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An Analytical Approach to Investigate the Parthians Painted Stuccoes from Qal'eh-i Yazdigird, Western Iran

Key words: Parthian Iran, Qal'eh-i Yazdigird, Painted Stuccoes, pigment, Egyptian blue

Introduction

The historical complex of Qal'eh-i Yazdigird is located in western Iran and near Sar pul Zuhāb (fig.1). Its natural location is within a relatively deep bunker with an area of 40 kilometers squared. It is bordered on the western and northern sides by a sheer escarpment that falls away to the plain of Zuhāb, and on the eastern side by steep cliffs that build up into the higher reaches of the Dālāhū mountain.¹ Within this collection, there exist relics from the Parthian to the Safavid period including: Galeh bāla, Gach Gumbad, Jay dar, Zendan, Kakakoshya, Baba yadegar Shrine, Qal'eh-i Davar, Ashpazgah, Divar-i Gach, Tape Rash, Darvāzeh, Ashiāba Tower, Naqāre Khāne Tower, and Hushtareh. The name of Qal'eh-i Yazdigird is adapted from the name of a castle on one of Dālāhū mountain peaks, and it is generally used for the whole historical complex of Qal'eh-i Yazdigird. The explorer of this area believes this complex has been the residential place of a Parthian prince who used to tribute convoys on the major highway between the Great Khorasan to Mesopotamia and sought independence.²

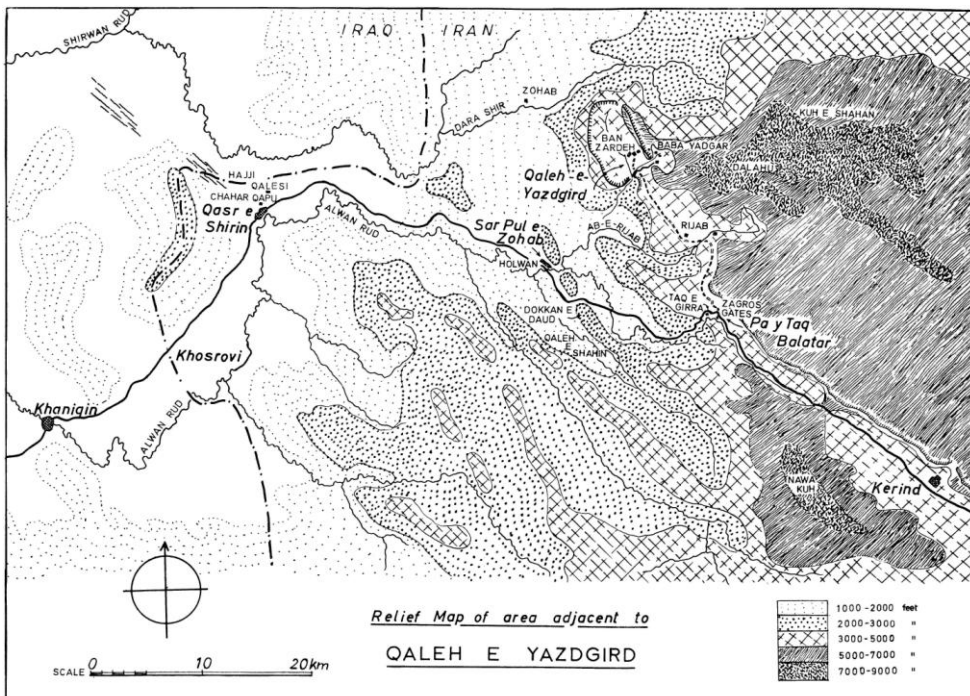


Fig. 1. Qal'eh-i Yazdigird: Relief map KEALL (1967). fig. 1

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¹ KEALL (1967) 99.

² KEALL (1976) 107.

