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# Continuity of Saljuq Architecture in Iran, the Friday Mosque of Firdaus

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**Abstract**

This paper examines in detail the little-known Friday Mosque (masjid-i jāmi‘) of Firdaus, located southwest of the Khurasan, which has had a key role in developing Saljuq architecture in the area. The original scheme of the mosque was unclear. The lofty īwān and two flanking dome chambers on the west (qibla) side of the courtyard are the central core of the mosque. The main aim of the article is to analyse the architecture of the mosque and demonstrate its association with the architectural style of the Saljuq mosque in the Khurasan area. During the conservation and restoration measures in 2006, some fresh materials were unearthed. The new findings shed light on the original features of the mosque and revealed its formation. The paper describes the city's history, defines its architectural characteristics, and then analyses the present information for replying to the research questions. Owing to the outcomes of the archaeological investigation, the study suggests the general scheme of the mosque as a further example of the two- īwān mosque, which may be dated to the late years of the 6th /12th century. Despite the importance of the mosque, no lengthy study has been published about the building. The accurate drawing of the plan and sections of this monument, with the proposal scheme for the reconstruction of the mosque, are being published in this paper for the first time.

**Keywords**: Khurasan, Firdaus, Friday mosque, Saljuq architecture, Ghurid.

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## 1.Introduction

A Friday or Congregational mosque (masjid-i Jami‘) is the most well-known monument in Islamic architecture history. The building typically presents architectural innovation in every period. To outline the conceptional formation and understanding the characteristic attributes provides sufficient material to determine the history of Iranian Islamic architecture. The building was erected in various styles, and classifying it in all areas is essential.

Khurasan is the name of a vast region in the northeast of modern Iran. This region was originally part of a far greater area with the exact name being equivalent in modern times to the present Khurasan of Iran, southern Turkmenistan, and north and northwest Afghanistan. The area has a significant cultural position in medieval Iran. It is not surprising that Khurasan can be seen as a innovative center of disdtinctive architecture schools, such as Saljuq, Ghaznavid and Ghurid, in the Iranian world from 1000-1250. Hitherto, two multiple types of mosques from this period have been recognised in Khurasan:

1. The two-*īwān* mosque - e.g Farūmad, Gunābād, and Zūzan.
2. The dome square mosque - e.g. Gunābād-i Sangān-i Pa’iyn [(1)]

In 2003, the Iranian Khurasan province was divided into three parts: Khurasan-i Shumalī (Northen Khurasan), Khurasan-i Raẓavī, and Khurasan-i Junūbī (Southern Khurasan). The city of Firdaus, formerly known as Tūn, [(2)] is located in the northwest of Khurasan-i Junūbī.

The city of Firdaus, despite its small size, has a valuable architectural heritage. Due to its remote location from the main roads, little attention has been drawn to its appreciated monuments. The city was destroyed by a fatal earthquake on 1st of September 1968, and then after, the new city was reconstructed to the north and northeast of the old one by local inhabitants. Despite this massive devastation, several significant monuments such as the Friday mosque (Masjid-i Jami‘), Masjid-i Kūshk (2nd half of the 9th century), [(3)] two neighbouring madrasas, Ḥabībiya (1505), and ‘Uliyā (2nd half of the 18th century) [(4)] have still survived near the Friday mosque, in the old part of the city.

This paper aims to discuss in detail the little-known Masjid-i Jami‘, the eminent surviving monument in Firdaus and the southwest Khurasan area. The study seeks to answer two main questions:

1. What are the main characteristics of the mosque and its construction date?
2. Architecturally, is there any link between the building and its neighbouring area?

The structure has been briefly noticed by a few scholars just as a historic building. However, there is no lengthy publication to examine the architectural history of the mosque. The present building was erected initially in the pre-Mongol first phase and developed in the Safavid and Qajar periods.

It is noteworthy that the accurate drawing of this monument, which was recently prepared by the Iranian Cultural Heritage, Handicrafts and Tourism Organisation (ICHHTO) local office in 2016, is being published in this paper for the first time.[(5)] In addition, the proposal for reconstruction of the mosque is produced in the paper (see below).

## Description of the Building

The Masjid-i Jamiʿ of Firdaus, 34˚00'24.42" N 58˚ 09' 31.92" E, is located to the southwest of the city, adjacent to Imām Khomeinī Street. The remains of the ruined citadel (*ārg*) of the city are to be found on the west side of the mosque. Firdaus had five districts before the earthquake: Sadat, Anbarī, Sardashat, Talār, and Miydān (Yāhaqī and Būzarjumihrī 1996: 43). The Friday mosque and other surviving monuments were located in the latter area. The earliest aerial photo of the city, dated 1956, shows that the mosque was originally surrounded by several buildings that were destroyed by the earthquake. The shrine complex of Imamzadh Muhammad and Ibrahim, which dates from the Timurid and Safavid periods (Yāhaqī and Būzarjumihrī 1996: 71-72), is to be seen to the southwest out of the mosque (Fig.1).

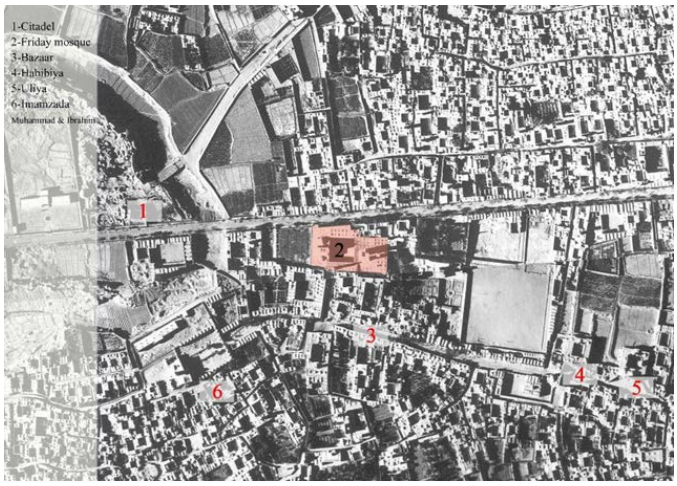


Fig. 1. Aerial photo of the mosque, 1956

Owing to the lack of archaeological investigation, the erection of the mosque over an earlier religious site such as a Zoroastrian structure, is uncertain. However, it seems that due to the orientation of the building, the present site was originally chosen for the mosque. The current mosque contains a huge *īwān* and some covered areas around a central courtyard (*ṣahn*) measuring 28.46 x 28.18 m. This vast size of the mosque, especially its courtyard, shows the mosque's key role in accommodating a large number of prayers (Fig.2).

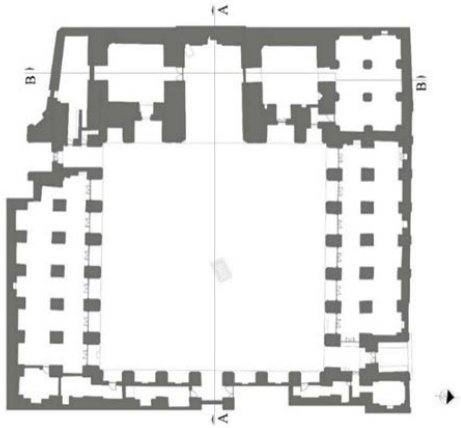

Fig. 2. Ground plan of the building, after ICHHTO.

A lofty *īwān* dominant on the west side, thanks to the *qibla* direction behind it, serves as the *qibla īwān* (Fig.3). It measures 12.15 deep, 7.39 wide, and 15.70 m high. Each wall of this *īwān* is 2.73 m wide. From the structural standpoint, this extraordinary thickness was intended to support the extra weight of the cover of the *īwān*.
It is flanked by two square dome chambers, each measuring 7.1 x 7.4 m. these dome chambers were planned to control the lateral thrusts of the *īwān*, and owing to the similar type of construction and decoration; they are simultaneous. The dome's profile to the north side is of the pointed arch of the *qibla īwān*, while that of the south side is semicircular (Fig.4).

