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GLASS CUP FROM QARYAT AL-FAW SITE (4TH CENTURY BC - 3RD CENTURY AD) SAUDI ARABIA: AN ANALYTICAL AND TYPOLOGICAL STUDY

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ABSTRACT

The paper aims to study a rare Roman glass cup, consisting of a set of glass breakages, preserved at the Museum of Archeology Department - College of Tourism and Archaeology, King Saud University, Saudi Arabia. The cup was found at Qaryat Al-Faw site (also Qaryat Al-Fau), the capital of the first Kindah kingdom (fourth century BC-fourth century AD). It is located about 100 km south of Wadi ad-Dawasir, and about 700 km southwest of Riyadh, the capital city of Saudi Arabia. Qaryat Al-Faw archeological site reveals various features such as residential area, markets, roads, cemeteries, temples, and water wells. On the exterior surface of the glass cup, there are color graphics representing what seems to be Egyptian(zing) elements. This cup was the only one consisting of such elements in all sites cross the Arabian Peninsula. Scanning Electron Microscope and Differential Scanning Calorimetry were applied indicating soda glass type, and compared with the chemical analysis of con-temporary imported pieces from Egypt the present study indicated that no furnaces for the manu-facture of glass were found in Qaryat Al-Faw site, which promotes the import hypothesis. According to preliminary interpretations, it is likely that the cup was of a Roman origin and was probably made in Alexandria in Egypt and dates from about the late first-early second century AD, and apparently brought to the site by one of Qaryat Al-Faw merchants. Although Qaryat Al-Faw is also famous of glass remains, there are no information about any local production of glass in the site and no kilns had been found. The local glass industry at Qaryat Al-Faw site, if any, was not documented during archaeological excavations conducted by the Dept of Archaeology, King Saud University.

KEYWORDS: Qaryat Al-Fau, Wadi ad-Dawasir, Tuwaiq mountain, Egypt, Saudi Arabia

1. INTRODUCTION

Qaryat Al-Faw is located about 100 km south of Wadi ad-Dawasir, and about 700 km southwest of Riyadh, the capital city of Saudi Arabia. Qaryat Al-Faw is also located on the northwestern edge of the Empty

Quarter desert, in an area where Wadi Al-Dawasir intersects with the Tuwaiq mountain range at the mouth of the course of a canal called Al-Faw (Fig. 1). Hence, it is recently called Qaryat Al-Faw to distinguish it from other sites and villages.



Figure 1. A map of the Arabian Peninsula showing the location of Qaryat Al-Faw and the main assumed ancient trade routes (Redesigned from Rohmer et al., 2018).

Sources and writings of the south of the Arabian Peninsula identified the capital of the state of Kinda in the middle of the Arabian Peninsula. They pointed to the capital as (*Qarya*) "the village" and described it as a "Qaryat Dhat Kahl" in reference to its god "Dhu Kahl". Kahl was the main deity worshipped by the Arab tribes of Kindah and Madh'hij. It is also known by the names of Qaryat al-Hamraa (Red City) and Dhat al-Jnan (City of Gardens) by its inhabitants in its period of prosperity. The inscriptions of Dhu Kahl were found at Qaryat Al-Faw and Twaiq mountain

(Fig 2) and on the walls of the residents' houses, the commercial market and incense burners. These sources indicated that Qaryat Al-Faw was the capital of the state of Kinda in central Arabia, mentioned in the inscriptions studied by the Albert Jamme in the texts (No. 576, No. 635, No. 660, No. 665) in addition to the inscriptions studied by Gonzague Ryckmans in the text (No 509) (In Al-Ansary, 1979: 8). Scholars have dated Qaryat Al-Faw to the time period between the end of the fourth century BC to the end of the third century AD.