The oldest reference to Qal'eh-i Yazdigird complex is in a dedicate pertaining to 933 (lunar calendar) where Amir Qomam Alddin, one of the Kurd Amir of Zuhāb district, dedicates a part of his state to Baba Yadegar shrine. Current Ban Zarde, which is the burial place of Baba yadegar, is there known as the *Yazdigirdi Yellow House*.³ The first recorded visit to this complex pertains to Rawlinson in 1839. Based on local myths and oral traditions of the local people, he related Ql'eh-i Yazdigird to Yazdigird, the last Sasanian kings and attributed the whole Qal'eh-i Yazdigird complex to the Sasanian period.⁴ After that, Colonel Chirikov visited there in 1849 and later on, Christopher Weightman who was involved in the search of a local religious group namely *Ahl-e Haqq*, pointed to a huge monument located near the Baba yadegar shrine. According to his description, it should have been a monument was built by Sasanians.⁵ This report drew Edward Keall attention who at the time was involved in the region to investigate the Sasanian pottery of western Iran to the Ban zarde historical area. Hence, the first archaeological excavation and survey in Qal'eh-i Yazdigird was carried out under his supervision in 1965. His publications which mainly have been appeared in journal of *Iran* all pointed to assign the palace of Qal'eh-i Yazdigird and the stuccoes found within to the Sasanian period⁶ but this conclusion was quickly rejected by himself during his subsequent field work in this area from 1976 to 1979.⁷ By the Islamic Revolution in 1979 the archeology projects of Qal'eh-i Yazdigird were ceased and lasted until the archeological excavations restarted in 2008 in the eastern sides of Gach Gumbad area by Azarnoush- an Iranian archaeologist. During his excavation, 68 stucco pieces were explored.⁸

Parthian Stuccoes from Qal'eh-i Yazdigird

During five seasons of excavations in Qal'eh-i Yazdigird, a significant number of stucco pieces were explored in eastern Gach Gumbad, Hushtareh (fig.2) as well as among the debris accumulated in an Ayvan of the western Gach Gumbad. Although some of the stuccos have still remained on the in situ walls but many pieces were found from the debris as well.

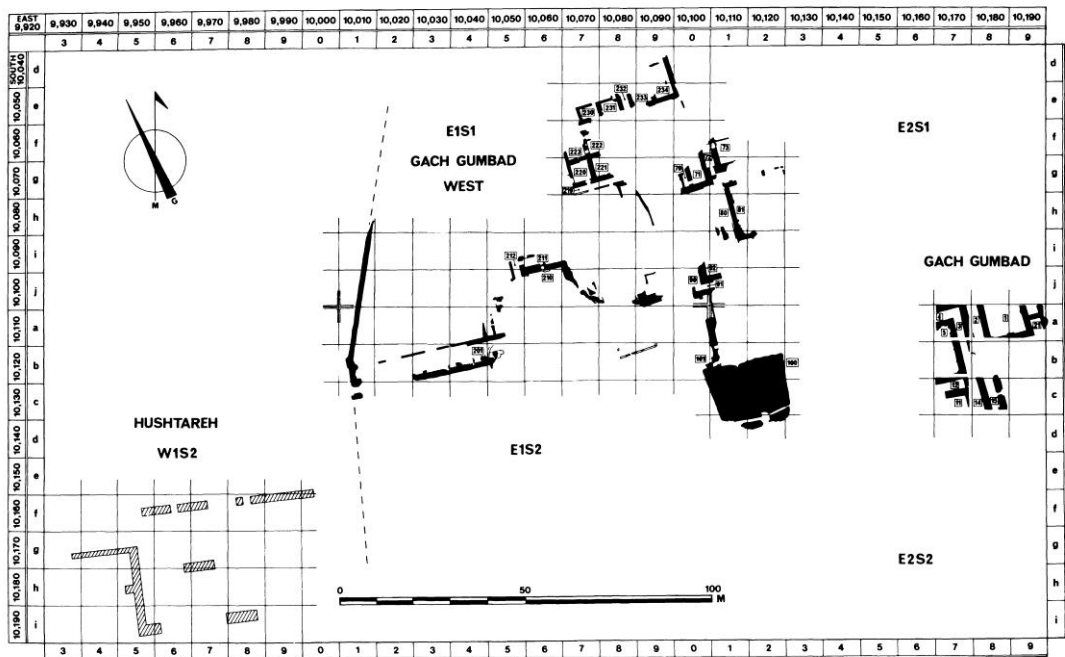


Fig. 2. Gach Gumbad site plan: KEALL et al. (1980). fig.1

³ JALILI, GOLZARI (1978) 141.

⁴ RAWLINSON (1939) 32.

⁵ KEALL (1975) 381.

⁶ KEALL (1967) 99.

⁷ KEALL (1975) 380-390.

⁸ AZARNOUSH (2008).

