475 BCE–220 CE). ARCH0305 (Prof. Carolyn Swann, May 7, 2012). Unpublished paper.
- Kim, D. – Lee, S. – Abe, Y. et al. 2019** A Joint Study on Some Ancient Glass Vessels and Beads Housed in Gyeongju National Museum. *Silla Munmul Yeongu / Journal of the Gyeongju National Museum* 12, 19–24. [In Korean]
- Koh, M. J. – Kang, H. T. – Kim, N. Y. et al. 2012** A Comparison in Characteristics of Chemical Composition of Glass Vessels Excavated from Neungsalli Temple in Buyeo, Korea, from Baekje Period. *Bulletin of the Korean Chemical Society* 33 (12), 4173–4179.
- Komoot, A. 2021** Maritime Connections in the Indian Ocean World during the First Millennium CE: An Archaeological Study of the Phanom-Surin Ship in Thailand. PhD Thesis, The University of Western Australia.
- Kucharczyk, R. 2011** Glass. In: Sidebotham, S. E. – Zych, I. (eds.), *Berenike 2008–2009: Report on the Excavations at Berenike, including a Survey in the Eastern Desert*. Warsaw: Polish Centre of Mediterranean Archaeology, University of Warsaw, 83–111.
- Kucharczyk, R. 2017** Come and dine with me ...: Early Roman luxury glass tableware from Berenike – new evidence from the harbor area and trash dumps. *Polish Archaeology in the Mediterranean* 26 (2), 147–166.
- Kwan, S. = Guan Shanming 關善明 2001** Zhongguo gudai boli 中國古代玻璃 / Early Chinese Glass. Hong Kong: Art Museum, The Chinese University of Hong Kong.
- La Baume, P. 1974** Zu einem Glasgefäß in Tiergestalt aus der Mandschurei (China). *Kölner Jahrbuch für Ur- und Frühgeschichte* 14, 126–127.
- La Vaissière, É. de 2005** Sogdian Traders. A History. Leiden / Boston: Brill.
- Lankton, J. W. – Lee, I. – Kim, G.-H. et al. 2009** Bactrian Glass Vessels in Korean Tombs. In: Janssens, K. – Degryse, P. – Cosyns, P. – Caen, J. – Van’t dack, L. (eds.), *Annales du 17e Congrès de l’Association Internationale pour l’Histoire du Verre*, Anvers, 2006. Antwerp: University Press Antwerp, 579–589.
- Lankton, J. W. – Gratuze, B. – Kim, G.-H. et al. 2010** Silk Road Glass in Ancient Korea: The Contribution of Chemical Compositional Analysis. In: Zorn, B. – Hilgner, A. (eds.), *Glass along the Silk Road, from 200 BC to AD 1000*. International conference within the scope of the “Sino-German project on cultural heritage preservation” of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 221–237.
- Lankton, J. W. – Dussubieux, L. 2013** Early Glass in Southeast Asia. In: Janssens, K. (ed.), *Modern Methods for Analysing Archaeological and Historical Glass*, vol. 2. Chichester: Wiley & Sons, 415–443.
- Lankton, J. W. – Gratuze, B. 2019** Suvarnabhumi in the 1st Century CE: The Glass Evidence. In: Pongpanich, B. – Thinapong, S. (eds.), *Suvarnabhumi: The Golden Land. The New Finding for Suvarnabhumi terra incognita*. Bangkok: GISTDA and BIA, 67–77.
- Lankton, J. W. 2022** From Regional to Global: Early Glass and the Development of the Maritime Silk Road. In: Billé, F. – Mehendale, S. – Lankton, J. W. (eds.), *The Maritime Silk Road. Global Connectivities, Regional Nodes, Localities*. Amsterdam: Amsterdam University Press, 72–94.
- Lee, I. 2010** Early Glass in Korean Tombs – Cultural Context. In: Zorn, B. – Hilgner, A. (eds.), *Glass along the Silk Road, from 200 BC to AD 1000*. International conference within the scope of the “Sino-German project on cultural heritage preservation” of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 211–219.
- Lee, I. 2013** Of Glass and Gold. Silla Tombs, the Silk Road, and the Steppes. In: Lee Soyoung – Leidy, D. P. (eds.), *Silla. Korea’s Golden Kingdom*. New York: The Metropolitan Museum of Art, New York, 115–131.