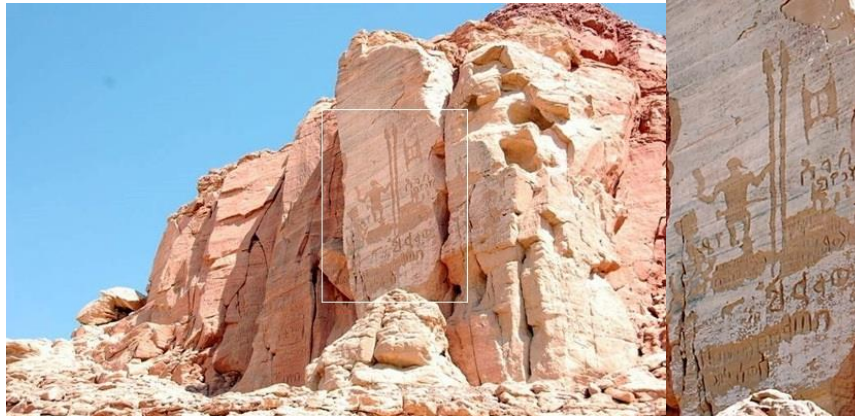


Figure 2. The foot of Mount Twaiq at Qaryat Al-Faw. The inscription represents the figure of Dhu Kahl holding a long spear in his hand, and in the other hand is what looks like a spearhead, and on the middle, he wears a sword (Al-Ansary, 1979).

Qaryat Al-Faw is characterized by an important location in the middle of the Arabian Peninsula on the ancient trade route linking the south of the Arabian Peninsula and its north coming from the Arab kingdoms in southern Arabia heading to Najran and from there to Qaryat Al-Faw, then towards the Al Aflaj and the Yamamah region, then eastward towards the Arabian Gulf and north to Mesopotamia and the Levant. Another road branches out from the Yamamah region to the northwest of the Arabian Peninsula, passing through the commercial centers in northwestern Arabia, such as Tayma, Dumat Al-Jandal, and Median, then northward to the Levant and Egypt, to the Mediterranean countries. This trade route had an impact on the cultural and commercial communication between the central Arabian Peninsula and other civilizations, including the Roman and ancient Egyptian civilization.

This article provides an important example of this communication, from the finds of the archaeological site of Qaryat Al-Faw, which is a glass cup found in season (16, 1990) in the southeast tombs (K.6) of the northwest cemetery (Fig. 3, Fig. 4). The aim is to examine this important glass piece regarding origin through a scientific analysis and comparative typological study.

2. DESCRIPTIONS OF THE GLASS CUP

Some typological data of the glass cup are as follows. Type: a cup (a group of glass fragments representing a cup); Probable date: late first-early second century AD.; Museum number: Museum of the Department of Archaeology (registration number 42 F16) - King Saud University; Material: colored glass; Measurements: Height (c. 15.5 cm), and the diameter of the base is (c.3 cm); Production method: blowing

tube; The function of the bowl: drinking; Decorations: a man, clothes, cartridges, what looks like the roundness of the moon disk, a cobra, the falcon (Horus?), what looks like a winged lion, and other simple decorations.

The cup consists of a group of glass fragments made of transparent paste by blowing, and it was restored and formed a large part of the cup (Fig.3,4) (Al Saleem, 2019). The cup rests on a flat ring-shaped base that loses a large part of it, and it becomes slightly wider as it moves towards the top. On the upper part of the body appears a depiction of a pharaonic figure of a dark-skinned man (Nubian?), his face turns to the left and the right leg is presented on the left, and on the head appears a low cover that has a shape like a round moon disk, and in the front of it is what resembles the original (cobra) similar to the Pharaonic cobra that represents a religious symbol in Egypt. The man has a sloppy triangle-like face, a nose that protrudes forward, a large almond eye with a black pupil, a small mouth with two lower lips, and a large ear. There is no clear drawing of the chin but a small, borrowed beard.

The man also has a long neck and a wide chest decorated with a necklace or embroidered dress that is placed on the shoulders and the top of the chest and wrapped around the neck and clasps behind the neck. This dress is very similar to the Egyptian *Wesekh Collar*, which means the wide necklace. It is one of the pieces that adorns the chest and neck. The *Wesekh Collar* is one of the adornments worn by men and women in Ancient Egypt, the living and the dead alike - it is also included in the offerings to the statue of the God within the Holy of Holies - and that is in the rituals of the daily service of the statue of God (Abu AlGasim, 2014: 29).



Figure 3. The glass cup from Qaryat Al-Faw site. Museum of the Department of Archaeology (registration number 42 F16), King Saud University.

The man extends his right hand forward, not clearly shaped, and bends his left hand just below the chest. The wrist of the hand, which has open fingers, may be adorned with two yellow bracelets. There is a long blue apron on the onyx which was executed in a simple way, and it was fastened at the waist with a belt. The man introduces his right leg and backs his left leg to give an impression of movement. On the man's right side might be a basket or a large bowl of pale-yellow color.