During the excavations carried out in Gach Gumbad and Hushtareh areas a total of 389 stucco pieces were found and have been repaired. A number of these stuccoes are kept in the storehouse of the National Museum of Iran and there has been still no information available concerning the fate of the reminders. The stuccoes obtained by Azarnoush are kept in the storehouse of the Cultural Heritage Organization of Kermanshah Province. In comparison to the simultaneous Parthian areas such as Uruk, Seleucia, Kuh-i Khwaje and Assure, the motifs of the stuccoes of Qal'eh-i Yazdigird witnessed the greater diversity and amount of the motifs leading to the fact that the stuccoes here have been used to decorate a larger sections of the buildings in these complex. The stuccoes are used to decorate walls, part of columns, capitals, niches and cornices of the buildings. The stuccoes of the Qal'eh-i Yazdigird can be divided into 6 major groups according to the type of decoration (fig.3), including human, animal, floral, geometric, architectural and compound elements and motifs.⁹ In fact until the Qal'eh-i Yazdigird excavations, there has been a belief that only floral, geometric and architectural elements and motifs were extensively used by Parthian stuccoes and the other motifs have been very rare especially in the course of depicting human portraits. While the Qal'eh-i Yazdigird date not only indicated the abundance of the human portraits on the stuccos but based on the type of the scenes we were enabled to classify the human decorations of this building into four groups of mythic, hunting, medallion and incomprehensible motifs which have been used in the various scenes.



Fig. 3. Parthian stuccoes of the Qal'eh-i Yazdigird

Painted Stucco

In the Parthian period, stuccoes were decorated by different paints. Examples from Seleucia,¹⁰ Uruk,¹¹ Qal'eh Zahak,¹² Taxila,¹³ Assure¹⁴ and Ai-khanum¹⁵ were reported. In Qal'eh-i Yazdigird, painted stuccoes in comparison with the other simultaneous areas were widely used so that out of 163 pieces of stuccoes from there, 69 pieces (42.3 percent) were painted. In fact, painting has been the latest stage in the creation of stucco

⁹ KHANMORDI (2006) 60.

¹⁰ DEBEVOIS (1941) 47.

¹¹ LOFTUS (1857) 225.

¹² QHANDGAR et al. (2004) 203.

¹³ MARSHALL (1960) 73.

¹⁴ COLEDGE (1977) 73.

¹⁵ HERMANN (1977) 13.

decoration process. In Qal'eh-i Yazdigird site, to the best representation of the motifs, the surface of stuccoes were firstly painted by a bright color while the motifs themselves were generally painted by the paints darker than the background one. The colors used in the stuccoes of Qal'eh-i Yazdigird were included: red, blue, yellow, green, pink, purple, orange and brown. In some cases, motifs were decorated by a particular paint (e.g. blue, red, green) which have mainly been used to portrait hunting scenes, a woman capital with two dolphins in hand and griffins. Some parts were also frequently painted by two or three paints such as pink and green crenellations as well as making more contrast between paints and the background plasters which would enhance the magnificence and beauty of the stucco decorations.

For the stuccoes of Qal'eh-i Yazdigird, it cannot be said that the coloring is confined to a particular motif or scene, since the study of Qal'eh-i Yazdigird stuccos is still incomplete and the impact of environmental factors in the modification of the stucco colors have not yet been properly identified. However, a statistical review on such stuccoes shows that 39 pieces of the motifs depicted human and animals while non animal motifs just compromise 27 pieces. On the other hand it seems that 103 stucco pieces of Qal'eh-i Yazdigird remained unpainted but Keall found residue of a brown powder on some pieces and considered it as the remaining of a rotten paint. Lack of paint on the some pieces may be due to the climatic conditions as ruined buildings were exposed to the local rains and floods during the long period of times. Moreover, the remains of paints have been found from the lower parts of the building walls where the dense debris have been pile up and prevented the paints from being washed out. At the moment, it cannot be assumed even that identical patterns were consistently painted, since one of the pair of "cupids" shows remnants of paint while the other bears none.¹⁶ Nowadays, with Raman analysis and visible-induced luminescence imaging, traces of paint can be easily identified on samples which they have been seemed before unpainted by naked eyes. For example, these methods have been applied on Uruk stuccoes in British Museum and blue paint was identified on a capital.¹⁷ In this research because of the importance of stuccoes of Qal'eh-i Yazdigird we tried to sample the stuccoes available in the National Museum of Iran to identify the kinds of pigments used as well as to understand the technology by which the colorful stuccoes of the Parthians were appeared.

Red paint

On the Qal'eh-i Yazdigird stuccos red paint has been extensively used as 46 pieces of stuccos indicated the applications of this color whether single or together with the other colors to decorate various motifs. Now we have to see what pigment the artists has used to make the red paint. To achieve this goal, we sampled the stuccoes located in the National Museum and thin polishes were made from the selected samples in petrographic laboratory of the Conservation Institute. We used a James Swift polarizing microscope by 4X and 10X magnification ratios. Red pigment has been to be combined with gypsum mineral. This pigment is isotropic (monochromatic) and has a dark red internal reflection. The study showed that the red pigment is of ochre type and was used together with gypsum (fig.4). The paint has been directly used on the stucco, therefore, it lack any other substrate. The use of ochre red pigment dated back to the Paleolithic period¹⁸ when it was used for ritual and artistic purposes. In fact this type of pigment has been in combination with iron oxide and clay which produces a paint ranging from yellow to red. Ochre is from the word *ochros* in Greek meaning yellow.¹⁹ Since the Paleolithic, this pigment has been widely used and in the historical periods, it has been used in architectural decorations. In Parthian Iran, in some archaeological sites such as Qal'eh-i Yazdigird, Nisa, Uruk and Kuh-i Khwaje the red ochre has been widely used to decorate not only the architectural elements but the objects such as those clay sculptures which were explored from Nisa.²⁰