- Lee Soyoung – Leidy, D. P. (eds.) 2013** Silla. Korea's Golden Kingdom. New York: The Metropolitan Museum of Art, New York.
- Leslie, D. D. – Gardiner, K. H. J. 1996** The Roman Empire in Chinese Sources. *Studi Orientali* vol. 15. Rome: Bardi.
- Li Yaobo 黎瑶渤 1973** Liaoning Beipiao xian Xiguanyingzi Bei Yan Feng Sufu mu 辽宁北票县西官营子北燕冯素弗墓 [The tomb of Feng Sufu of the Northern Yan at Xiguanyingzi, Beipiao, Liaoning]. *Wenwu* 1973 (3), 2–28.
- Li Yao-po 1974** Die Gräber der Familie des Feng Sufu in Hsi-kuan-ying-tzu/Kr. Pei-p'iao, Prov. Liaoning, aus der Zeit der Nord-Yen-Dynastien. *Kölner Jahrbuch für Ur- und Frühgeschichte* 14, 111–125.
- Li Qinghui 李青会 2005** Zhongguo gudai boli wupin de huaxue chengfen huibian 中国古代玻璃物品的化学成分汇编 [The Tables of Chemical Analysis of Chinese Ancient Glass Artifacts]. In: Gan Fuxi 干福熹 (ed.), *Zhongguo gudai boli jishu de fazhan 中国古代玻璃技术的发展* [Development of ancient Chinese Glass Technology], Appendix 2. Shanghai: Shanghai kexue jishu chubanshe, 281–326.
- Li Qinghui – Gu Donghong – Gan Fuxi et al. 2005** Chemical Composition Analyses of Ancient Glasses Found in Xinjiang Province, China. In: *Proceedings of the XX International Congress on Glass in Kyoto*, September 27th – October 1st, 2004. Tokyo Ceramic Society of Japan, paper O-15-004 (pp.1–6).
- Li Jun 李军 – Luo Haiming 罗海明 2006** Anhui Dangtu Dong Jin mu fajue jianbao – jianlun chutu de boli wan canpian leibie he lai yuan 安徽当涂东晋墓发掘简报——兼论出土的玻璃碗残片类别和来源 [Brief Report on the Excavation of Tomb of Eastern Jin Dynasty in Dangtu, Anhui Province and on Patterns and Sources of Uncovered Broken Glass Bowl]. *Dongnan wenhua* 2006 (2), 33–39.
- Li Qinghui – Li Zebin – Gu Donghong 2016** Archaeological and Technical Study of Western Han Dynasty Lead Barium Glass Chimes (Bian Qing) Unearthed from the Jiangdu King's Mausoleum. In: Gan, Fuxi – Li, Q. – Henderson, J. (eds.), *Recent Advances in the Scientific Research on Ancient Glass and Glaze*. Singapore: World Scientific, 113–127.
- Li Qinghui – Yu Yongshan – Zhang Ping et al. 2009** Chemical Composition Analyses of Early Glasses of Different Historical Periods Found in Xinjiang, China. In: Gan Fuxi – Brill, R. H. – Tian Shouyun (eds), *Ancient Glass Research along the Silk Road*. Singapore: World Scientific Publishing, 331–357.
- Li Qinghui 李青会 – Zhang Bin 张斌 – Gan Fuxi 干福熹 et al. 2003** Yipi Zhongguo nanfang chutu gu boli de huaxue chengfen de PIXE fenxi jieguo 一批中国南方出土古玻璃的化学成分的 PIXE 分析结果. In: Gan Fuxi (ed.), *Zhongguo nanfang gu boli yanjiu: 2002 nian Nanning Zhongguo nanfang gu boli yantaohui lunwen ji 中国南方古玻璃研究: 2002 年南宁中国南方古玻璃研讨会论文集* [Study on Ancient Glass in Southern China: Proceedings of 2002 Nanning Symposium on Ancient Glass in Southern China]. Shanghai: Shanghai kexue jishu chubanshe, 76–84.
- Liaoning 2015** Liaoning sheng bowuguan 辽宁省博物馆 [Liaoning Provincial Museum] (ed.), *Bei Yan Feng Sufu mu 北燕冯素弗墓* [Feng Sufu Couple's Tombs of the Northern Yan]. Beijing: Wenwu chubanshe.
- Lin Meicun 林梅村 2017** Tang Wude Ernian Jibin Guo Gongpin Kao. *Jianlun Xi'an Hejiacun Tangdai jiaocang yuanwei Daminggong Qionglinku huangjia baozang 唐武德二年颍滨国贡品考——兼论西安何家村唐代窖藏原为大明宫琼林库皇家宝藏* [On the Royal Tributes from Kapisa during Wude Second Year in the Tang Period: A Dissertation on the Relationship between the Tang Period Treasure Hoard of Hejiacun and the Royal storehouse of Qionglinku]. *Kaogu yu wenwu* 2017 (6), 94–103.
- Lin Yixian 林宜娴 2010** A Scientific Study of Glass Finds from the Niya Oasis. In: Zorn, B. – Hilgner, A. (eds.), *Glass along the Silk Road, from 200 BC to AD 1000*. International conference within the scope of the "Sino-German project on cultural heritage preservation" of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 203–210.
- Lin Yixian 林宜娴 2017** Laizi "Manzu" de yinqi – Zaiyi Xinjiang suo jian momian wen bolibei 来自“蛮族”的饮器——再议新疆所见磨面纹玻璃杯 [Research on Faceted-cut Glass Beakers in Xinjiang]. *Kaogu yu wenwu* 2017 (6), 82–93.
- Lin Yixian 林宜娴 n. d.** Niya Yizhi xinfaxian Laitong de chengfen ceding fenxi 尼雅遗址新发现来通的成分测定分析 [Compositional Analysis of the newly discovered Rhyton at the Niya Site]. Unpublished Report.
- Liu Xinru 1990** Ancient India and Ancient China. Trade and Religious Exchanges AD 1–600. Delhi: Oxford University Press.
- Liu Song – Li Qinghui – Gan Fuxi et al. 2011** Characterization of Some Ancient Glass Vessels Fragments Found in Xinjiang, China, Using a Portable Energy Dispersive XRF Spectrometer. *X-ray Spectrometry* 40, 364–375.
- Liu Song – Li Qinghui – Gan Fuxi et al. 2012** [Silk Road Glass in Xinjiang, China: Chemical Compositional Analysis and Interpretation Using a High-Resolution Portable XRF Spectrometer](#). *Journal of Archaeological Science* 39, 2128–2142.
- Lu Xuan 卢轩 – Liu Zixin 刘子信 – He Daxin 贺达忻 et al. 2017** Hejiacun Tangdai jiaocang baoshi ji boliwan jiance baogao 何家村唐代窖藏宝石及玻璃碗检测报告 [Analytical Report on Gemstones and Glass Bowls Discovered in the Tang Period Treasure Hoard of Hejiacun]. *Kaogu yu wenwu* 2017 (6), 114–120.
- Luczanits, C. (ed.) 2009** Gandhara: Das buddhistisches Erbe Pakistans. *Legenden, Klöster und Paradiese*. Mainz: von Zabern.
- Luo Zongshen 罗宗真 1994** Liu Chao kaogu 六朝考古 [Archaeology of the Six Dynasties Period]. Nanjing: Nanjing daxue chubanshe.
- Luoyang Cultural Relics Work Team 1990** Luoyang chutu wenwu ji cui 洛阳出土文物集萃 [Ancient Treasures of Luoyang]. Beijing: Morning Glory Publishers.