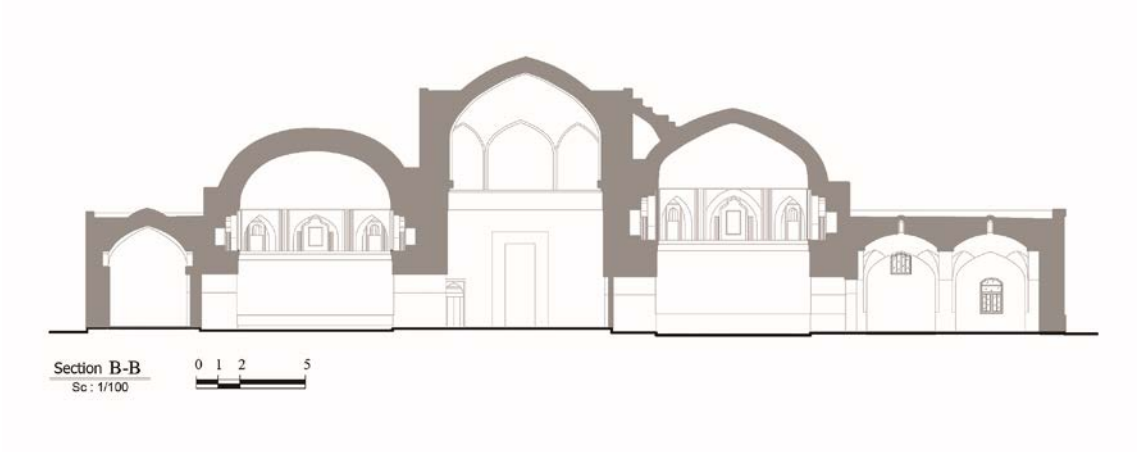


Fig. 4. Cross section of the *qiblh* area, after ICHHTO

In addition, the height of the transition zone of the second dome is lower than that of the first one. These differentiations between the two dome chambers may probably refer to the later repair or reconstruction of the northwest dome.
Inside, each squinch of the dome is decorated with three adjacent rectangular frames. Each of them contains a trilobed arch in plaster that has been slightly executed in a rough way (Fig.5a). In the distance between each squinch a blind pointed arch is placed. Inside the arch is a decorated form containing a broken-headed keel arch. Each spring of the latter sits on an ornamented engaged semi-column of plaster (Fig.5b). This type of arch is rare in Iranian Islamic architecture and is possibly a local sample. The closest parallel is to be seen over the entrance of the Qal‘a Huḍābad (locally known as Qal‘a Rustam) near Zābul in the Sistan area.(6) The exact function of the dome chambers is unclear; however, due to their decoration, they likely served as private praying rooms or teaching spaces. Due to the education of traditional Islamic sciences in the mosque, the latter function is more likely. A similar scheme is to be found in the Madrasa Shah-i Mashad (1176) in Afghanistan.(7) At present, there is no inscription inside the dome chambers.

Fig. 5 a,b. Decoration of the transitional zon

A series of harmonised arcades, except the west or *qibla* side, are around the courtyard (Fig.6). The façade of the *qibla īwān* is flanked by two *īwān*-like entrances. Each entrance provides access to the rear dome chamber. Over each entrance is a stilted pointed arch. Each base of this arch sets over a slim engaged column in brick. This figure is to be seen in the other Saljuq monuments, such as the Masjid-i Malik in Kirman (1084-98)[8] and the caravanserai at Ribāṭ-i Sharaf (1114-54), north of Khurasan.[9] A large *shabistān* measuring 26.1 m x 8.7 m is north of the courtyard. This *shabistān* is covered by 12 domical vaults of baked bricks. A further *shabistān* measuring 24.2 m x 6.3 m, with the same construction style, can be seen to the south of the courtyard. Similar intercolumniation styles of vaulting and courtyard façade suggest that these two *shabistān*s were built at the same time.

A smaller *shabistān* is to be found in the northwest of the courtyard. The *shabistān* measures 12.4 m x 8.4 m, and it is covered by six domical vaults. This *shabistān* has only access from the adjacent dome chamber, so it seems it was added later to the building.In the 3rd phase, a further *shabistān*, measuring 30 m x 30 m that was locally known as *Shabistān*-i Ṣad Sitūn (100 columns sanctuary) was added to the mosque behind the east part of the courtyard. According to the date of the foundation stone [10] of the *shabistān*, which is still placed on a wall to the east part of the courtyard, the *shabistān* was added to the mosque in 1822-23. The *shabistān* was destroyed by the earthquake. However, its reconstruction is now in progress under the supervision of the border trustee of the mosque and is near completion. [11]

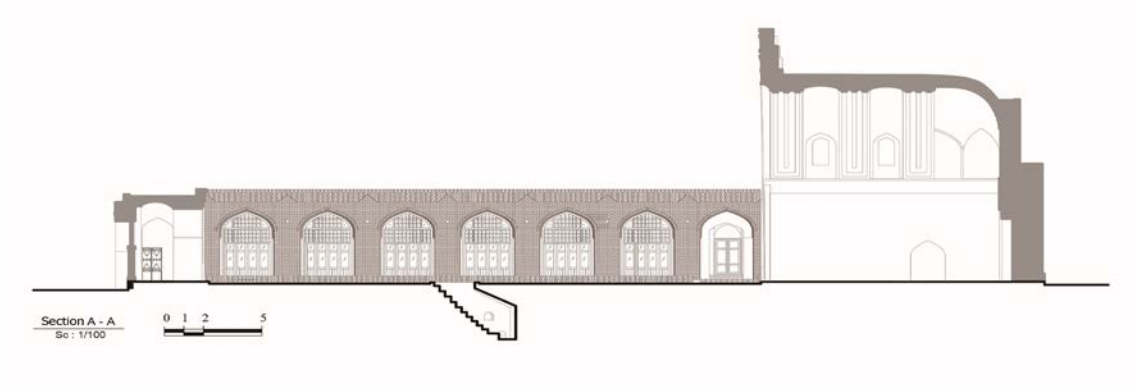


Fig. 6. Longitudinal section of the mosque, facing the south side, after ICHHTO

The height of each entry is about half of the *qibla īwān*. A blind niche arcade, at the height of the south and north *shabistān*, is to be seen at both ends of the *qibla* façade of the courtyard. This combination creates a hierarchy of size on the west façade to stress the *qibla īwān* as the mosque element.

As mentioned above, a lofty *īwān* of baked brick is to the west side of the mosque. The arch of the *qibla īwān* is four-centred and placed over two outset imposts. Above the arch is a rectangular frame measuring 8.05 m x 0.5 m. It is likely that an inscription band, which has vanished now, was placed inside this frame.(12) Two decorative motifs in the form of *muqarnas*, are set below the imposts of its arch façade, marking the inner northwest and southwest corners of the *qibla īwān*. These two motifs likely replaced two original engaged columns in baked brick later. A herringbone pattern in baked brick covers the spandrel of the arch of the *qibla īwān*. Similar to the surviving parts of the façade decoration of the *īwān*, it is more likely that the spandrel was initially decorated with stars and carved arabesques of baked terracotta, which have vanished now.

A large *miḥrāb* of plaster consisting of a very shallow rectangular frame, measuring 4.45 m x 2.57 m, is on the *qibla* wall of the *īwān*. A niche measuring 1.90 m x 0.07 m., with a pointed arch hood, is in the centre of the rectangular frame. A further smaller *miḥrāb* of plaster that was built later to show the exact direction of *the qibla* is in the southwest corner of the *qibla* wall of the *īwān*. It is noteworthy that in the eastern lands of Iran, because of the difficult calculation of the *qibla* direction, the mosque was traditionally oriented toward the West, the general direction of Mecca. The *miḥrāb*s are simple and not adorned. Two doorways opposite each other in the *qibla īwān* provide access to the flanking dome chambers. Each lateral wall of the *īwān* was likely pierced by one opening, which provides the present accesses to the dome chambers.

The *īwān* is constructed of baked brick and decorated with terra cotta. These materials are also widely applied in the Ghurid monuments in Afghanistan (Ball 2008: 135). A succession of panels linked by knotted frames runs around the façade of the *qibla īwān*. These panels are of baked brick and are filled with geometric lines that form an interlaced strapwork of carved baked terracotta (Fig.7). The remains of light blue (turquoise) glazed tiles are to be seen on two exterior surfaces of each knot. Between these two panels is decorated with a broader band of a moulded geometrical pattern of baked terracotta, (13) containing a series of ten-sided stars beside each other. This type of design includes an elaborate strap work, locally known as *hizārbāf* (thousand-weave). Each part of the decoration is usually created on the ground and installed in its place according to its pre-designed scheme. This star design is also to be seen in the spandrel of the *qibla īwān* in the mosque of Farūmad (14) and the soffit of the arch at Bust, both datable to the middle of the 12$^{th}$ century. Inside, each star was decorated with cut light blue glazed tiles.

Fig. 7. Decoration of the qiblah īwān

This decoration is also to be seen on the nearby monuments: the mosque-madrasa at Zūzan (1219) and [15] Masjid-i Sangān Pai'n in Khāf (ca. 1150).[16] The decoration is also visible in Ghurid monuments such as the minaret of Jam (ca. 1190), [17] the madrasa of Shāh-Mashad (1176),[18] and the mausoleum of Ghiyāth al-Dīn (late 12th and early 13th century) (Hillenbrand 2002: 123-143) in Herat, Shāhzadih Sarbāz at Bust (c. 1203), and in the south palace at Lashgarī Bāzār (Hillenbrand 2002: 195). This association may suggest the influence of Ghaznavid and Ghurid architecture in the South Khurasan area.

There is no decorative epigraphy in the Firdaus mosque, so it was originally less decorated than those mentioned above. The shortage of ornamentation in the main *īwān*, as the old part of the mosque, is unclear. It is possible that the *īwān* was embellished originally; however, it was later destroyed and was not restored. In addition, it is likely the mosque was built by order of a local and not a royal patron, so the financial support was insufficient.

The vast application of light blue glazed tiles shows the continuation of the Ghurid style and its popularity in Khurasan. It is noteworthy that the upper part of the original decoration on the portal *īwān* in Firdaus was destroyed by the earthquake in 1968. [19] However, according to old photos, it was reconstructed as its present form by the ICHHTO in 2014.