On the bottom of the cup appears a falcon-like symbol of the famous god Horus in the ancient Egyptian civilization. The falcon is turned left, with a sloppy configuration, oval head, large eye, short prominent beak, bulging chest, plucked back and two short legs. Above are decorations in the form of a group of yellow dots, which give a shape similar to a semicircle or an arched shape upwards. There is also a drawing that resembles a winged lion heading towards the right side, and behind the falcon is a rectangular configuration that somewhat resembles the cartouche used to write the names of kings in ancient Egypt.

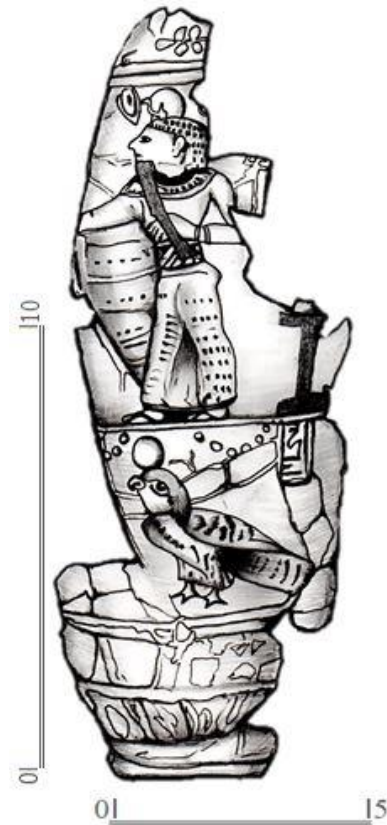


Figure 4. The glass cup from Qaryat Al-Faw site. Museum of the Department of Archaeology (registration number 42 F16), King Saud University.

The bottom of the cup's body is depicted with two lines joined in brown and yellow, rotating around the cup. In the upper part there is also a yellow line, topped by a brown one, surrounding the top of the cup, and above the two lines there are some decorations in the form of a group of yellow dots. It is noticeable that the artist confined the drawings on the body of the cup between the upper and lower lines that may have been used for framing, which shows his artistic ability to show coordination between the artistic elements on the cup and the filling of the spaces. The cup has a pale olive blue color and reflects a clear development in the stained-glass industry in Arabia.

3. METHODS AND RESULTS

Scanning electron microscopy (SEM-EDS) and differential DSC analysis is applied in addition to the typological work. Similar archaeometric analyses have been well known in the past in relevant glass investigations (Alawneh et al., 2017; Hodgkinson and Frick, 2020; De Francesco et al., 2019; Zacharias et al., 2020; Liritzis et al., 2020).

Methods

The Scanning Electron Microscope SEM-EDS and Differential Scanning Calorimetry (DSC) were used for first time to analyze the sample.

SEM of the JEOL Model 6380 LA (JEOL, Tokyo, Japan) was used. The Scanning Electron Microscope (SEM) is operating at 25 Kev. Energy dispersive X-ray spectroscopy (EDS) was performed using a Delta kevox device (JEOL, Tokyo, Japan) attached to an electron microscope, the JED-2200 Series (JEOL, Tokyo, Japan). The following settings were used: 25 kV accelerating voltage, 120 s accumulation duration, and 6 mm window width. The Asa approach, Zaf-correction, and Gaussian approximation were used to determine the surface molar composition.

Thermal analysis method of thermal effects under controllable program temperature measurements were taken using DSC1, Mettler Toledo AG, Analytical CH-8603, Schwerzenbach, Switzerland. The experiments were carried out in a nitrogen gas atmosphere with a gas flow rate of 40 mL min⁻¹ at temperatures ranging from 25 to 500 °C. The experimental sample was heated at a rate of 2 °C per minute.

The T_g temperature at which the glass turns from a ductile material to a hard has been calculated. T_g is directly proportional to bond strength, e.g. it depends on quasi-equilibrium thermodynamic parameters of the bonds e.g. on the enthalpy H_d and entropy S_d of configures - broken bonds: $T_g = H_d / [S_d + R \ln[(1 - f_c)/f_c]]$ where R is the gas constant and f_c is the percolation threshold. This value characterizes the glass and depends on the glass production (chemical composition etc).