- Lü, Q.-Q. – Basafa, H. – Henderson, J. 2023** Connected in Diversity: Isotopic Analysis Refines Provenance for Islamic Plant-ash Glass from the Eastern Silk Roads. *iScience* 26, 108450, December 15, <https://doi.org/10.1016/j.isci.2023.108450>
- Ma Chengyuan 马承源 – Yue Feng 岳峰 (eds.) 1998** Xinjiang Weiwuer Zizhiqu Silu kaogu zhen pin 新疆维吾尔自治区丝路考古珍品 / Archaeological Treasures of the Silk Road in Xinjiang Uygur Autonomous Region. Shanghai: Shanghai yi wen chubanshe.
- Ma Yan 马艳 2014** Datong chutu Bei Wei mohua boli wan yuanliu 大同出土北魏磨花玻璃碗源流 [Origin of a facet-cut glass bowl excavated in Datong of the Northern Wei dynasty]. *Zhong yuan wenwu* 2014 (1), 96–100.
- Ma Yongqiang 马永强 2017** Jiangsu Pizhou Jianyaomiao Xi Jin mudi 江苏邳州煎药庙西晋墓地 [Western Jin Period Jianyaomiao Cemetery in Pizhou, Jiangsu]. In: 2016 Zhongguo zhongyao kaogu faxian 2016 中国重要考古发现 [Major Archaeological Discoveries in China in 2016]. Beijing: Wenwu chubanshe, 110–114.
- Mairs, R. 2012** Glassware from Roman Egypt at Begram (Afghanistan) and the Red Sea Trade. *British Museum Studies in Ancient Egypt and Sudan* 18, 1–14.
- Manguin, P.-Y. 2019** Sewn Boats of Southeast Asia: the Stitched-plank and Lashed-lug tradition. *The International Journal of Nautical Archaeology* 48 (2), 400–415.
- Manguin, P.-Y. – Stark, M. T. 2022** Mainland Southeast Asia's Earliest Kingdoms and the Case of "Funan". In: Higham, C. F. W. – Kim, N. C. (eds.), *The Oxford Handbook of Southeast Asia*. Oxford: Oxford University Press, 637–659.
- Marshall, J. H. 1951** Taxila. 3 vols. Cambridge: Cambridge University Press.
- Mather, R. B. 1976** Shih-shuo Hsin-yü. A New Account of Tales of the World. Minneapolis: University of Minnesota Press.
- Menninger, M. 1996** Untersuchungen zu den Gläsern und Gipsabgüssen aus dem Fund von Begram (Afghanistan). Würzburg: Ergon.
- Meredith-Goymour, H. 2006** Disentangling Material Cultures: Late Roman and Sasanian Facet Cut Glassware in Late Antiquity. In: Day, J. et al. (eds.), *Symposium on Mediterranean Archaeology 2004. Proceedings of the Eighth Annual Meeting of Postgraduate Researchers, School of Classics, Trinity College Dublin, 20–22 February 2004*. Oxford: Archaeopress, 123–129.
- Meyer, C. 1992** Glass from Quseir al-Qadim and the Indian Ocean Trade. Chicago: The Oriental Institute.
- Michaelson, C. 1998–99** Han Dynasty Chinese Glass Plaques in the British Museum. *Transactions of the Oriental Ceramics Society* 63, 45–64.
- Mirti, P. – Pace, M. – Negro Ponzi, M. M. et al. 2008** ICP-MS Analysis of Glass Fragments of Parthian and Sasanian Epoch from Seleucia and Veh Ardašir (Central Iraq). *Archaeometry* 50 (3), 429–450.
- Mirti, P. – Pace, M. – Malandrino, M. et al. 2009** Sasanian Glass from Veh Ardašir: New Evidence by ICP-MS Analysis. *Journal of Archaeological Science* 36 (4), 1061–1069.
- Mischke, S. – Liu, C. – Zhang, J. et al. 2017** The World's Earliest Aral-Sea Type Disaster: the Decline of the Loulan Kingdom in the Tarim Basin. *Scientific Reports* 7, article no. 43102. <https://doi.pangaea.de/10.1594/PANGAEA.871173>.
- Moore, O. 1998** Islamic Glass at Buddhist Sites in Medieval China. In: Ward, R. (ed.), *Gilded and Enamelled Glass from the Middle East*. London: British Museum Press, 78–84.
- Morris, L. 2021** The Begram Hoard and Its Context. (PhD thesis, University of Munich).
- Müller, S. 1998** Die Gräber der Nördlichen Wei-Zeit (386–534). University of Munich, PhD thesis.
- Müller, S. 2019** Northern Material Culture. In: Dien, A. E. – Knapp, K. N. (eds.), *Cambridge History of China vol.2: Six Dynasties*. Cambridge: Cambridge University Press, 384–417.
- Nakamura, D. – Tamura, T. – Warashina, T. et al. 2021** Scientific Analysis on the Glass and Stone Artifacts in Ulaanbaatar State University. *Saitama Daigaku-kiyō / Saitama Daigaku Kyōyō Gabuku [Saitama University Review / Faculty of Liberal Arts]* 56 (2), 105–116. <http://doi/10.24561/00019239>
- Nanjing Shi Bowuguan 南京市博物馆 1972** Nanjing Xiangshan 5 hao, 6 hao, 7 hao mu qingli jianbao 南京象山5号、6号、7号墓清理简报 [A Brief Report on Excavation of Tomb Numbers 5, 6, and 7 in Xiangshan, Nanjing]. *Wenwu* 1972 (11), 23–41.
- Nanjing Shi Bowuguan 南京市博物馆 1983** Nanjing beijiao Dong Jin mu fajue jianbo 南京北郊东晋墓发掘简报 [A Brief Report on the Excavation of an Eastern Jin Tomb in the Northern Suburb of Nanjing]. *Kaogu* 1983 (4), 315–322.
- Nanjing Museum 2015** Mausoleum M 1 of the Jiangdu Feudatory Kingdom of the Western Han Dynasty at Dayuan Hill in Xuyi County, Jiangsu Province. *Chinese Archaeology* 15, 127–143.
- Nanjing Bowuyuan 南京博物院 – Xuzhou Bowuguan 徐州博物馆 – Pizhoushi Bowuguan 邳州市博物馆 2018** Jiangsu Pizhou Jianyaomiao Xi Jin mudi M1 fajue jianbao 江苏邳州煎药庙西晋墓地M1发掘简报 [The Excavation of Tomb M1 of the Western Jin Cemetery at Jianyaomiao, Pizhou, Jiangsu Province] *Dongnan wenhua* 2, 20–32.
- Negro Ponzi, M. M. 1968–69** Sasanian Glassware from Tell Mahuz (North Mesopotamia). *Mesopotamia* 3–4, 293–384.
- Negro Ponzim, M. M. 2002** The Glassware from Seleucia (Central Iraq). *Parthica* 4, 63–156.
- Negro Ponzi, M. M. 2005** Mesopotamian Glassware of the Parthian and Sasanian Period: Some Notes. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre*, London 2003. Nottingham: AIHV, 141–145.
- Negro Ponzi Mancini, M. M. 1984** Glassware from Choche (Central Mesopotamia). In: Boucharlat, R. – Salles, J.-F. (eds.), *Arabie orientale, Mésopotamie et Iran méridional de l'âge du fer au début de la période*

islamique. Paris: Éditions Recherche sur les Civilisations, 33–40.