¹⁶ KEALL et al. (1980) 7-16.

¹⁷ SIMPSON et al. (2012) 213-214.

¹⁸ GODLOVE (2011) 8.

¹⁹ BARNETT et al. (2006) 445-453.

²⁰ BOLLATI (2008) 188; see also BATER (2010); SIMPSON et al. (2012) 213; BAHADORI, BAHROLOLOMI (2010).

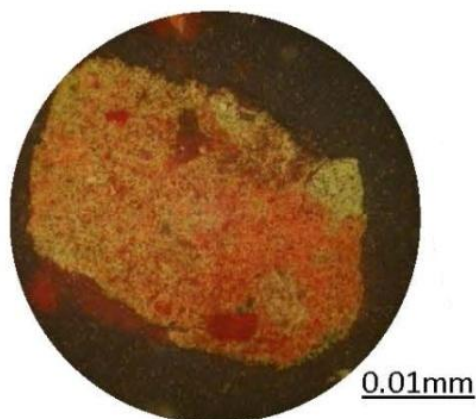


Fig. 4. Microscopic feature of the red pigment used on the Qal'eh-i Yazdigird stuccos

Blue paint

The next color which has been abundantly used on the Qal'eh-i Yazdigird stuccos is that of blue color (applied on 33 pieces). Like the red paint, blue paint also has a light to dark spectrum which has been classified in this study into six groups. It has sometimes been used to paint a human portrait or sometimes a column. To determine the type of the blue pigment, the stuccoes in the National Museum were sampled. This sample was taken from piece number QY78 A5 which shows the torso of a woman. It is a piece of a 31 cm long and 22 cm wide stucco was unearthed from space 202 of eastern Gach Gumbad (Fig.5) in 1978 indicating the existence of red, black, pink, yellow and orange colors in addition to the blue one. To understand the real substances of the pigments and we used Fourier Transform Infrared spectroscopy to characterize the pigments internal elements. For experimental analysis, a few milligrams of the sample were grinded with 70 times of Potassium Bromide (KBr) in a ruby onyx. Then under vacuum, it has been transformed into a transparent tablet of 1 mm thickness. A spectrum of the sample was recognized by a Nicolet 510P model FTIR device. The FTIR spectrum showed the presence of the so called Egyptian blue pigment as well as calcium sulfate which in turn was penetrated into the sample from the background plaster (fig.6). In the further steps to ensure the accuracy of the test we used the X-ray diffraction experiment (XRD) analysis to which the slides analyzed by the T2T powder model of X-ray diffraction of SIEFERT Company at a 30Ma current and 40Kv voltage. As a result and according to the XRD analysis, the existence of Egyptian blue pigment ($\text{CaO}\cdot\text{CuO}\cdot\text{SiO}_5$) was indicated (fig.7).