Results

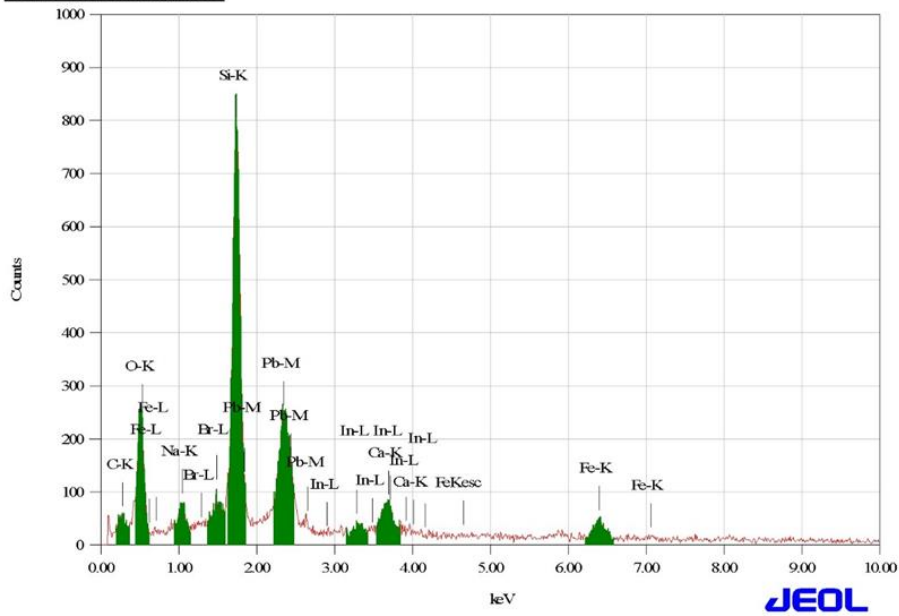
The glass pieces recovered from the archaeological excavations of Qaryat Al-Faw site represent a wonderful exhibition of several types, shapes and colors of glass industries. They include the remains of small utensils and bottles that were used to store perfumery and cosmetics, bracelets, decorative tools, glass beads, rings, and other products. These glass products were manufactured in a variety of ways and means, although there is no evidence of local production. Some

of them are made by the pressure and the mold methods, and others by the blowing method. The glass products are decorated in a variety of colors, including yellow, white, blue, purple, brown, green, and other colors. The collection from the dept of Archaeology Museum includes a variety of glass vessels, plates, bowls, cups, and rings.

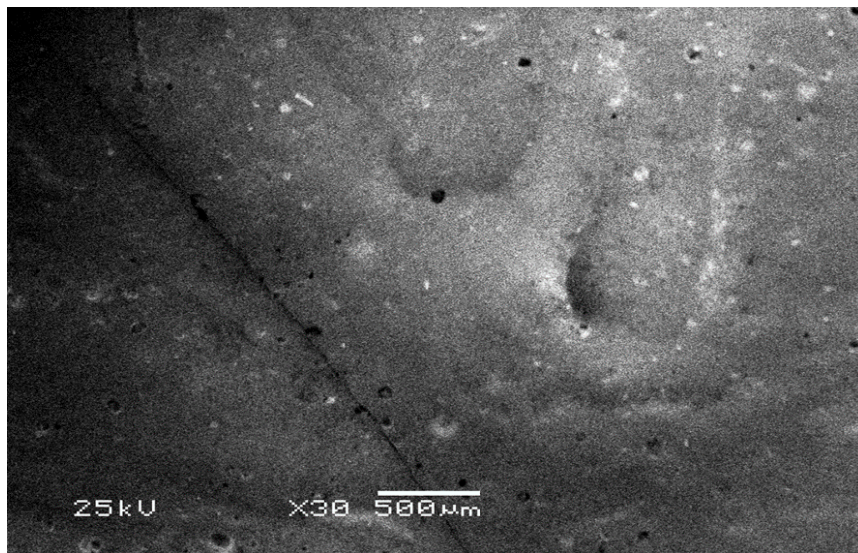
The current cup is made of transparent paste by the method of a glassblowing. Glassblowing is a glass forming technique that involves inflating molten glass into a bubble (or parison) with the aid of a blowpipe (or blow tube). This method held a pre-eminent position in glass forming ever since its introduction in the middle of the 1st century BC until the late 19th century and is still widely used as a glass forming technique, especially for artistic purposes. The process of free blowing involves the blowing of short puffs of air into a molten portion of glass called a "gather" which has been spooled at one end of the blowpipe. This has the effect of forming an elastic skin on the interior of the glass blob that matches the exterior skin caused by the removal of heat from the furnace. The glassworker can then quickly inflate the molten glass to a coherent blob and work it into a desired shape.