**Nenna, M.-D. 1999** La verrerie. In: Lombard, P. (ed.), Bahrein. La civilisation des deux mers. Paris: Institut du monde arabe, 181–191.

**Nenna, M.-D. 2003** Verres gravés d'Égypte du Ier au Ve siècle ap. J.-C. In: Foy, D. – Nenna, M.-D. (eds.), Échanges et commerce du verre dans le monde antique. Montagnac: Monique Mergoil, 359–375.

**Nenna, M.-D. 2012** Innovation et tradition dans la production des verres de l'Égypte romaine. In: Ballert, P. (ed.), Grecs et Romains en Égypte. Territoires, espaces de la vie et de la mort, objets de prestige et du quotidien. Cairo: Institut Français d'Archéologie Orientale, 309–325.

**Nenna, M.-D. 2014** Egyptian Glass abroad: HIMT glass and Its Markets. In: Keller, D. – Price, J. – Jackson, C. (eds.), Neighbours and Successors of Rome. Traditions of Glass Production and Use in Europe and the Middle East in the Later 1st Millennium AD. Oxford: Oxbow, 177–193.

**Nenna, M.-D. – Gratuze, B. 2009** Étude diachronique des compositions de verres employés dans les vases mosaïqués antiques: résultats préliminaires. In: Janssens, K. – Degryse, P. – Cosyns, P. – Caen, J. – Van't dack, L. (eds.), Annales du 17e Congrès de l'Association Internationale pour l'Histoire du Verre, Anvers, 2006. Antwerp: University Press Antwerp, 199–205.

**Oates, D. – Oates, J. 1959** Ain Sinu: A Roman Frontier Post in Northern Iraq. *Iraq* 21, 207–242.

**Oliver, A. Jr. 1984** Early Roman Faceted Glass. *Journal of Glass Studies* 26, 35–58.

**Otani, I. 大谷育恵 2017** モンゴルならびに中国の遺跡で出土した漢代並行期のガラス容器(資料集成) [A Catalogue of Glassware Excavated in China and Mongolia (Han and Xiongnu Period)]. *The Archaeological Journal of Kanazawa University* 76, 65–73 [in Japanese].

**Otani, I. 大谷育恵 2022** 東アジアで出土したガラス容器資料 (集成 II: 三国～北魏並行期) [A Catalogue of Glassware Unearthed in East Asia (Catalogue No. 2: 3rd–6th century CE)]. *The Archaeological Journal of Kanazawa University* 81, 22–58 [in Japanese].

**Paynter, S. – Jackson, C. 2019** Clarity and Brilliance: Antimony in Colourless Natron Glass Explored Using Roman Glass Found in Britain. *Archaeological and Anthropological Sciences* 11, 1533–1551.

**Peacock, D. 2011** Glass. In: Peacock, D. – Blue, L. (eds.), *Myos Hormos – Quseir al-Qadim. Roman and Islamic Ports on the Red Sea, vol. 2: Finds from the Excavations 1999–2003*. Oxford: Oxbow Books, 57–78.

**Pelliot, P. 2008** Carnets de voyage, 1906–1908. Paris: Les Indes savantes / Guimet-Musée national des arts asiatiques.

**Phelps 2017** Phelps, M. O. R., An Investigation into Technological Change and Organisational Developments in Glass Production between the Byzantine and Early Islamic Periods (7<sup>th</sup>–12<sup>th</sup> Centuries) Focusing on Evidence from Israel. PhD thesis University College London (Oct. 2016).

**Picon, M. – Thirion-Merle, V. – Vichy, M. 2008**

Les verres au natron et les verres aux cendres du Wadi Natrun (Égypte). *Bulletin de l'Association Française pour l'Archéologie du Verre* 22, 36–41.

**Piromrak, N. 2020** Khlong Thom Shipwreck: Evidence of Early Lashed-lug Boat in Thailand. *Silpakorn Journal* 63, 5, September–October, 30–41. [in Thai]

**Ployer, R. 2012** Glass from the Excavations of the So-called 'Hellenistic' Town of Palmyra. A Preliminary Report. In: Ignatiadou, D. – Antonaras, A. (eds.), *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre, Thessaloniki 2009*. Thessaloniki: ZITI publishing, 104–108.

**Ployer, R. 2013** Gläser. In: Schmidt-Colinet, A. – Waleed al-As'ad (eds.) *Palmyras Reichtum durch weltweiten Handel. Archäologische Untersuchungen im Bereich der hellenistischen Stadt, vol. 2: Kleinfunde*. Wien: Holzhausen, 127–205.

**Ploymukda, S. 2020** Pak Khlong Kluay Shipwreck Site: Evidence-based Shipbuilding Technology and Marine Interaction Across the Andaman Coast in Early History Period. *Silpakorn Journal* 63, 5, September–October, 42–57. [in Thai]

**Priestman, S. 2016** The Silk Road of the Sea? Sasanian and Islamic Exports to Japan. *Journal of Islamic Archaeology* 3 (1), 1–35.

**Psarras, S.-K. 2015** Han Material Culture. An Archaeological Analysis and Vessel Typology. Cambridge: Cambridge University Press.

**Pugachenkova, G. A. 1966** Khalchayan. Tashkent: Fan.

**Qin Ying – Wang Yinghong – Chen Xi et al. 2016** The Research of Burning Ancient Chinese Lead-barium Glass by Using Mineral Raw Materials. *Journal of Cultural Heritage* 21, 796–801.