Fig. 5. Painted stucco show Egyptian blue pigment

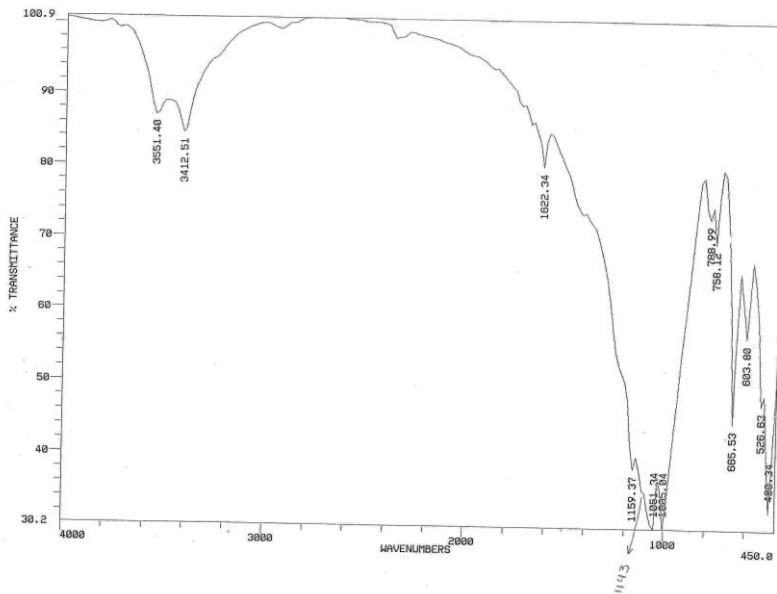


Fig. 6. FTIR spectrum of the blue pigment

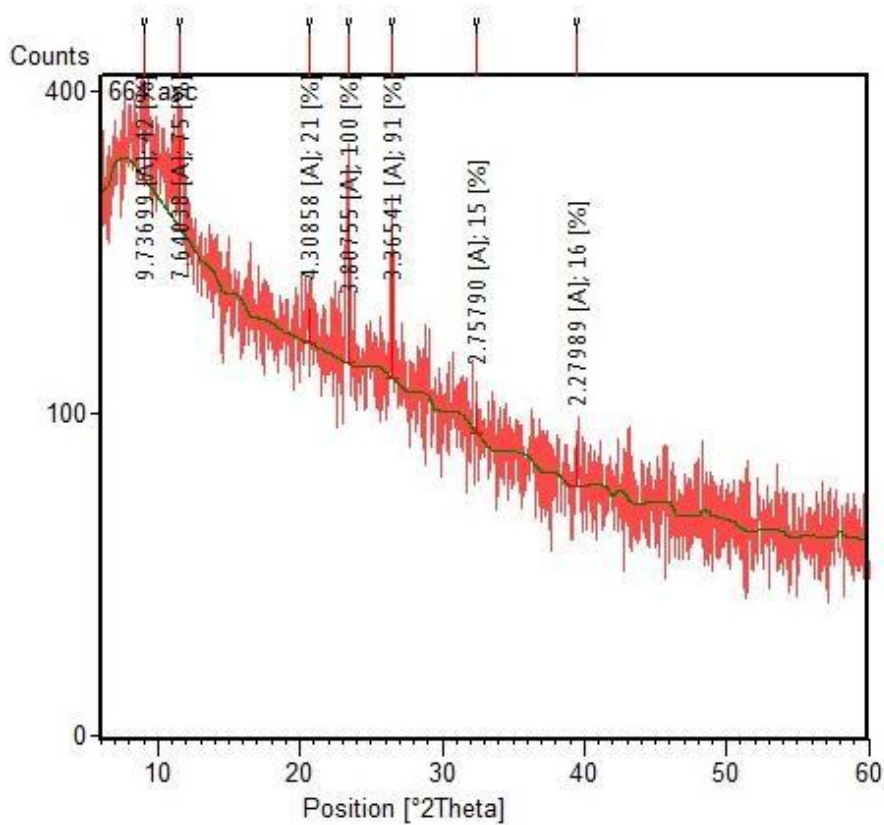


Fig. 7. XRD spectrum of the blue pigment

Egyptian blue pigment is the oldest human-made pigment which was used for painting from the third millennium BC onwards.²¹ In terms of its chemical composition, this pigment consists of a mixture of silica

²¹ GAETANI et al. (2004) 14.

(sand and gravel), calcium (calcite or limestone), copper (malachite) along with a small amount of an alkaline material heating them at a temperature of about 850 to 1000° C until it takes a powder form.²² Archaeological evidence from Iran, Mesopotamia, Egypt and East Mediterranean, approved the usage of this pigment for the decoration of architectural buildings. There has been also research conducted by the British Museum indicated that this pigment was widely used to decorate stuccoes of the Uruk architectural monument belonging to the Parthian period.²³ The Egyptian blue has also found its way to take part in the painting of the Nisa clay figurines.²⁴

Pink paint

Pink paint comprises 10 stucco pieces of Qal'eh-i Yazdigird sample. The most important pieces include stuccoes depicted by Nike, the goddess of Victory whose dresses were painted by pink color. During Parthian period, pink paint has also been seen from the Qal'eh Zahak and Uruk stuccos,²⁵ as well as from the wall painting of Khwaja²⁶ and Nisa.²⁷ As polarizing microscope showed (fig.8), this pigment is isotropic (monochromatic) and has a dark red internal reflection. In fact under the microscope, the sample has the similar characteristics with those of red paint and they probably share the similar compositions. The paint varies according to their density. As a result, it can be concluded that the pigment is of an ochre type. The paint is applied directly on the stucco and has no other substrate.