The remains of a delicate floral pattern of baked terracotta, set in a light reddish-plaster ground, can be seen on the facade of the *qibla īwān.* It appears that this decorative band originally runs on the extrados of the arch. The closest parallel of the decoration is to be found on the northeast exterior façade of the mausoleum of Ghiyāth al-Dīn in Herāt.[20]

The rectangular area of the *īwān* is roofed by a series of crossing vaults that are typically applied to cover a vast rectangular space. The roofing type is known as *tāq-i kajāwh* (*kajāwh* vault) in Iran.[21] By contrast, in the barrel vault type of construction in

the Sasanian period, there is no need for the back wall of the *īwān* to be constructed up to its full height to support the construction of the roof of the *īwān*. In addition, a barrel vault typically makes lateral thrust forces; however, in this type of construction, the vault load is beared by the cross arches and leads it directly to the ground (Miʻmāriyān 2012, 225). This vault, generally known as the developed form of a barrel vault, is comprised of a series of transverse pointed arches. A further barrel vault of the suggested arch profile fills the interval space between each cross arch. The closest parallel is to be seen in the Masjid-i Jamiʻ Gunābād.(22) *Tāq-i kajāwh* was developed and widely used as an innovative type in the Ilkhānīd monuments, such as the Masjid-i Jamiʻ at Yazd (Wilber 1969: 58, 160).

In the case of Firdaus, owing to stress on the *miḥrāb* in the *qibla īwān*, the end part of *tāq-i kajāwh* is covered by a semi-domical vault with a pair of the squinch (Fig.8). So, the vaulting type of south *īwān* in Firdaus is a rare example of this style in Iranian land in the pre-Mongol invasion. It is noticeable that the idea of vaulting was developed and applied in later monuments such as the Friday mosque in Qā'n (d.1393) in the South Khurasan province.(23)

The mosque has two entrances. The main entrance is to the northeast side of the courtyard, which opens to the present Imam Khomeini Street. The *īwān*-like portal, decorated with a series of crossing ribs of plaster,(24) likely dates from the Qajar or early Pahlavi period. A further entrance, without any specific decoration, is to the southwest side of the mosque. The earliest aerial photo of the city (d. 1956) shows a minaret whose size is unclear – besides the latter entrance. This minaret was destroyed by the earthquake in 1968. It is notable that there is no evidence of a portal with an adjacent minaret in Khurasan in the 12 century. So, it seems the minaret was probably a later addition.

Fig. 8. Vaulting of the qiblh īwān

Except for the Ghurid portal in the Friday mosque of Herat,(25) which was intentionally decorated for political purposes (see below), the mosque at Firdaus, similar to the other contemporary surviving mosques in Khurasan, namely Farūmad and Gunābād, are disadvantaged from an elaborated entrance.

During the restoration in 2006, the remains of the original pavement of the mosque courtyard were discovered (Fig.9). Consequently, an archaeological investigation was started to find other pieces of evidence from the ICHHTO local office in Firdaus.(26) This excavation discovered the remains of two lateral walls of a *īwān* to the east side of the courtyard, precisely opposite the *qibla īwān*. The discovered *īwān* was 2.11 m deep and 7.1 m wide, and each wall was 2.63 m wide.

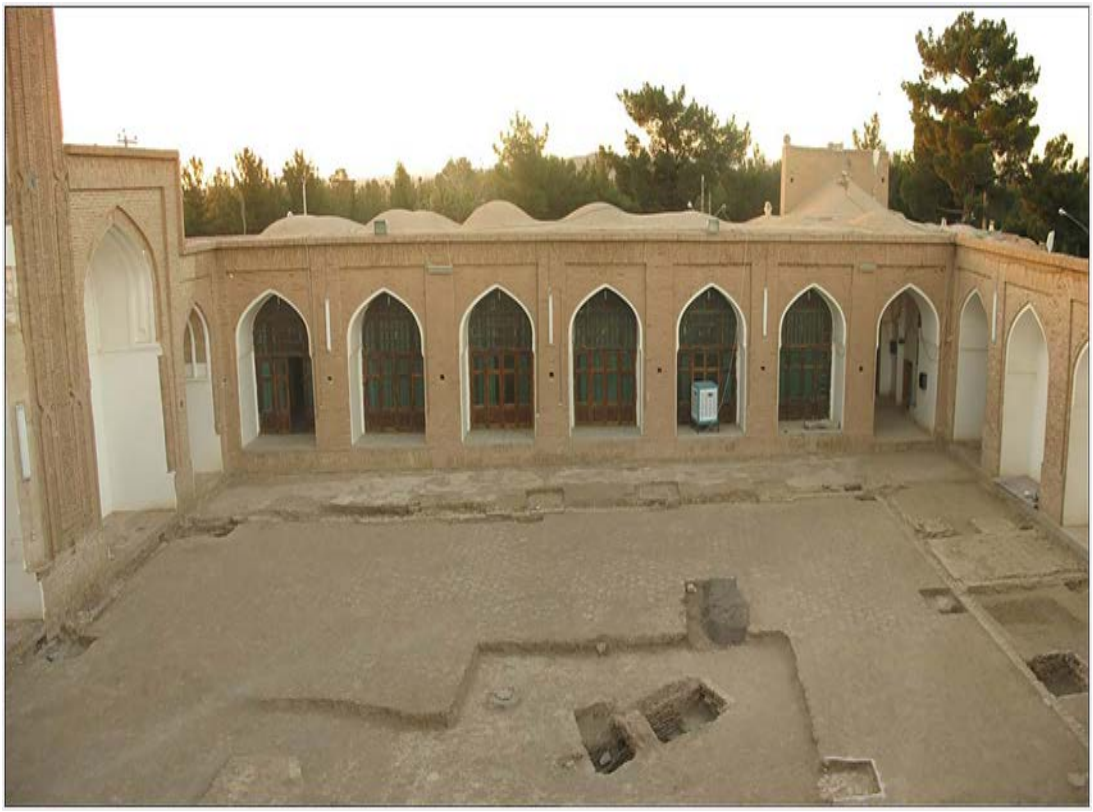

Fig. 9. View of new discovery in the courtyard, after ICHHTO

The width of this *īwān* and each lateral wall of it are equal to those of the *qibla īwān*. It shows that the destroyed *īwān* was possibly as tall as the *qibla īwān* or had a close height to it. This discovery clarifies that the Friday mosque at Firdaus was initially constructed according to the two-axial *īwān* scheme.(27) The closest parallel of this type of design is to be found in the Masjid-i Jāmiʿ in Farūmad (12th century),(28) Gunābād (1212), (29) and the well-known mosque-madrasa at Zūzan (1219).(30) It is noteworthy that the ratio of the depth of *qibla īwān* to its opposite *īwān* in the Friday mosque at Gunābād corresponds to the same proportion at the Firdaus mosque. This similarity suggests that these two mosques were built in the same scheme and perhaps at the same time in neighbouring areas.

This excavation also unearthed the original peripheral of the courtyard (Fig.10). It shows that the courtyard was developed on all sides except the west (*qibla*) side. Hence, the north and south existing *shabistān*s are a result of this expansion (Fig.11).

Fig .10. Discovery of the Original Peripheral of the Courtyard to the North Side, after ICHHTO

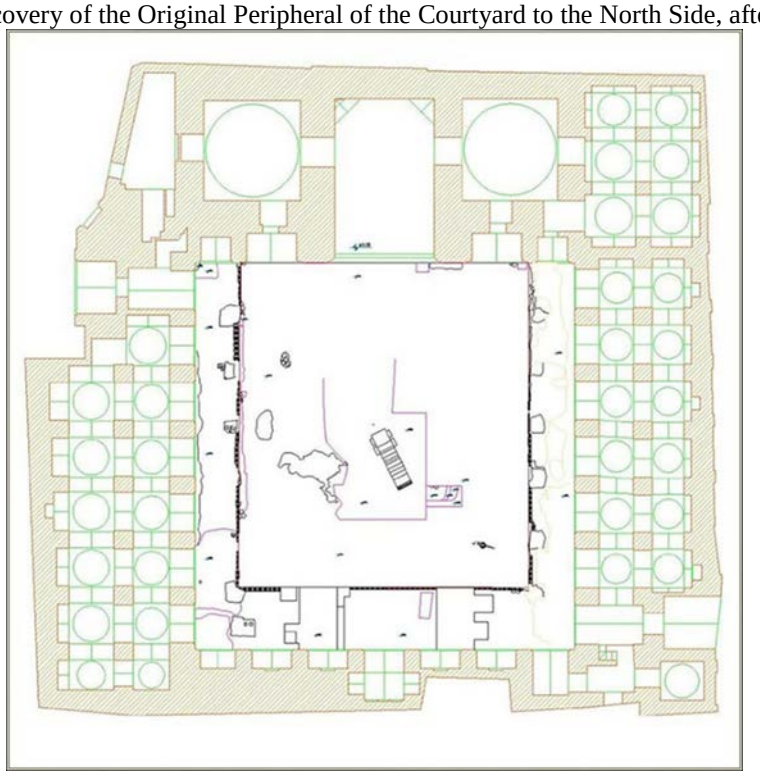

Fig .11. Plan of the Architectural Remains, after ICHHTO

In addition, the excavation also revealed a stairway (*pāyāb)*, which is comprised of ten stairs - each stair measures 1.12 m wide and 34 cm high – in the middle of the courtyard. The stairway led to the remains of an underground waterway, which is 3.40 m under the existing level of the courtyard. It suggests that the site of the mosque was

carefully designed for benefiting the water of a *qanāt* for ablution.(31) It is worth mentioning that the city of Firdaus benefits from sufficient historic *qanāts*.(32)

The new discovery shed light on the original scheme of the mosque. Based on the latest findings, a proposed reconstruction plan, as of the first period, comprising of two opposing *īwān*s and a *riwāq* (arcade) around the central courtyard) shows the three sequences of formation of the mosque (Fig.12).