An analysis of a glass piece taken from the cup was processed using a Delta kevox device. The analysis was made by the dept of science laboratory in King Saud University. Glass EDS patterns are shown as in Fig. 5. The presence of the signal characteristic components of Carbon (C), Oxygen (O), Sodium (Na), Silicon (Si), Calcium (Ca), Iron (Fe), Bromide (Br), Indium (In) and Lead (Pb) were recorded attributing the glass to the potash type (Si-K-Ca).

Differential Scanning Calorimetry (DSC) Technique is also used to determine the temperature and heat flow associated with a glass piece from the cup. The sample was heated from zero temperature to 500 °C, with an apparent change from liquid to solid occurring at a temperature of 108.2 °C which is characteristic for this phase transition glass and depends on the thermodynamics and chemical composition of this production type glassware (Fig.6).

JED-2200 Series

(A)



(B)

Element	Level	(ke V)	mass%	Error%	At%	Compound	mass%	Cation K
C	K	0.277	15.04	0.50	29.42	C	15.04	2.9407
O	K	0.525	29.64	0.30	23.97			
Na	K	1.041	2.85	0.35	2.64	Na ₂ O	3.84	2.8908
Si	K	1.739	21.99	0.33	33.38	SiO ₂	47.03	26.3668
Ca	K	3.690	1.65	0.28	1.76	CaO	2.31	2.6627
Fe	K	6.398	3.42	0.44	2.61	FeO	4.40	5.5194
Br	L	1.480	3.15	0.32	1.68	Br	3.15	4.0404
In	L	3.285	1.85	0.69	0.34	In ₂ O ₃	2.23	2.6147
Pb	M	2.342	20.42	0.64	4.20	PbO	22.00	27.3585
Total			100.00		100.00		100.00	

(C)

Figure 5. An analysis of a glass piece from the cup using a Delta kevox device (King Saud University) a) SEM-EDS spectrum, b) the analyzed image, c) the chemical data indicating soda glass type.

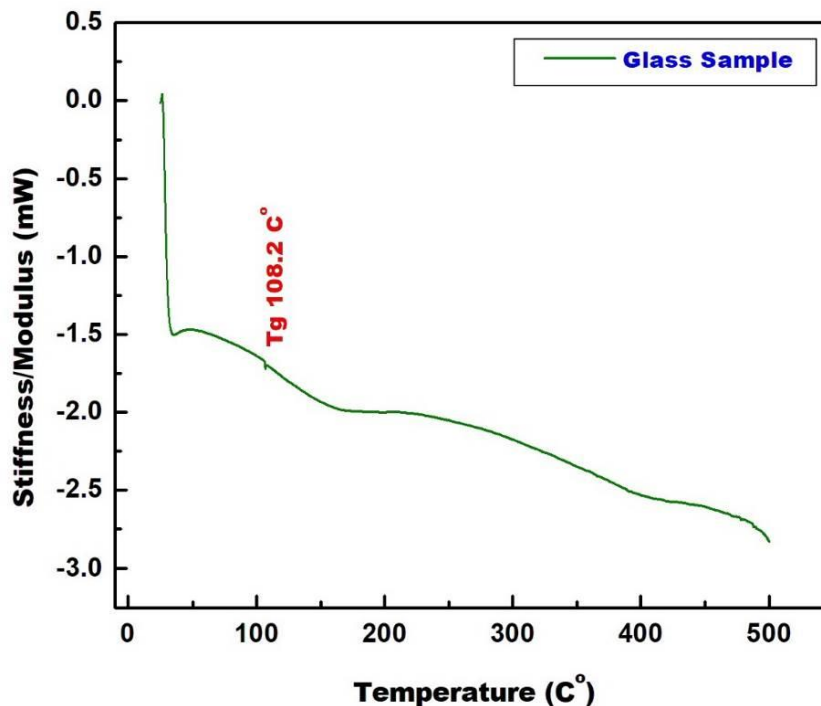


Figure 6. Analysis of the temperature of a glass piece from the cup using a Differential Scanning Calorimetry (DSC) Technique (King Saud University). Left high stiffness represents the glassy state and right of Tg the rubbery state and further right reaches the viscous flow.