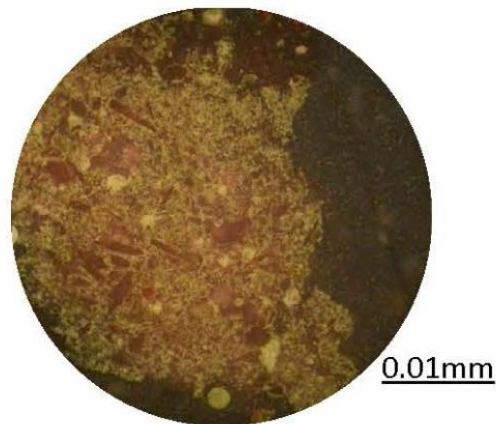


Fig. 8. Microscopic features of the pink pigment Qal'eh-i Yazdigird stuccos

Green Paint

Among the Qal'eh-i Yazdigird stuccoes, 17 pieces represent application of sole green paint particularly to depict hunting scenes on the columns and sometimes in the combination with other colors to decorate various motifs of human, animal and architectural elements. Through spectroscopy analysis, it became clear that the absorption bands in 800, 439, 462, and 979 cm^{-1} are due to the existence of a silicate material of green earth pigment (fig.9). In addition, it was found that the background plaster layers of stuccos contained an amount of calcium sulfate (gypsum) and calcium carbonate (limestone) elements. XRD analysis conducted to characterize the composition, resulted in to recognize the existence of earth green pigments (silage) ($\text{CaO}\cdot\text{CuO}\cdot\text{SiO}_5$), which is known as terre verte (fig.10); it is a natural pigment in the form of a mud mass composed of celadonite and glauconite.²⁸

²² TITE et al. (1987) 39.

²³ SIMPSON et al. (2012) 213-214.

²⁴ BOLLATI (2008): 196; APPOLONIAI et al. (2008) 204.

²⁵ SIMPSON et al. (2012).

²⁶ BATER (2010).

²⁷ PILIPKO (2005).

²⁸ SCOTT (2015) 11.

To achieve the pigment from the mud mass it was crushed and washed to remove impurities. It was finally pulverized and used for painting.²⁹ Using earth green was less known in Iran and Mesopotamia. Based on the available information, it was first used in the Hellenistic period in Egypt and the Levant.³⁰ During this period, in Egypt, Palestine and Cyprus, earth green pigment was mixed with Egyptian blue pigment which resulted in bluish-green or greenish-blue paint. Of course, it was used alone in wall painting and other historical monuments.³¹ During the Parthian period, this pigment has also been used for painting the stuccoes of Uruk.³²