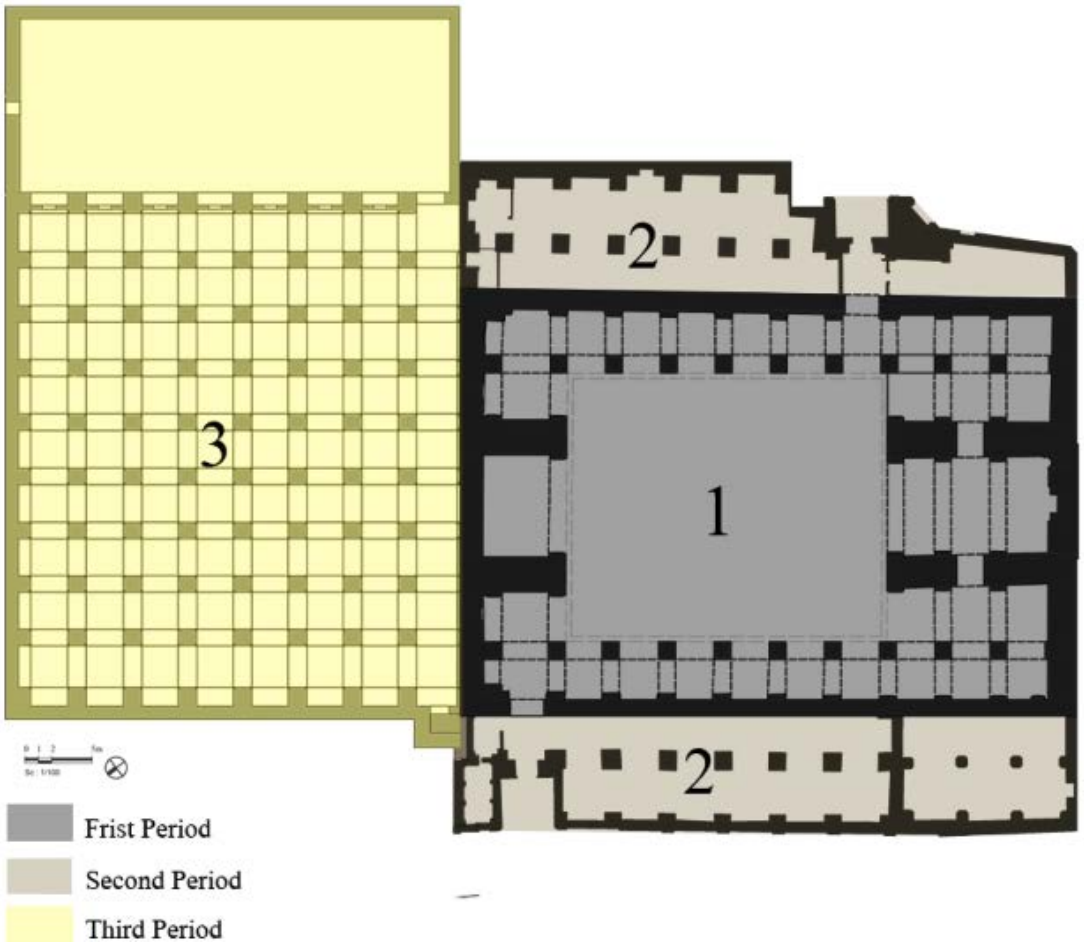


Fig. 12. Proposed Reconstruction of the Early Mosque and Sequence of its Development

## Dating of the Building

Firdaus, known as Tūn in the early Islamic geographic sources, was an important city in the Khurasan area in the pre-Mongol period. The Arabs entered Khurasan through Ṭabas around 648 (Yaḥaqqī and Buzarjumihrī 1996: 23). Considering the closeness of the Tūn area to Ṭabas, it seems likely that this area was conquered at the same time or a date close to this period.

*Ashkāl al- ʻĀlam*, by Aḥmād Jaīyhanī (2nd half of the 10th century), names Tūn as a large and prosperous city (Jaīyhanī 1990: 170). The anonymous author of *Hudūd al-ʻĀlam* (982) mentions Tūn as a prosperous city (Anonymous 1983: 283). Muqaddasī, in his *Aḥsan al-Taqāsīm* (985), gives a good description of the city. He writes that the city is well-populated with many weavers. He mentions that over the town stands a fortress, and its *jāmiʻ* (Friday mosque) is in the middle of the city, and the drinking-water of the inhabitants is from a *qanāt* (underground water channel), which has been found in the Friday mosque (Muqaddasī 1994: 283).

His description corresponds to the present situation of the mosque. The current mosque may be in the exact location of the original *jāmi'* of the city. However, its structure was modified and expanded later.

Nāsir-i Khusraw visited Tūn in 1052 when it was in decline. However, he describes Tūn as a large city with a strong fort. He also notices the existence of many gardens in the eastern suburbs of the city and describes its good economic condition at that time (Nāṣir-i Khusraw 1956, 126-27).

By 1091-92, Ismā'ilis appeared in the Quhistān region, which, thanks to its impassable mountains were an apt place for placing their strongholds. Soon after, they conquered all the area's cities, including Tūn, in 494/1100. Then, this city became a key center for their activities (Yāḥaqqī and Budharjumihrī 1996: 51). Khurasan underwent instability after the death of Aḥmad Sanjar in 1157. The area was basically under the attacks of Ghuzz Turks (Bosworth 2001: 587).

The 2nd half of the 6th /12th century coincides with the zenith time of the short-lived Ghurid Sultānate (c.1126 -1215), which was based in Ghur, in Afghanistan. Muḥammad, also known as Ghīyāth al-Dīn Ghūr (r. 1163-1203), with the assistance of his brother Mu 'izz al-Din Muḥammad b. Sām or Muḥammad-i Ghur (r. 1173-1206) occupied the Khurasan. By 1200, Ghīyāth al-Dīn was able to take over most of the towns of Khurasan as far west as Basṭām in Qūmis (Bosworth 2001: 588).

He defeated the Ghuzz Turks and retrieved the city of Ghazni in 1173 and, soon after, Herat in 1175 (Jūzjānī 2012: 371). After seizing power in Khurasan, he ordered that the earlier Friday Mosque of Herat, which was destroyed by a fire as a symbol of architectural patronage and political power, be rebuilt and expanded in 1175. The building was reconstructed according to a typical form in the Khurasan region, namely the two-*īwān* scheme without a domed sanctuary, open to an arcade around a central courtyard, and finished according to an inscription band in 1200-201 (Hansen et al. 2010: 35, 57).

It seems that the above idea in Herat, as a pattern, was repeated in Tūn, so a new Friday mosque of a larger size was constructed and replaced the earlier one in the city. Considering the similar scheme and the decoration of the *qibla īwān*, similar to the Ghurid type, the Friday Mosque of Firdaus can be dated to the late years of the 6th / 12th century.

The city was conquered, and Mongols mascaraed its inhabitants in 1255 (Yāḥaqqī and Budharjumihrī 1996: 53-54). Despite this disaster, due to its crucial geographical location and natural potential, the city recovered soon and flourished in the Ilkhānīid period. By 1339, Mustūfī Qazvīnī, in his book *Nuzhat al-Qulūb*, describes it as a prosperous city (Mustufī Qazvīnī 1999: 207). It became the center of Safavids in the south of Khurasan and prospered during this period (Turkamān 1972: 140). The eastern īwān and two riwāqs were demolished in the second phase, and the mosque was expanded. A large shabistān was externally added to the mosque in the third stage.

**Conclusion**

The Friday Mosque of Firdaus is important on many counts. The structure represents a further instance of a two - *īwān* mosque scheme without a dome chamber on the *qibla* side. Owing to other surviving parallels in Khurasan, this type of plan can be recognised as the Khurasnai style of mosque architecture. The building was probably built in the late years of the 6th / 12th century, a period that is stylistically known as the continuation of the Saljuq style of architecture in Iran.

The baked brick as the primary construction medium and carved moulded terracotta for external decoration indicate the influences of its neighbouring Ghaznavid and Ghurid architecture. Applying the vast light blue glazed tiles in various forms on the *qibla īwān* façade of the mosque illustrates the popularity and development of this type of ornament in Khurasan in the pre-Mongol period. In addition, the technique of vaulting in the *qibla īwān* is one of the earliest examples of this type of construction in the same period.