This chemical analysis of the glass piece from the cup is in agreement with a recent analysis performed on fragments from the Qaryat Al-Faw site and other sites in eastern Arabian Peninsula (Al Otaibi 2022; 2012: 192-196). The main component of glass in our analysis is silica SiO₂ quartz, sodium carbonate, and limestone with the presence of other compounds such as Iron (Fe), Bromide (Br), Indium (In) and Lead (Pb), among others. Al-Otaibi (2012, 197, 2022. 82-83) concluded that most of the pieces of glass in Qaryat Al-Faw contain a high percentage of silica, calcium oxide and calcium carbonate, which were compared with the chemical analysis of contemporary imported pieces from Egypt. The present study also indicated that no furnaces for the manufacture of glass were found in Qaryat Al-Faw site, which promotes the import of most of the pieces from other regions, despite the possibility of a local industry that may reveal its traces in the future excavation of the site (Al Otaibi. 2012, 196-197).

4. DISCUSSION

Preliminary view by Al-Ansary (2010: 307) indicated that the glass cup dates to “the late period of the ancient Egyptian civilization”. This opinion was based on the descriptive analysis of the decorations and on another set of glass fragments similar to the

quality of this cup, on one of which appears the remains of a person's head and one of his arms raised to the top in a position similar to supplication to the god in e.g. an Egyptian *Wesekh* Collar (Fig.7). In front of him what looks like a royal cartouche. The man depicted on the glass cup was interpreted as “a Nubian” from ancient Egypt (Al-Ansary, 2010: 307).



Figure 7. *Wesekh* collar of Senebtisi, 1850–1775 BC; faience, gold, carnelian and turquoise; Metropolitan Museum of Art (Source: <https://www.metmuseum.org/art/collectio n/search/544168>)

Typically, Horus was symbolized by the falcon. In Qaryat Al-Faw, Horus was found depicted in a rectangular scarab seal made of faded blue plaster (Fig. 8). On the face of the seal appears a representation of a falcon on a base with a rectangular decorative frame at the bottom of its feet, which contains five unclear hieroglyphic signs.

The scarab seals are one of the most archaeological finds indicating the communication between Egypt and the Arabian Peninsula, as some of them were found in Dhahran (Fig. 8), Bahrain, Kuwait, the United Arab Emirates and Oman. One of the scarab seals found at the Bat site in Oman contains a depiction of the god Horus. Other seals also contain Egyptian signs such as the Sphinx and Ankh, some of which date back to the period from 100 to 150 AD and are contemporary to the final period of the Qaryat Al-Faw site. The representation of the eagle or falcon is also known in Arabian mythology. Craved eagles were found in Mada'in Saleh tomb facades dated back to Nabataean period (169 BC-106 AD) (Al Amer and Al Ghanem, 2017) (Fig. 9).

The other example is from the current cup which drawn as a rectangular configuration that resembles the cartouche. The rectangular shape contains indistinct scribbles, which may be an imitation of a cartouche inspired by the artist. Thus, the symbols of this "cartouche" shows a pictogram, not an inscription.



Figure 8: Horus depiction in a rectangular scarab seal found at Qaryat Al-Faw (Al-Ansary, 1982).

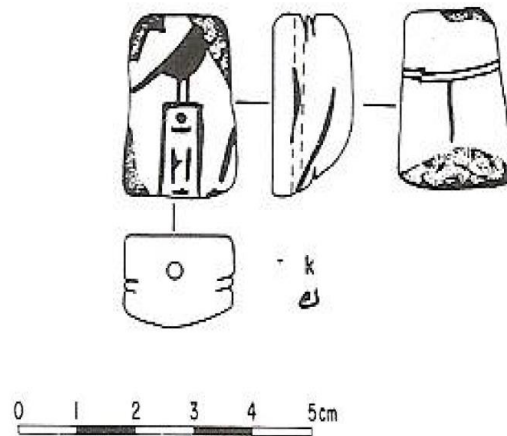


Figure 9. Representation of Horus from Dhahran. (Zarins et al., 1984)

Although the initial interpretation of this glass point to different Egyptian elements, it was probably made in Alexandria in Egypt and dates from about the late first-early second century AD. It is not Egyptian but Roman. It is not locally made as there are no evidence, to this point, of any local glass production in Qaryat Al-Faw. It is possible that the cup was brought from Egypt to Qaryat Al-Faw by a merchant or otherwise, especially since Qaryat Al-Faw is located in a strategic location on the ancient Arab trade route. However, no glass products with similar graphics have been found at Qaryat Al-Faw.