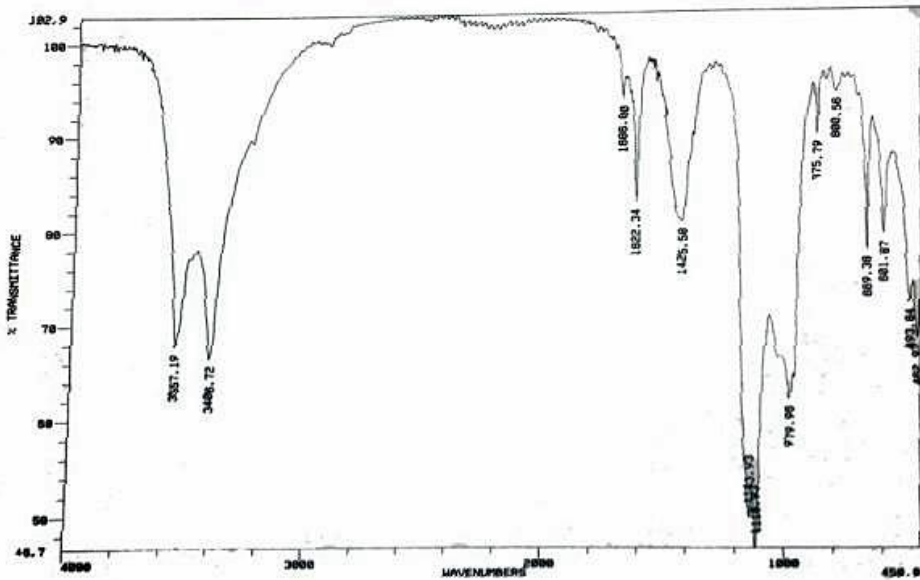


Fig. 9. FTIR spectrum of the green pigment

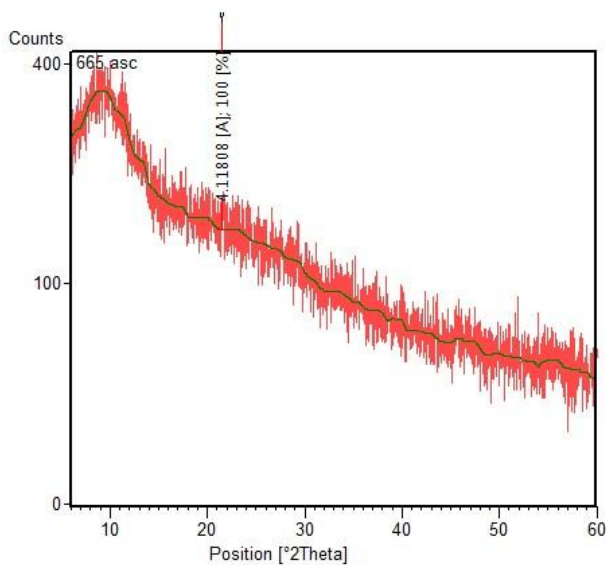


Fig. 10. FTIR spectrum of the green pigment

²⁹ VARICHON, (2000) 210-211.

³⁰ KAKOULLI, (2009) 46.

³¹ KAKOULLI, (2002) 80.

³² SIMPSON et al. (2012) 214.

Yellow paint

Yellow is another paint which was favored by the Qal'eh-i Yazdigird stucco decorators. It can be seen on 22 pieces of our samples. This paint is used to decorate human motifs and architectural elements, along with other paints such as red, green and blue. In Parthian period art works such as figurines as well as stuccos portraying used yellow paint as seen from Nisa,³³ Kuh-I Khwaja³⁴ and Uruk.³⁵

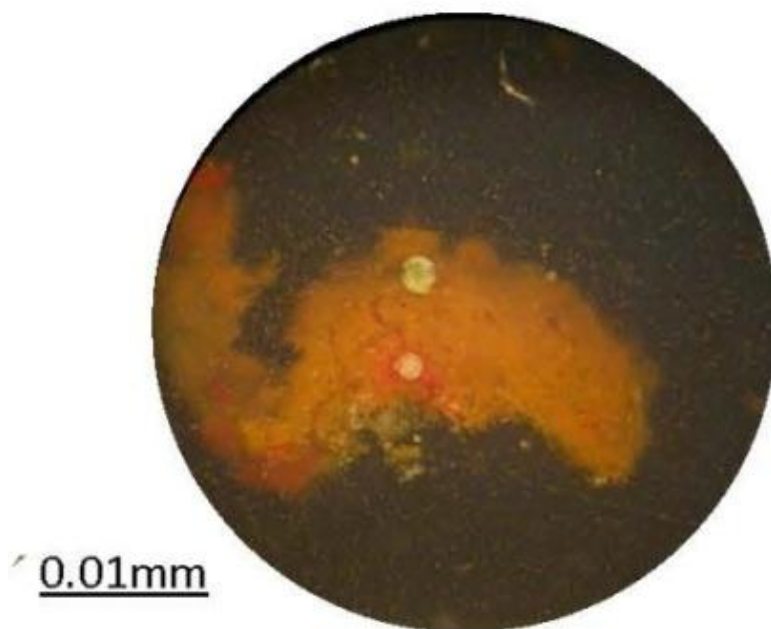


Fig. 11. Microscopic feature of the yellow pigment Qal'eh-i Yazdigird stuccos

Other paints

In addition to the paints mentioned above, other paints are also used on the stuccoes of Qal'eh-i Yazdigird (e.g. orange, purple and brown. The interesting point to note is that Qal'eh-i Yazdigird ground is currently the only area of the Parthian period, for which the purple paint is reported on the stuccoes but nowadays, there has been no remnant of the purple and brown paints visible on the available stucco pieces. As stated before, the stuccoes in the museum are a part of the stuccoes belonging to Qal'eh-i Yazdigird grounds. Some pieces have uncertain fate. In fact some of the similar parts were again embedded in the ground by the explorer. Unfortunately, the amount of orange paint was too little on two pieces in the museum's stuccoes and it was not possible to separate them. Therefore, sampling was not possible to determine the pigment type. The important point to note is that, on some apparently colorless stucco pieces, there exists dark deposit. The authors suppose this deposit must be the remnant of the existing paint on the stucco. The deposit was the sampled and studied with a polarizing microscope of James Swift model in petro graphic laboratory. The samples are a collection of small and large deposits. Gypsum can be seen in two forms, fine crystal and coarse crystalline. In addition, iron oxides and calcite mineral can be seen. Moreover, a small amount of red, blue and green pigments are also observed with pieces of gypsum mineral. So it is likely that due to unfavorable conservation conditions, precipitation rainfall and deterioration of paints on some pieces, dark spots have remained as deposit (fig.12).