The enlargement of the mosque in the Safavid time shows the growing number of inhabitants and attests to the city's position as a major base of Shi'ism in this period. Adding a large *shabistān* in the reign of Fatḥ 'Alī Shāh Qajar shows the significance and popularity of the Friday mosque in the city.

**Acknowledgement**

I am grateful to Mr. Hamid Halaj Muqadam and Mr. Kazim Shabnamzadh for providing me with information about the mosque.

**Footnotes**

1.For a recent and detailed study on the building see Korn 2010: 81- 104.

2.The name of city was converted from Tūn (a very hot place or hell) into Firdūas (heaven) by the approval of the Iranian government in 1929.

3.For a detail description of this mosque see Anisi 2008: 234-240. The date of the mosque is mentioned as the 1st half of the 4th/10th century in the dissertation, however with more survey by the present writer, the new dating for the building that is mentioned in this paper is more likely.

4.For this building see Anisi 2016: 3-20.

5. I am grateful to the ICHHTO local office in Southern Khurasan Province for this information.

6.For the photo of the entrance Lacoste 1909:190.

7.For the plan of the madrasa see Najimi 2015:153.

8.For a detailed discussion on this building see: Anisi 2004, 137-157.

9.For a photo of the building see Hillenbrand 2000: 345, fig. 6.20.

10.The foundation plaque in stone starts with a Quranic verse (Quran 9:18). Beneath it, is the second band contains a *hadith* from the prophet of Islam and at the end, the date 1238 H/ 1822-23 CE, is inscribed. Below the latter, several bands of poems are on the foundation stone.

11.It is notable that the reconstruction plan of the vanished *shabistān* has been designed by the present writer in 2013.

1 It is notable that the uppermost part of the *īwān* was reconstructed in 2014 according to its photos before the earthquake.

12.Godard describes the construction of same type of decoration, which has been applied in the Masjid-i Jam' of Farūmad. See Godard, 1949: 91-95.

13.For a photo of the decoration see Godard 1949: 94.

14.For Zūzan see: Blair 1985: 75-91; Adle 1990: 231-48.

15.For this monument see: Pickett 1997: 24, fig. 19. It is noteworthy that the east part of the mosque was destroyed some time ago and now is replaced by a new *shabistān*. Owing to similarities between the Friday Mosque of Firdaus and this building, it is very likely that a further *īwān* originally stood opposite its *qibla īwān* and its remains can be found later.

16.For a recent discussion on this minaret see, Pinder-Wilson 2001: 166-171.

17.Casimir and Glatzer 1971: 53-68; for a recent discussion on this monument see also Najīmī, 2015:143-170.

18.For a photograph of the damaged *qibla īwān* of the mosque see Hutt and Harrow 1977: 134, pl.78.

19.For the photo of the building see; Hillenbrand 2002: 133, pl.12.13

20.For this type of vault see Mi'māriyān 2012, 226-240.

21.For the longitudinal section of the mosque see: Hajqāsimī 2004: 96.

22.For the floor plan and section of the mosque see Hajqāsimī 2004:147

23.This type of decoration because of creating a geometric pattern is generally classified as *kārbandī*.

24.For a new and complete study on the monument see Hansen *et al* 2015.

25.I am grateful to Mr. Kazim Shabnamzada, archaeologist in the ICHTTO local office in Firdaus, for providing me with this information.

26.Robert Hillenbrand has classified the mosque at Firdaus as a mosque with a single *īwān* on the *qibla* side in the Saljuq architecture. See Hillenbrand 1976:93.

27.For the mosque see Godard 1949: 110, fig. 59.

28.For the ground plan of the building see Ḥajqāsimī 2004: 96- 97.

29.For the plan of the building see Godard 1949, fig. 20.

30.This form is to be seen in the Friday mosque of Naṭanz and used to in the Masjid-i Malik in Kirman.

31.The Qanāt-i Qaṣabh near the city was inscribed in the World Heritage List as Persian Qanāts.

32.For a brief history of the dynasty see Bosworth 1996: 298-99.

33.For a brief classification of Saljuq mosques in this period see: Hillenbrand 1976: 93-94; and Korn, 2000.

34. The building was built in the reign of Khwarazm Shahs (1172-1231) in Khurasan and so, it is chronologically to be distinguished as Khwarazm Shah's mosques (Akbari 1998: 162), however, architecturally this period still is known as the continuous of the Saljuq style in Iran. There is no any general agreement on the supremacy of Saljuq Architecture style but the era of 1055-1250 is more plausible.

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# تداوم معماری سلجوقی در ایران، مسجد جامع فردوس

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## چکیده

این مقاله به بررسی دقیق مسجد جامع فردوس در جنوب‌غربی خراسان که نقشی کلیدی در توسعه معماری سلجوقی در این منطقه داشته است، می‌پردازد. طرح اولیه مسجد و گسترش آن نامشخص است. ایوان رفیع و دو گنبدخانه در طرفین آن در ضلع غربی (قبله) حیاط، هسته مرکزی مسجد را تشکیل می‌دهند. هدف اصلی مقاله، تحلیل معماری مسجد و نشان دادن ارتباط آن با سبک معماری مسجد سلجوقی در منطقه خراسان است. در طول اقدامات حفاظتی و بازسازی در سال ۲۰۰۶، برخی از مواد تازه کشف شد. یافته‌های جدید ویژگی‌های اولیه مسجد ر و شکل‌گیری آن را آشکار می‌کند. این مقاله در ابتدا تاریخ شهر را توصیف و ویژگی‌های معماری آن را تعریف و سپس اطلاعات موجود را برای پاسخ به سؤالات پژوهش بررسی و تحلیل می‌کند. با توجه به نتایج بررسی‌های باستان‌شناسی، این مطالعه طرح کلی مسجد را به‌عنوان نمونه‌ای دیگر از مسجد دو ایوانی نشان می‌دهد که ممکن است قدمت آن به سال‌های پایانی قرن ششم/ دوازدهم باشد. علیرغم اهمیت مسجد، هیچ مطالعه تفصیلی در مورد این بنا منتشرنشده است. نقشه دقیق پلان و مقاطع این بنا با طرح پیشنهادی بازسازی مسجد برای اولین بار در این مقاله منتشر می‌شوند.

**واژه‌های کلیدی:** خراسان، فردوس، مسجد، سلجوقی، غوری.

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# The Settlement Pattern of the Ancient Sites of the Southeastern Sub-Basins of the Caspian Sea, from a Hydro Geomorphological Perspective

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**Abstract**

The presence of water resources, particularly rivers, significantly influences site selection. Throughout history, settling near rivers has brought numerous advantages, but it has also posed certain risks. This study focuses on the sub-basins southeast of the Caspian Sea. Initially, we explore the connection between the layout of ancient settlements and the drainage networks. Additionally, we analyze the relationship between flood risk and the settlement patterns of these ancient sites by estimating the flooding risk based on linear, areal, and relief aspects. This research marks the first time such an analysis has been conducted. The findings underscore the importance of proximity to rivers in site selection, with areas close to rivers with lower stream orders being the most favorable for settlements. The study reveals a decrease in the frequency of sites near higher stream orders in relation to flooding risk. Conversely, there is an increase in the frequency and density of ancient sites near the first stream orders and at greater distances from the rivers, coinciding with an elevated flooding risk in the sub-basins. These results indicate that the inhabitants of the southeastern areas of the Caspian Sea sub-basins were cognizant of the flooding danger and factored it into their decision-making when selecting settlement sites.

**Keywords**: Geoarchaeology, Settlement Pattern, Hydro-geomorphology, Flood, Southeast Caspian Sea.

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## 1. Introduction

Settlement patterns, which may be defined as “the arrangement of population upon a landscape” are the most powerful class of data to explain sociocultural contexts of a society (Price 1978). The relationship between nature and civilization is mutual; just as humans with their technical measures have completely changed the landscapes in some areas, every culture and civilization is also dependent on nature (Kardavani 2007: 46). Settlement patterns can provide insights into political control through space (Renfrew and Bahn 2000). Above all, they reflect the characteristics of the natural environment. In general, for examining the natural factors affecting the establishment of settlements, attention should be paid to the following factors: geomorphology, climate, vegetation, and finally, water and soil resources (Saidi 2007: 43).

Topics related to the settlement pattern and landscape-oriented approaches are among the topics raised in contemporary archaeology (Renfrew 2003; Kowalewski 2008). After the expansion of landscape archaeology, attention paid to settlement pattern of ancient sites also increased (Neely & Wright 1994; Ur, 2002). During the decades from the 1950s to 1970s, the settlement patterns of ancient sites in the centers of the most important regions were investigated, including Mesopotamia, the highlands of Mexico, the banks of the Aegean Sea, and also the southwest of the United States of America (Billman & Feinman 1999). In recent years, investigating the impact of the natural environment on the settlement patterns of ancient sites is one of the topics that have been welcomed by interdisciplinary researchers. Studies also have been carried out in this interdisciplinary mode in Iran, which can be seen in the studies of Maghsoudi et al.'s studies in Tehran Plain (2013), Varamin Plain (2014 and 2015), near Jayedar Lake (2015), west of Dasht-e Lut (2017), Seymareh Dam Lake (2016), the southern slopes of Alborz Mountain and the ancient northern lakes of the Dasht-e Kavir (2019), by Mousavi Kouhpar et al. (2011), Sharifi et al. (2014), Heydari et al. (2021) and Ehdaei et al.'s studies in Mazandaran province (2022).