As regards the Egyptian(-izing) decoration on the cup, this is unusual and is only found on beakers of a different type found in Sudan (Leclant, 1973). Other examples with this style of painted decoration have Greco-Roman scenes with figures and animals (for other similar Roman glasses see: Whitehouse, 2012; Lightfoot, 2017; Roberts, 2010; Schmidt, 2007; Auth 1983; Grose, 1989).

According to Department of Archaeology excavation archives (Fouad Al Amer, and Salim Tayarn, Per. Comm.), there are traces of many pieces of glass melting remains were found in Qaryat Al-Faw site, which include pieces of ferric oxide, glass firing remains, slags etc. (Figs.10, 11). Most of the glass product discovered in Qaryat Al-Faw are dated to the period between the 1st century BC to the 2nd century AD.

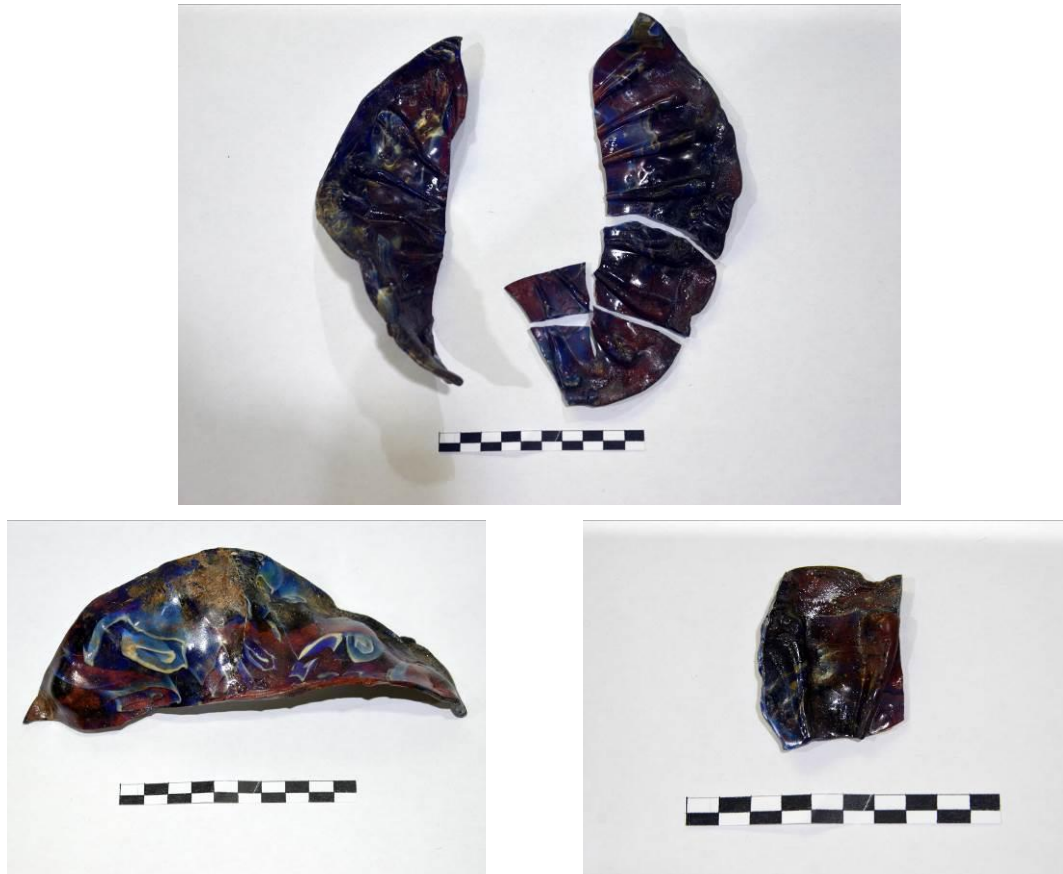


Figure 10: Glass products from Qaryat Al-Faw, showing the traces of firing (Qaryat Al-Faw, season 11, 1984, southern cemetery)