**Rehren, T. – Osório, A. – Anarbaev, A. 2010** Some Notes on Early Islamic Glass in Eastern Uzbekistan. In: Zorn, B. – Hilgner, A. (eds.), *Glass along the Silk Road, from 200 BC to AD 1000*. International conference within the scope of the "Sino-German project on cultural heritage preservation" of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 93–103.

**Rehren, T. – Freestone, I. C. 2015** Ancient Glass: From Kaleidoscope to Crystal Ball. *Journal of Archaeological Science* 56, 233–241.

**Rehren, T. – Connolly, P. – Schibille, N. et al. 2015** Changes in the Glass Consumption in Pergamon (Turkey) from Hellenistic to Late Byzantine and Islamic Times. *Journal of Archaeological Science* 55, 266–279.

**Reinhardt, H. 2019** Glas aus Beirut. Die Glasfunde aus der römischen Therme in BEY 178. Marburg: Archäologisches Seminar der Philipps-Universität.

**Rhie, M. M. 1999** Early Buddhist Art of China and Central Asia, vol. 1: Later Han, Three Kingdoms and Western Chin in China and Bactria to Shan-shan in Central Asia. Leiden / Boston / Cologne: Brill.

- Rhie, M. M. 2002** Early Buddhist Art of China and Central Asia, vol. 2: The Eastern Chin and Sixteen Kingdoms Period in China and Tumshuk, Kucha and Karashahr in Central Asia. Leiden / Boston / Cologne: Brill.
- Rosenow, D. – Rehren, T. 2014** Herding Cats – Roman to Late Antique Glass Groups from Bubastis, Northern Egypt. *Journal of Archaeological Science* 49, 170–184.
- Rosenow, D. – Rehren, T. 2018** A View from the South: Roman and Late Antique Glass from Armant, Upper Egypt. In: Rosenow, D. – Phelps, M. – Meek, A. – Freestone, I. (eds.), *Things that Travelled. Mediterranean Glass in the First Millennium CE*. London: University College London Press, 283–323.
- Rosenow, D. 2020** The Roman Glass Finds from Tombs 2 and 6 at Tuna el-Gebel. In: Flossmann-Schütze, M. C. – Hoffmann, F. – Schütze, A. (eds.), *Tuna el-Gebel – Eine ferne Welt. Tagungsband zur Konferenz der Graduate School “Distant Worlds” vom 16. bis 19.1.2014 in München*. Vaterstetten: Patrick Brose, 161–171.
- Rütti, B. 1991** Die römischen Gläser aus Augst und Kaiseraugst, 2 vols. Augst: Römermuseum.
- Rumyantseva, O. – Belikov, C. 2017** A Late Roman Glass Workshop at Komarov (Middle Dniestr) and the Problem of the Origin of ‘Barbarian’ Facet Cut Beakers. In: Wolf, S. – De Pury-Gysel, A. (eds.), *Annales du 20e Congrès de l’Association Internationale pour l’Histoire du Verre, Fribourg / Romont 2015*. Rahden/Westf.: Verlag Marie Leidorf / Association Internationale pour l’Histoire du Verre, 257–264.
- Rumyantseva, O. – Lyubitchev, M. – Petrauskas, O. et al. 2021** ‘Barbarian’ Beakers with Facet Cut Decoration: Composition, Origin, Social and Cultural Context. In: Sevindik, O. (ed.), *Annales du 21e Congrès de l’Association Internationale pour l’Histoire du Verre, Istanbul 2018*. Istanbul: Association Internationale pour l’Histoire du Verre, 333–348.
- Salisbury, A. – Glover, I. 1997** New Analyses of Early Glass from Thailand and Vietnam. *Bead Study Trust Newsletter* no. 30 (Winter 1997), 7–14.
- Sarianidi, V. I. 1985** Bactrian Gold. Leningrad: Aurora Art Publishers.
- Sayre, E. V. – Smith, R. W. 1961** Compositional Categories of Ancient Glass. *Science* 133 (3467), 1824–1826.
- Sayre, E. V. – Smith, R. W. 1967** Some Materials of Glass Manufacturing in Antiquity. In: Levey, M. (ed.), *Archeological Chemistry. A Symposium*. Philadelphia: University of Pennsylvania Press, 279–311.
- Schibille, N. 2022** Islamic Glass in the Making. Chronological and Geographical Dimensions. Leuven: Leuven University Press.
- Schlick-Nolte, B. – Werthmann, K. 2003** Glass Vessels from the Burial of Nesikhons. *Journal of Glass Studies* 45, 11–34.
- Schlick-Nolte, B. – Werthmann, K. 2010** More Glass Beakers for Nesikhons: A Preliminary Report. *Journal of Glass Studies* 52, 235–240.
- Schmidt, K. 2019** Glass and Glass Production in the Near East during the Iron Age. Evidence from Objects, Texts and Chemical Analysis. Oxford: Archaeopress.
- Schwarzer, H. – Rehren, T. 2021** Glass Finds from Pergamon. A Report on the Results of Recent Archaeological and Archaeometric Research. In: Klimscha, F. – Karlsen, H.-J. – Hansen, S. – Renn, J. (eds.), *Vom Künstlichen Stein zum durchsichtigen Massenprodukt / From Artificial Stone to Translucent Mass-Product*. Berlin: Edition Topoi, 161–215.
- Scott, R. B. – Degryse, P. 2014** The Archaeology and Archaeometry of Natron Glass Making. In: Degryse, P. (ed.), *Glass Making in the Greco-Roman World. Results of the ARCHGLASS Project*. Leuven: Leuven University Press. Chapter 1, 15–26.
- Seland, E. H. 2010** Ports and Political Power in the Periplus: Complex Societies and Maritime Trade on the Indian Ocean in the First Century AD. Oxford: Archaeopress.
- Seland, E. H. 2010** Palmyrene Trading Networks. In: Raja, R. (ed.), *The Oxford Handbook of Palmyra*. Oxford: Oxford University Press, 261–274.
- Selbitschka, A. 2010** Prestigeüter entlang der Seidenstraße? Archäologische und historische Untersuchungen zu Chinas Beziehungen zu Kulturen des Tarimbeckens vom zweiten bis frühen fünften Jahrhundert nach Christus. 2 vols. Wiesbaden: Harrassowitz.
- Seligman, C. G. – Beck, H. C. 1938** Far Eastern Glass: Some Western Origins. *Bulletin of the Museum of Far Eastern Antiquities* 10, 1–64.
- Shen Congwen 沈从文 – Li Zhitan 李之檀 2005** Boli shihua 玻璃史话 [History of Glassware]. Shenyang: Wan Juan Chuban Gongsi.
- Shi Meiguang 史美光 – Qu Changzhi 曲长芝 – Zhang Riqing 张日清 et al. 1984** Zhongguo zaoqi boliqi jianyan baogao 中国早期玻璃器检验报告 [Analyses of Glasses from the West Han Dynasty to the North Song Dynasty] *Kaogu xuebao* 1984 (4), 449–457. [English translation by M. Henderson, ca. 1987, A Report on the Examination of Early Chinese Glass, in: An Jiayao, *Early Chinese Glassware*. Oriental Ceramic Society Translations No.12, 40–46].
- Shi Meiguang – He Ouli – Zhou Fuzheng 1987** Investigation on Some Chinese Potash Glasses Excavated in Han Dynasty Tombs. In: Bhardwaj, H. C. (ed.), *Archaeometry of Glass. Proceedings of the Archaeometry Session of the XIV International Congress on Glass, 1986, New Delhi*. Calcutta, 15–20.
- Shortland, A. 2012** Lapislazuli from the Kiln: Glass and Glassmaking in the Late Bronze Age. Leuven: Leuven University Press.
- Shortland, A. J. – Rehren, T. 2020** Glass. In: Richards, M. P. – Britton, K. (eds.), *Archaeological Science. An Introduction*. Cambridge: Cambridge University Press, 347–364.
- Silvano, F. 2009** Roman Glass from the Fayum Oasis, Egypt. In: Janssens, K. – Degryse, P. – Cosyns, P. – Caen, J. – Van’t dack, L. (eds.), *Annales du 17e Congrès de l’Association Internationale pour l’Histoire du Verre*,