The foundational prerequisite for sustaining life is water, and it is commonly asserted that where water is absent, culture cannot thrive. Throughout human history, reliance on water has manifested in diverse ways, encompassing the provision of sustenance through fishing, the facilitation of cargo and human transportation, and the supply of potable water for both humans and domesticated animals. Subsequently, with the ascendancy of agriculture, additional dependencies emerged to foster conducive conditions for cultivation (Kardavani 2007: 46). In the era preceding the advent of agriculture, humans demonstrated a limited concern for the earth and its biological capacities. However, with the gradual assimilation of agricultural practices, considerations such as settlement patterns, geomorphology, and soil composition assumed heightened significance. Generally, human settlements materialized in regions featuring relatively propitious soil and water conditions. The Persian terms "abad" and "abadi," which gained currency during the Pahlavi period, denote a locale abundant in water and vegetation, reflecting the significance accorded to these factors (Mahdavi 2008: 8). Over the course of millennia, rivers have emerged as pivotal sources of water supply. A river is delineated as a natural watercourse that traverses distinct catchment basins. Rivers, however, transcend mere linear flows, exhibiting intricate branching structures, characterized by sub-branches, thus constituting an interlinked system or network. The expanse drained by a singular river system is termed the watershed or basin of that river. The conceptual demarcation that separates the banks of a watershed

from contiguous watersheds is designated as the drainage divide. This demarcation can be graphically delineated by connecting the highest points between adjacent basins on a map (Jedari Eyvazi 2007: 129).

As previously mentioned, the presence of water sources, particularly rivers, constitutes a pivotal factor in the selection of sites. Due to the paramount significance of this subject, studies have been conducted, highlighting the role of rivers in shaping the patterns of ancient settlements. In one investigation, the alteration in settlement patterns along the banks of the Rena River in the southeast of Norway was scrutinized in relation to the modifications in the river's course and the climatic shifts during the Holocene era (Balbo et al. 2010). Another study employed an examination of sedimentary ancient layers to reconstruct environmental events along the Big Fork River, delving into human activity within the dynamic environment of that region (Hill et al. 2011). Likewise, an article focused on 276 archaeological sites on the south bank of the Xar Moron River in Northeast China, exploring changes in prehistoric cultures and settlement patterns vis-à-vis factors such as climate changes, landforms, and livelihood strategies (Jia et al. 2016). A distinct research endeavor examined ancient sites in the Rio Ica watershed, Peru, employing quantitative methods to underscore the role of rivers as one of the foremost influencing factors in human settlement. The researchers concluded that environmental changes spanning from a millennium before Christ until 1532 AD contributed to alterations in the settlement patterns of ancient sites (Haburaj et al. 2017). Another study delved into the settlement patterns of ancient sites located in the dynamic landscapes of the northwest of the Nile Delta, employing geo-archaeological research methods (Ginau et al. 2018). While domestic studies in this domain are currently limited, they are burgeoning. For instance, an article titled "The Shileh River and its Impact on Human Settlements in the Region" investigated the distinctive characteristics of this river and explored how these natural features influenced the formation of human settlements across different ancient periods (Mousavi Haji et al. 2010). Further examinations include a study of the Jajroud alluvial fan in Tehran plain and the Haji-Arab alluvial fan in Varamin plain, analyzing the role of alluvial fans in the distribution of prehistoric settlements. The findings indicated that as canals shifted, ancient settlements followed suit (Maghsoudi et al. 2012). Another article delved into the significant role of ancient canals in determining the location of the Chaltasian ancient site in Varamin plain (Maghsoudi et al. 2014). Utilizing the HEC RAS model, an investigation simulated the flooding of the Sivand River with a return period of ten thousand years and assessed its impact on the ancient sites of Persepolis and Nagshe Rostam (Nadderi et al. 2014). Lastly, a study examined the effect of natural landscapes on changes in settlement patterns and the cultural response to these changes, underscoring the importance of geoarchaeological investigations in Iran (Rashidian 2020).

Throughout history, the establishment of settlements along rivers, despite its myriad benefits, has also entailed inherent risks. Millennia ago, the human mind grappled with questions surrounding these dangers, propelling individuals to explore hazardous phenomena and gradually transforming this curiosity into science. However, in numerous instances, the inability to comprehend such perilous occurrences led to the formation of superstitions (Moghimi 2015:1). The early understanding of dangers in ancient times was imbued with mythological elements, fostering a constant sense of fear. According to myth, storms were deemed insurmountable—a deterministic notion

that permeated the early human psyche. The fundamental inquiry arose: Are risks an inescapable destiny, or can they be endured? Over time, evolving from the foundational knowledge of mythology, humans realized the necessity of not merely fleeing from dangers but instead developing strategies to avoid harm and subsequently overcome it (Jahani et al. 2015). This imperative arises from the perennial human need to comprehend ways to safeguard both personal health and the surrounding environment (Moghimi 2015:1). From ancient times to the present, one hazard that has significantly impacted human populations across various dimensions, causing substantial damage, is flooding. Floods are characterized by a flow of water exceeding the average along a river. Inland river floods arise from precipitation or dam bursts. Rapid downslope water flow resulting from snowmelt, rain-on-snow, or diverse rainfall types combines with the baseflow from sub-surface water, augmenting runoff and leading to floods as discharge increases (Goudie 2004: 378). In this research endeavor, the focus lies on studying the sub-basins of the southeastern regions of the Caspian Sea. By examining their physiographic and hydrological characteristics, the aim is to ascertain the most suitable places for settlement establishment based on stream order and distance from the river. Initially, the investigation delves into the relationship between the settlement patterns of ancient sites and drainage networks. Subsequently, for the first time, the analysis extends to estimating the flooding risk of the sub-basins, considering linear, areal, and relief aspects. The research thus pioneers an exploration into the interplay between sub-basin flood risks and the settlement patterns of ancient sites.

## 2.Materials and Methods

The study area in this research comprises the southeastern sub-basins of the Caspian Sea. Using a 30m resolution DEM (SRTM), the study area was divided into four sub-basins: Neka-Tajan, Talar-Babolroud, Haraz, and Behshahr (Fig. 1). The Neka-Tajan sub-basin is located to the south of the Caspian Sea. Its geographical boundaries are limited by the Caspian Sea to the north, the Central Iranian Plateau to the south, the Gorgan River sub-basin to the east, and the Talar-Babolroud sub-basin to the west. Among the important rivers of this sub-basin are Neka Roud, Tajan Roud, Zam Roud, Sefid Roud, Darab Kola River, and Shirin Roud (Armed Forces Geographical Organization 2003: 237). The geographical boundaries of the Talar-Babolroud sub-basin are limited by the Caspian Sea to the north, to the Central Iranian Plateau to the south, the Neka-Tajan sub-basin to the east, and the Haraz Sub-basin to the west. The Talar, Babolroud, Siyahrud and Kelarud are the most important rivers in this sub-basin (Armed Forces Geographical Organization 2003: 225). The geographical boundaries of the Haraz sub-basin are limited by the Caspian Sea to the north, the Central Iranian Plateau to the south, the Talar Babolroud sub-basin to the east and the Chalus sub-basin to the west. Its important rivers include the Haraz, Nowrud, Lar and Kari (Armed Forces Geographical Organization 2003: 211). In addition, a number of documented ancient sites are located in the western part of the Gorgan Rud sub-basin. For this reason, using ArcGIS software and based on topographic features, the western part of this sub-basin was identified as a catchment and investigated as the Behshahr sub-basin. The Behshahr and Tirtash rivers can be mentioned among the independent rivers of this sub-basin that flow into Behshahr city (Armed Forces Geographical Organization 2003: 254).