³³ PILIPKO (2002); BOLLATI (2008) 188.

³⁴ BAHADORI, BAHROLOLOMI (2010) 9.

³⁵ SIMPSON et al. (2012) 213.

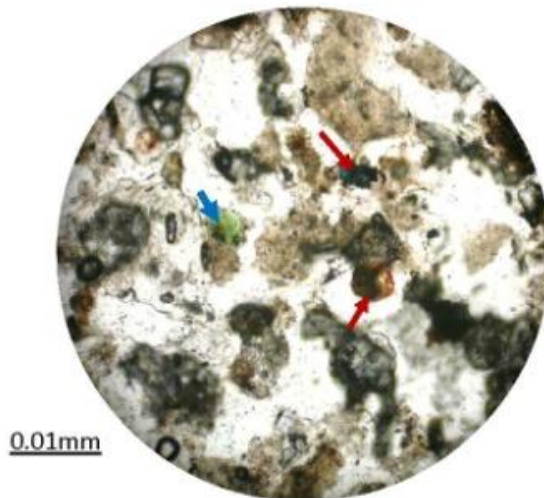


Fig.12. Green, blue and red pigments in the deposit along with pieces of gypsum mineral and other components, light (PPL)

Conclusion

The Qal'eh-i Yazdigird complex with a large amount of stucco decorations is considered to be one of the most important Parthian sites whose numerous and various decorations more or less demonstrate how the monuments of that period are decorated by stucco motifs. These stucco motifs can be classified into six groups, i.e. human, animal, geometrical, floral, architectural elements and combined motifs. Polychromatic stucco is among the most significant characteristics of this complex. The paints used in these stuccos include: blue, red, green, orange, purple, brown, yellow and pink. Paints used in Qal'eh-i Yazdigird are more diverse in comparison to the simultaneous Parthian sites. This proves the knowledge of the Parthian artists on the exploring and processing of materials necessary for their most full art. Despite the long time since the production of these works, there are still many long lived painted stuccos have been seen from Uruk, Qale Zahak, Seleucia and Assure and particularly from Qal'eh-i Yazdigird; a Parthian site in northwestern Iran. Although some works are monochromatic, a significant number of painted stuccoes are painted with two or more paints so that in some pieces, six different paints have been used. Investigating stuccoes indicates that paints are used in all motifs and painted stuccoes are not confined to a particular role or scene.

Until now no research has been done on the Qal'eh-i Yazdigird stuccoes. Due to the importance of identifying the mineral compositions of the pigments used by Parthians in general and those which were used in Qal'eh-i Yazdigird art works an laboratory compositional analysis carried out for the first time to recognize the important elements of the paints which have been used solely or compositionally colouring the motifs. The experiments showed that in Qal'eh-i Yazdigird, pigments such as Egyptian blue are used for blue paint, silo green or earth green for green paint and ochre is used for red, yellow and pink paint. In fact, only inorganic pigments are used for painting stuccoes and botanic pigments have not been identified. The existence of the Egyptian blue pigment which is a handmade material proved to have been used for the first time during the Parthian period but still we do not know whether it was imported or has been made locally. As mentioned earlier, this pigment has been verified from the Uruk and Nisa art works seemed to have been inherited from the preceding Achaemenids but did not continued to the subsequent Sasanian dynasty. It is a challenge should be clarified by the further researches.

Acknowledgement

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Summary

An Analytical Approach to Investigate the Parthians Painted Stuccoes from Qal'eh-i Yazdigird, Western Iran

The use of stucco decoration on buildings has become popular in Iran from the first century but from the second century onwards stucco decorations were painted in bright colors. An important group of the Parthians Painted Stuccoes excavated in the 1965-79 and 2008 in Qal'eh-i Yazdigird. Qal'eh-i Yazdigird is a Parthian Palace Stronghold in the Zagros range of mountains in western Iran. At Qal'eh-i Yazdigird the decoration includes geometric, figural, vegetal and architectural motifs. Much of the stucco decorations were vividly painted. Some of the fragments are Polychrome. These colors consist of green, deep blues, pink, deep reds, orange, brown, purple and yellow. These were analyzed for the first time within in 2013 in Iran. The pigments red ochre and yellow ochre (identified by the presence of the main chromophores hematite and goethite), Egyptian blue and green earth (terre-verte glauconite) were found on decorated surfaces. FTIR, X-ray diffraction (XRD) and Petrography methods have been used to study the characterize pigments used in the stucco decoration.

Key words: Parthian Iran, Qal'eh-i Yazdigird, Painted Stuccoes, pigment, Egyptian blue