Anvers, 2006. Antwerp: University Press Antwerp, 222–226.

**Silvestri, A. – Molin, G. – Salviulo, G. 2008** The Colourless Glass of Iulia Felix. *Journal of Archaeological Science* 35: 331–341.

**Simpson, St. J. 2014** Sasanian Glass: An Overview. In: Keller, D. – Price, J. – Jackson, C. (eds.), *Neighbours and Successors of Rome. Traditions of Glass Production and Use in Europe and the Middle East in the Later 1st Millennium AD*. Oxford: Oxbow Books, 200–231.

**Simpson, St. J. 2015** Sasanian Glassware from Mesopotamia, Gilan, and the Caucasus. *Journal of Glass Studies* 57, 77–96.

**Simpson, St. J. 2022** Sasanian Archaeology: Settlements, Environment and Material Culture. Oxford: Archaeopress.

**Simpson, St. J. 2023** Sasanian Skeuomorphs: The Influence of Metalware on the Glass Industry. In: Colburn, H. P. – Hensellek, B. – Lerner, J. A. (eds.), *In Search of Cultural Identities in West and Central Asia: A Festschrift for Prudence Oliver Harper*. Turnhout: Brepols, 71–83.

**Spaer, M. 1993** Gold-Glass Beads: A Review of the Evidence. *Beads. Journal of the Society of Bead Researchers* vol. 5, 5–25.

**Spaer, M. 2001** Ancient Glass in the Israel Museum, Beads and Other Small Objects. Jerusalem: The Israel Museum.

**Stein, M. A. 1907** Ancient Khotan. Detailed Report of Archaeological Explorations in Chinese Turkestan, Carried out and Described under the Orders of H. M. Indian Government, 2 vols. Oxford: Clarendon.

**Stein, M. A. 1921** Serindia. Detailed Report of Explorations in Central Asia and Westernmost China, Carried out and Described under the Orders of H. M. Indian Government, 5 vols. Oxford: Clarendon.

**Stein, M. A. 1928** Innermost Asia. Detailed Report of Explorations in Central Asia, Kan-Su and Eastern Iran. Carried out and Described under the Orders of H. M. Indian Government, 4 vols. Oxford: Clarendon.

**Stern, E. M. 1991** Early Roman Export Glass in India. In: Begley, V. – De Puma, R. D. (eds.), *Rome and India. The Ancient Sea Trade*. Madison: The University of Wisconsin Press, 113–124.

**Stern, E. M. 2001** Roman, Byzantine and Early Medieval Glass, 10 BCE–700 CE. Ernesto Wolf Collection. Ostfildern-Ruit: Hatje Cantz.

**Stern, E. M. – Schlick-Nolte, B. 1994** Early Glass of the Ancient World: 1600 B.C.–A.D. 50, Ernesto Wolf Collection. Ostfildern: Hatje. Ostfildern-Ruit: Hatje Cantz.

**Strauch, I. (ed.) 2012** Foreign Sailors on Socotra: The Inscriptions and Drawings from the Cave Hoq. Bremen: Hempen.

**Su Huihe 苏会和 – Gao Wei 高薇 – Liu Ning 刘宁 2015** Feng Sufu mu chutu boli qiwu chengfende dianzi xianweijing jiance baogao 冯素弗墓出土玻璃器物成分的电子显微镜检测报告 [Report on electron microscopy analyses of the glass vessels from Feng Sufu's tomb].

In: Liaoning sheng bowuguan – Liaoning Provincial Museum (ed.), *Bei Yan Feng Sufu mu 北燕冯素弗墓 / Feng Sufu Couple's Tombs of the Northern Yan*. Beijing: Wenwu chubanshe, 246–265.