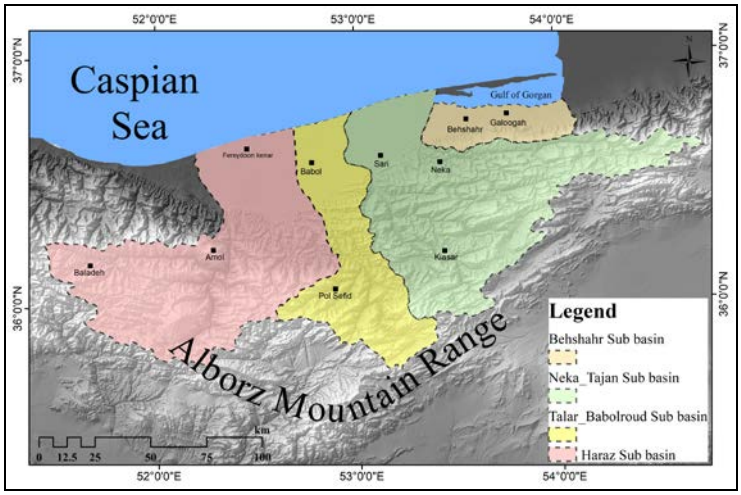

Fig 1: The Study Area

Following the identification of sub-basins, the distribution map of ancient sites was meticulously prepared using Arc GIS software, incorporating the geographical coordinates of these sites obtained by a group of archaeologists (Mousavi Koohpar 2008) as depicted in Figure 1. Subsequently, Arc GIS software was employed to generate maps illustrating stream order and distance from the river. The dispersion, abundance, and density of ancient sites were then scrutinized concerning factors such as the order of the nearest stream to these sites and the distance of settlements from rivers across different historical periods. To explore the potential for flooding in the study area, the effective factors within each sub-basin were systematically calculated. Given the research objective of analyzing the correlation between the location of ancient settlements and the occurrence of floods, emphasis was placed on factors that have exhibited relative constancy over several millennia. Among the parameters considered in these calculations, notable items (Table. 1) encompassed the linear aspects of sub-basins (perimeter (km), stream order, stream length (km), main stream length (km), bifurcation ratio, length of overland flow), areal aspects (area, stream frequency, drainage density, drainage texture, shape factor, form factor, compactness ratio, circularity ratio, constant of channel maintenance, time of concentration), and relief aspects (basin relief, mean height, longest stream height, ruggedness number) (Apaydin et al. 2006; Waikar et al. 2014; Aher et al. 2014; Sukristiyanti et al. 2018; Choudhari et al. 2018; Abdide et al. 2011; Rahmati et al. 2015; Choubin et al. 2018).To estimate the time of concentration of the sub-basins, several points should be considered. including the possibility of determining the variables for most of the sub-basins, the variety of parameters in the formula, and the popularity among specialists, designers, and hydrology books. In this research, Giandotti's equation was used to estimate the time of concentration since this equation is suitable for large mountainous sub-basins (Mehrabi 2005: 4&5).

In order to produce a map of flooding risk potential zones, after extracting information related to the study area, the layers were prepared using ArcGIS software and due to the Gaussian nature of some layers and their normalization, fuzzification was performed on all layers. Afterward, the flooding risk map was prepared. The studied sub-basins were classified into four categories with low, medium, high, and very high

flooding risk. Then, the location of ancient sites in relation to the flooding risk in each sub-basins was analyzed.

Table 1: Methodology adopted for computations of morphological parameters

| Morphometric parameters | formula | Definition | References |
|---|---|---|---|
| Stream frequency | $F_s = \frac{total\ number\ of\ stream}{asin\ area\ in\ square\ kilometers}$ | _____ | Horton (1932) |
| drainage density | $D_d = \frac{total\ lengt\,h\ of\ channels}{Basin\ area\ in\ square\ kilometers}$ | _____ | Horton (1932) |
| Bifurcation ratio | $BR = (\frac{n1}{n2} + \frac{n2}{n3} + \cdots + \frac{ni-1}{ni}) \frac{1}{i-1}$ | n1, n2, … = The number of stream of order 1, 2, … i = the order of main stream | Horton (1932) |
| Texture ratio | $T_r = \frac{total\ number\ of\ stream}{Perimeter\ of\ basin}$ | _____ | Horton (1945) |
| Length of overland flow | $L_O = \frac{1}{2D}$ | Drainage density = D | Horton (1945) |
| Shape Factor | $S_f = \frac{L^2}{A}$ | L = Basin length A = Area of basin | Horton (1945, 1932) |
| Form Factor | $F_f = \frac{A}{L^2}$ | L = Basin length A = Area of basin | Horton (1945, 1932) |
| Compactness | $C = \frac{0.28P}{\sqrt{A}}$ | A = Basin area in square kilometers P = Perimeter of basin (KM) | Horton (1945) |
| circularity ratio | $R_c = 4\pi\ \frac{A}{P^2}$ | A = Basin area in square kilometers P = Perimeter of basin (KM) | Miller (1953) Strahler (1964) |
| Constant of channel maintenance | $C = \frac{Basin\ area}{Stream\ Lengt\,h}$ | _____ | Horton (1945) Schumm (1956) |
| Pilgrim McDermott Time of concentration | $T_C = 0.76A^{0.38}$ | A = Basin area in square kilometers | Pilgrim McDermott (1989) |
| Giandotti Time of concentration | $T_C = \frac{(4\sqrt{A}+1.5L)}{0.8\sqrt{H_{mean}}}$ | A = Basin area in square kilometers H = Mean elevation (m) L = main Stream Length (km) | Giandotti (1934) |
| Basin relief | $R = H - h$ | H = The highest point of the basin h = The lowest point of the basin | Hadley and Schumm (1961) |
| Ruggedness number | $R_n = \frac{Basin\ relief}{drainage\ density}$ | _____ | Strahler(1957) |

In the next step, in order to increase the accuracy of the results, the four main sub-basins were divided into 31 smaller sub-basins to be recalculated. Based on this, the Haraz Sub-basin was divided into 10, the Neka-Tajan Sub-basins into 7, the Talar-Babolroud sub-basins into 6 and the Behshahr Sub-basins into 8 smaller sub-basins. Sub-basins No. 7 and 8 in the Behshahr, No. 4 in the Neka-Tajan and No. 2 in the Haraz sub-basin do not have ancient settlements, due to this, despite the calculation the flooding risk, they were removed from the analysis part of this research and the other sub-basins were taken into consideration. Since the area of the sub-basins are different and some of them are spread only in coastal areas, the Pilgrim-McDermatt equation was used to estimate their time of concentration. And after estimating the flooding risk in these sub-basins, the settlement pattern of the ancient sites in relation to the distance of the rivers, the nearest stream order to the sites, and also the flooding risk of the sub-basins were analyzed.

## 3. Discussion and results

Due to the enhancement in the accuracy of the obtained results and a better understanding of the effect of the characteristics of streams on the location of sites, in order to create the map of distance to the rivers (Fig. 2), ten intervals were considered and the frequency and the density of sites in each of these intervals were obtained (table. 2).

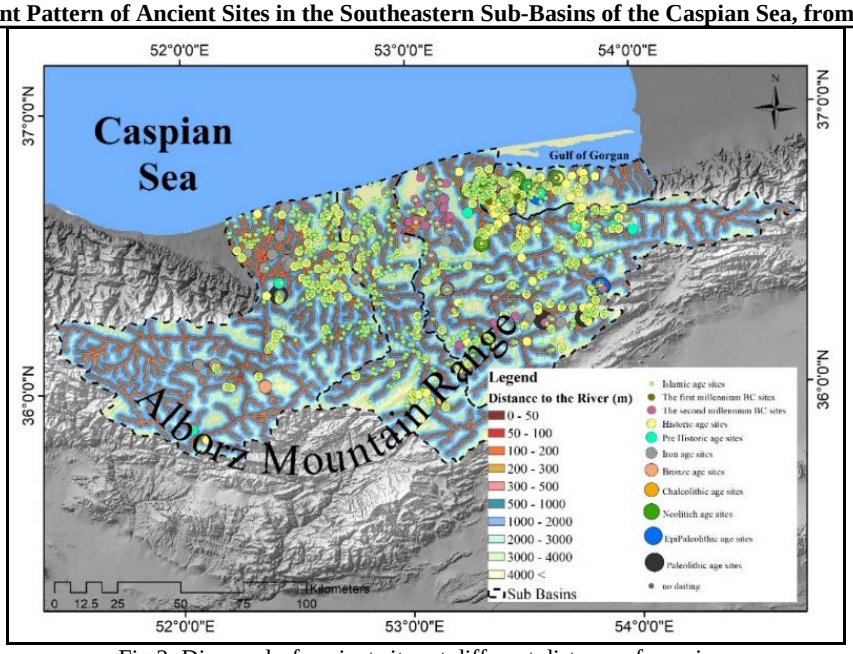


Fig 2: Dispersal of ancient sites at different distances from river

Table 2: Densityl of ancient sites at different distances from river

| | Distance to the River (m) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age of Sites** | **0 - 50** | **50 - 100** | **100 - 200** | **200 - 300** | **300 - 500** | **500 - 1000** | **1000 - 2000** | **2000 - 3000** | **3000 - 4000** | **4000 <** |
| Islamic age | 45 | 41 | 67 | 65 | 93 | 180 | 265 | 112 | 25 | 6 |
| the first millennium BC | 2 | 4 | 3 | 1 | 9 | 11 | 17 | 14 | 5 | 1 |
| the second millennium BC | 2 | 3 | 1 | 7 | 5 | 4 | 4 | 8 | 2 | 2 |
| Historic age | 12 | 15 | 17 | 28 | 41 | 78 | 123 | 40 | 10 | 4 |
| Prehistoric age | 1 | 0 | 3 | 0 | 1 | 7 | 1 | 1 | 1 | 0 |
| Iron age | 4 | 3 | 7 | 9 | 8 | 25 | 23 | 10 | 2 | 0 |
| Bronze age | 0 | 0 | 1 | 2 | 0 | 2 | 1 | 2 | 0 | 0 |
| Chalcolithic age | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 0 |
| Neolithic age | 0 | 0 | 1 | 1 | 2 | 1 | 4 | 7 | 1 | 0 |
| Epipaleolithic age | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 0 |
| Paleolithic age | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 |
| No Dating | 5 | 3 | 5 | 8 | 11 | 9 | 8 | 6 | 0 | 0 |
| Total Number | 71 | 69 | 107 | 121 | 171 | 322 | 449 | 203 | 45 | 13 |
| Percent (%) | 4.52 | 4.39 | 6.81 | 7.70 | 10.88 | 20.50 | 28.58 | 12.92 | 2.86 | 0.83 |
| Area ($km^2$) | 482.744 | 461.708 | 807.116 | 894.647 | 1579.282 | 3692.755 | 5496.358 | 2932.973 | 1158.891 | 606.139 |
| Density | 0.147 | 0.149 | 0.133 | 0.135 | 0.108 | 0.087 | 0.082 | 0.069 | 0.039 | 0.021 |

The results demonstrate the importance of proximity to the rivers in the site selection. As it is clear in figure 3, the density of ancient sites in the sub-basins, with increasing distance from the rivers, has a downward trend and reaches its minimum in the last interval. The densest interval is not the closest interval to the rivers (0-to-50 meters), but the 50-to-100 meter interval.