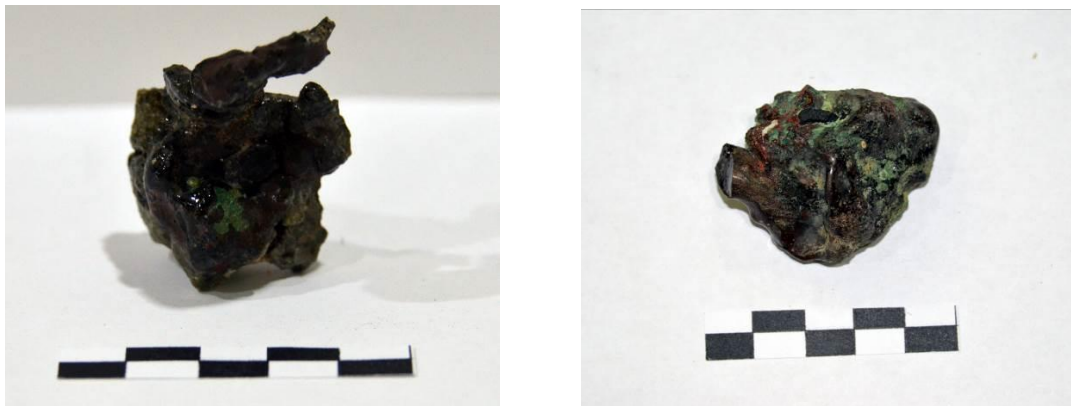


Figure 11. Glass firing slags from Qaryat Al-Faw, showing the traces of firing (Qaryat Al-Faw, season 7, 1981, house G.18)

Although it is not logical to accept that the large quantities of fragments and pieces of glass vessels discovered through the sequence of layers at Qaryat Al-Faw site were imported and brought from other regions, the molten fragments in Fig.10 appear to be of a ribbed mosaic bowl, a typical Roman bowl of the early 1st century AD (see Grose, 1989, pp. 244–49). They do not suggest local manufacture or even local working of glass.

There are also some glass pieces, complete and semi complete, from Qaryat Al-Faw site, which

clearly indicate trade relations with northern Arabia, the countries of the Mediterranean basin, Roman and Ptolemaic Egypt. Qaryat Al-Faw also contains utensils and luxurious cups which were imported from the major manufacturing centers of glass production in the Levant or in Egypt during the first and second millennium BC, especially in Alexandria, whose production was widespread throughout the eastern world (Figs. 12-15).



Figures 12. Glass products from Qaryat Al-Faw (Exhibition "Masterpieces of Antiquities of the Kingdom through the Ages")



Figures 13. Left: A glass bottle made at Qaryat Al-Faw dated to the 1st century AD. Right: A glass bottle from Qaryat Al-Faw, dated to the 1st - 2nd century AD. (Museum of the Department of Archaeology at King Saud University)

Figure 14. A bowl of blue glass, from Qaryat Al-Faw dated to the 1st century AD. (Museum of the Department of Archaeology at King Saud University)



Figure 15. A glass vase from Qaryat Al-Faw dated to the 1st century AD. (Museum of the Department of Archaeology at King Saud University)

I believe that the most likely opinion is that the cup was made in Alexandria in Egypt and dates from about the late first-early second century AD. Although Qaryat Al-Faw was famous for the of many glass products and many of them were discovered

through excavations conducted by the Department of Archeology at King Saud University during the 1970s and 1980s, these excavations revealed no evidence of local manufacture or even local working of glass.

5. CONCLUSION

This study discussed the typology and analysis of a rare Roman glass cup from the site of Qaryat al-Faw (4th century BC - 4th century AD). A descriptive study of the cup decorations indicated that the glass cup dates to the "late period of the ancient Egyptian civilization". The comprehensive review of the cup in this study suggests that the cup is of a Roman origin,

and it is likely that it was made in Alexandria in Egypt and dates to the late first century and early second century AD. We have also based our conclusion on the fact that there is no evidence of glass-making kilns at this site to date. This study proves the importance of trade contacts between central Arabia and the Mediterranean Sea, on the one hand, and the need of further investigation of glass assemblage at Qaryat al-Faw.

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