**Szmoniewski, B. Sz. 2018** Roman Glassware from Korean Peninsula: Silla, Gaya, Baekje from Fourth to Sixth Century AD – Myth or Reality (I). *Pontica* 51, 151–189

**Taniichi, T. 1990** Early Roman Faceted Glass Beaker Recently Excavated at Loulan in China. In: *Orientalia* ronshū: Nihon Oriental Gakkai sōritsu sanjūgoshūnen kinen / Collected Papers for the Thirty-Fifth Anniversary of the Establishment of the Society for Near Eastern Studies in Japan. Tokyo: Tosui Shobo, 315–333 [in Japanese, with English summary on pp. xvi–xvii]

**Tatsumi, Y. – Abe, Y. 2019** The Root of Sasanian Glass Cups with Circular Facet-cut Decoration. In: Nakato, I. – Nishianki, Y. – Odaka, T. – Yamada, M. – Yamada, S. (eds.), *Prince of the Orient. Ancient Near Eastern Studies in Memory of H. I. H. Prince Takahito Mikasa*. Tokyo: The Society for Near Eastern Studies in Japan, 113–127.

**Tatton-Brown, V. 2012** The Roman Empire. In: Tait, H. (ed.), *Five Thousand Years of Glass*. London: The British Museum Press, 62–97.

**Thierry, F. 1993** Sur les monnaies sassanides trouvées en Chine. In: Gyselen, R. (ed.), *Circulation des monnaies, des marchandises et des biens*. *Res Orientales* vol. 5, 89–139.

**Trombert, É. 1996** Une trajectoire d'ouest en est sur la route de la soie. In: *La Persia e l'Asia Centrale da Alessandro al X secolo*. Rome: Accademia Nazionale dei Lincei, 205–227.

**Van Ham-Meert, A. – Claeys, P. – Jasim, S. et al. 2019** Plant Ash Glass from First Century CE Dibba, U.A.E. *Archaeological and Anthropological Sciences* 11, 1431–1441.

**Von Saldern, A. 2004** Antikes Glas. *Handbuch der Archäologie*. Munich: C.H.Beck.

**Wang Bo – Lu Lipeng 2009** Glass Artifacts Unearthed from the Tombs at the Zhagunluke and Sampula Cemeteries in Xinjiang. In: Gan Fuxi – Brill, R. H. – Tian Shouyun (eds), *Ancient Glass Research along the Silk Road*. Singapore: World Scientific Publishing, 299–329.

**Wang Bo – Wang Mingfang – Happar, M. et al. 2016** Zhagunluke fangzhipin zhenbao 扎滚鲁克纺织品珍宝 / Textile Treasures of Zhagunluke. Beijing: Wenwu chubanshe / Riggisberg: Abegg-Stiftung. [In Chinese and English]

**Wang Yikang 王义康 2007** Zhengcangyuan cang xifang fengge boli qi yanjiu 正仓院藏西方风格玻璃器研究 [A Study on the Glass Vessels with the Western Style Collected in the Shoso-in]. *Zhongguo lishi wenwu* [Journal of National Museum of China] 2007 (6), 13–26.

**Wang Zhigao 王志高 2011** Liu Chao muzang chutu boli rongqi mantan – jianxi Chaoxian bando Sanguo shidai boli rongqi de lai yuan 六朝墓葬出土玻璃容器漫谈—兼析朝鲜半岛三国时代玻璃容器的来源 [On the Glass Containers Unearthed from the Six Dynasties Tombs: Analyzing the Glass Containers' Origin of the Three Kingdoms Period in Korean Peninsula]. *Nanjing bowuyuan jikan* 12 (12), 55–63.

- Wang Zhigao 王志高 2015** Liu Chao muzang chutu boli rongqi mantan – jianxi Chaoxian bandao Sanguo shidai boli rongqi de lai yuan 六朝墓葬出土玻璃容器漫谈—兼析朝鲜半岛三国时代玻璃容器的来源 [Glass Vessels Found in Southern Dynasties Tombs – Discussion on the Source of Glass Vessels in the Three Kingdom Period in Korea Peninsula]. In: Liu Chao Jiankang cheng fa jue yu yan jiu 六朝建康城发掘与研究 [Excavation and Research of the Jiankang City Site During the Six Dynasties]. Nanjing: Jiangsu renmin chubanshe, 421–435.
- Wang Zichu 王子初 2016** Jiangsu Xuyi Dayunshan yihao mu chutu fang yu boli bianqing de fuyuan yanjiu 江苏盱眙大云山一号墓出土仿玉玻璃编磬的复原研究 [Research of the Restoration of the Jade-like Glass Chimes Unearthed at Dayunshan in Xuyi in Jiangsu Province]. Yishu bai jia [Hundred Schools in Arts] 2016 (2), 45–61.
- Watt, J. C. Y. (ed.) 2004** China – Dawn of a Golden Age 200 – 750 AD. New York: The Metropolitan Museum of Art.
- Weinberg, G. D. – Stern, E. M. 2009** Vessel Glass. The Athenian Agora vol. XXXIV. Princeton, N.J.: The American School of Classical Studies at Athens.
- Werner 1981** Werner, S., Das Grab des Feng Su-fu aus der Nördlichen Yan-Dynastie (gest. 415 n.Chr.). In: Müller-Karpe, H. (ed.), Allgemeine und Vergleichende Archäologie als Forschungsgegenstand. Munich: C. H. Beck, 137–151.
- Wheatley, P. 1983** Nāgara and Commandery. Origins of the Southeast Asian Urban Traditions. Chicago: The University of Chicago, Department of Geography Research Paper Nos. 207–208.
- Whitehouse, D. 2000** Ancient Glass from ed-Dur (Umm al-Qaiwain, U.A.E.) 2: Glass Vessels Excavated by the Danish Expedition. Arabian Archaeology and Epigraphy 11, 87–128.
- Whitehouse, D. 2005** Sasanian and Post-Sasanian Glass in The Corning Museum of Glass. Corning, N.Y.: The Corning Museum of Glass.
- Whitehouse, D. 2012** Glass. A Short History. Washington, D.C.: Smithsonian Books.
- Whitfield, R. 1985** The Art of Central Asia. The Stein Collection in the British Museum 3: Textiles, Sculpture and Other Art. Tokyo: Kodansha.
- Worrell, S. – Price, J. 2003** The Glass from Kush, Ra's al-Khaimah, U.A.E. In: Potts, D. – Hasan Al Nabrodah – Hellyer, P. (eds.), Archaeology of the United Arab Emirates. London: Trident Press, 246–252.
- Xinjiang Loulan Kaogudui 新疆楼兰考古队 1988** Loulan guchengzhi diaocha yu shijie jianbao 楼兰古城址调查与试掘简报 [Preliminary Report on the Survey and Excavation of Loulan Ancient Site]. Wenwu 1988 (7), 1–22.
- Xinjiang 1985** Xinjiang Weiwuer Zizhiqiu shehui kexue yuan kaogu yanjiusuo 新疆维吾尔自治区科学院考古研究所编, Xinjiang guda minzu wenwu 新疆古代民族文物 [Ancient Ethnic Cultural Relics of Xinjiang]. Beijing: Wenwu chubanshe.
- Xinjiang 1999** Xinjiang Weiwuer Zizhiqiu wenwu shiye guanliju 新疆维吾尔自治区文物事业管理局 et al. (eds.), Xinjiang wenwu gu ji da guan 新疆文物古迹大观 / A Grand View of Xinjiang's Cultural Relics and Historic Sites. Ürümqi: Xinjiang meishu she ying chubanshe.
- Xinjiang Weiwuer Zizhiqiu Bowuguan 新疆维吾尔自治区博物馆 – Bayinguoleng Menggu Zizhizhou Wenwu Guanlisuo 巴音郭楞蒙古自治州文物管理所 – Qiemo Xian Wenwu Guanlisuo 且末县文物管理所 2003** Xinjiang Qiemo Zhagunluke yihao mudi fajue baogao 新疆且末扎滚鲁克一号墓地发掘报告 [Excavation of Graveyard No. 1 at Zhagunluk in Charchan, Xinjiang]. Kaogu xuebao 2003 (1), 89–136.
- Xu, Bing – Gu, Zhaoyan – Qin, Xiaoguang et al. 2017** Radiocarbon Dating the Ancient City of Loulan. Radiocarbon 59 (4), 1215–1226. <http://doi.org/10.1017/RDC.2017.21>
- Yadin, Y. 1963** The Finds from the Bar Kokhba Period in the Cave of the Letters. Jerusalem: The Israel Exploration Society.
- Yang Hong 2004** Jade Suits of the Han Dynasty and Painted Pottery Figurines of the Tang Dynasty: Reflections of Han and Tang Aristocratic Burial Practices. In: Yang Xiaoneng (ed.), New Perspectives on China's Past. Chinese Archaeology in the Twentieth Century, vol. 1: Cultures and Civilizations Reconsidered. New Haven and London: Yale University Press, 345–361.
- Yang Jun 2019** The Underground Luxury of a Western Han Marquis: Major Discoveries from the Tomb of the Marquis of Haihun in Nanchang. Asian Archaeology 2, 65–102. <https://doi.org/10.1007/s41826-019-00021-2>
- Yang Xiaoneng (ed. and principal author) 2004** New Perspectives on China's Past. Chinese Archaeology in the Twentieth Century, vol. 2: Major Archaeological Discoveries in Twentieth-Century China. New Haven and London: Yale University Press.
- Yangzhou Bowuguan 扬州博物馆 1991** Jiangsu Hanjiangxian Ganquan Laohudun Han mu 江苏邗江县甘泉老虎墩汉墓 [Han tomb at Laohudun in Ganquanxiang of the County of Hanjiang, Jiangsu]. Wenwu 1991 (10), 62–70.
- Yu Zhiyong 于志勇 2010** Some Thoughts on Glass Finds in the Tarim Oasis from the Past Ten Years. In: Zorn, B. – Hilgner, A. (eds.), Glass along the Silk Road, from 200 BC to AD 1000. International conference within the scope of the “Sino-German project on cultural heritage preservation” of the RGZM and the Shaanxi Provincial Institute of Archaeology, December 11th–12th 2008. Mainz: Römisch-Germanisches Zentralmuseum, 191–202.
- Yu Zhiyong 于志勇 2013** Jinnianlai Xinjiang gudai boliqi de kaogu faxian, yanjiu yu sikao 近年来新疆古代玻璃器的考古发现、研究与思考 [Archaeological Discovery, Research and Thought on Ancient Glass Vessels in Xinjiang in Recent Years]. Xinjiang wenwu 2013 (2), 107–117.
- Yu Zhiyong 于志勇 – Zhang Huajie 张化杰 n.d.** Niya Yizhi xinfaxian boliqi – Laitong de chubu yanjiu 尼雅遗址新发现玻璃器—来通的初步研究 [Preliminary

Study of a Newly Discovered Glass Rhyton at the Niya Site]. Unpublished report.

**Zhao Yong 赵永 2014** Xinjiang Qiemo Zhagunluke 49 hao mu chutu boli bei de niandai wenti 新疆且末扎滚鲁克49号墓出土玻璃杯的年代问题 [The Dating Study of the Glass Cup Unearthed from M49 at Zhagunluke, Qiemo, Xinjiang]. *Kaogu yu wenwu* 2014 (4), 77–80.

**Zhao Yong 赵永 2019** “Liuli zhi lu” yu Chaoxian bandao, Riben chutu de boli qi “琉璃之路”与朝鲜半岛、日本出土的玻璃器 [The Glass Road and Glass Vessels Unearthed in the Korean Peninsula and Japan]. *Journal of the National Museum of China* 8, 22–33.

**Zhou Zheng 周铮 1992** Hebei Jingxian Fengshi muqun congkao 河北景县封氏墓群丛考 [Research on the Tombs of the Feng Family in Jingxian County, Hebei Province]. *Wenwu chun* 1992 (2), 31–36.

**Zhu Lanxia 朱兰霞 1983** Nanjing beijiao Dong Jin mu fajue jianbao 南京北郊东晋墓发掘简报 [A Brief Report on the Excavation of an Eastern Jin Tomb in the Northern Suburb of Nanjing]. *Kaogu* 1983 (4), 315–322.

**Żuchowska, M. 2013** Palmyra and the Far Eastern Trade. *Studia Palmyreńskie* 12: 381–387.

**Żuchowska, M. – Szmoniewski, B. Sz. 2017** Glass along the Silk Road in the First Millennium AD. *Archaeologia Polona* 55, 161–188.



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