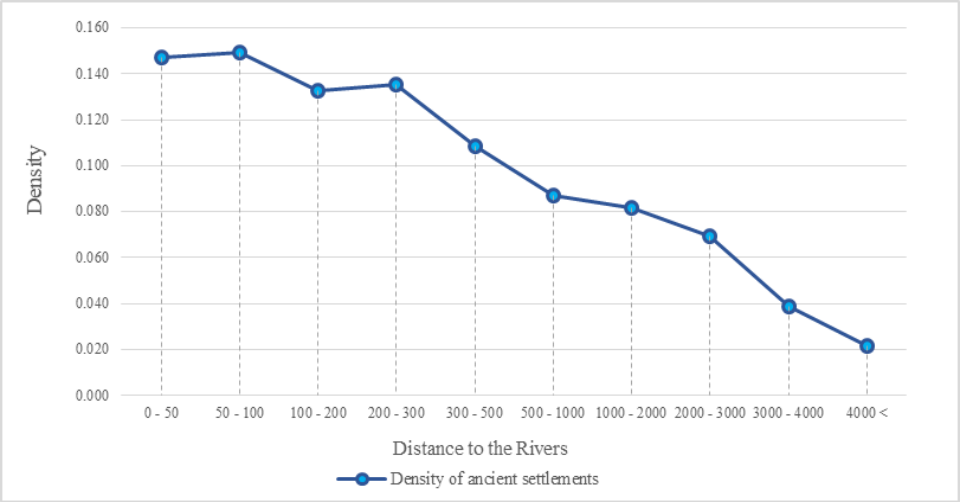


Fig 3: The Density of ancient sites at different distances from river

Examining the location of settlements in relation to the orders of the streams showed more than 56% of the settlements have been located near the first-order streams (table. 3). The frequency of settlements has a negative correlation with the increase of the stream orders so that as the order of the streams increases, the number of ancient sites located near them decreases, and only 0.76% of the sites are located in the vicinity of the 6th order (fig.5).

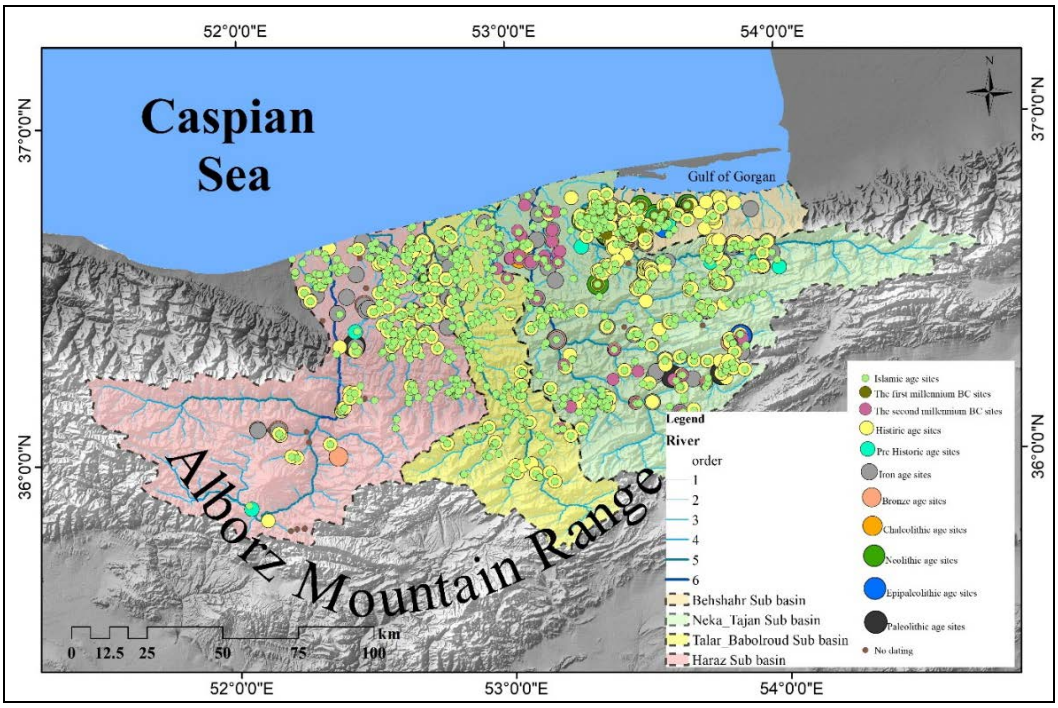


Fig 4: Distribution of ancient sites in relation to the stream orders

Table 3: Frequency of ancient sites in relation to the stream orders

| | Strahler Stream Order | | | | | |
|---|---|---|---|---|---|---|
| **Age of Sites** | **1** | **2** | **3** | **4** | **5** | **6** |
| Islamic age | 500 | 160 | 107 | 69 | 56 | 7 |
| the first millennium BC | 45 | 13 | 7 | 0 | 1 | 1 |
| the second millennium BC | 22 | 7 | 4 | 2 | 2 | 1 |
| Historic age | 206 | 77 | 39 | 32 | 13 | 1 |
| Prehistoric age | 8 | 6 | 1 | 0 | 0 | 0 |
| Iron age | 58 | 15 | 8 | 3 | 5 | 2 |
| Bronze age | 7 | 1 | 0 | 0 | 0 | 0 |
| Chalcolithic age | 5 | 0 | 0 | 0 | 0 | 0 |
| Neolithic age | 11 | 4 | 2 | 0 | 0 | 0 |
| Epipaleolithic age | 0 | 4 | 0 | 0 | 0 | 0 |
| Paleolithic age | 0 | 2 | 1 | 1 | 0 | 0 |
| No Dating | 27 | 12 | 8 | 5 | 3 | 0 |
| Total Number | 889 | 301 | 177 | 112 | 80 | 12 |
| Percent (%) | 56.59 | 19.16 | 11.27 | 7.13 | 5.09 | 0.76 |

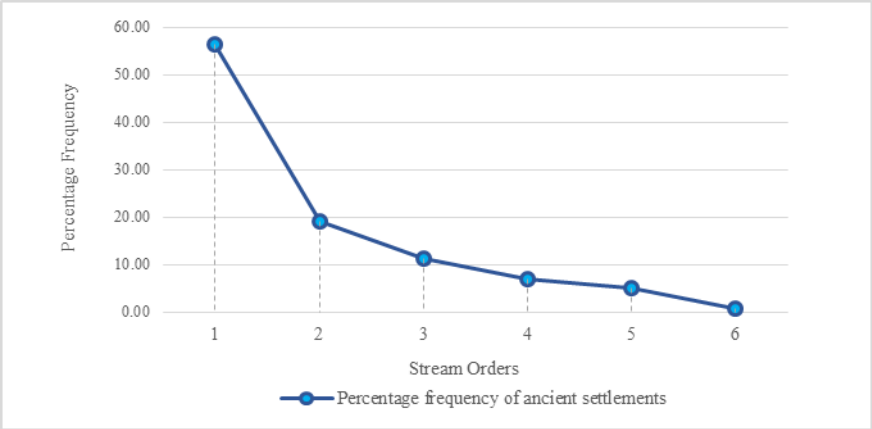


Fig 5: The percentage frequency of ancient sites in relation to the stream orders

## 3.1: Estimating the flooding risk

As stated earlier, morphometric analysis was performed through the measurement of linear, areal, and relief aspects of the basins (table. 4).

Table 4: Linear, Areal and Relief aspects of the morphometric analysis of the main sub-basins

| | Sub basins | | | |
|---|---|---|---|---|
| **Aspects** | **Behshahr** | **Neka-Tajan** | **Talar-Babolroud** | **Haraz** |
| **linear Aspects** | | | | |
| Primeter (km) | 201.97 | 554.79 | 375.97 | 472.28 |
| Stream Length (km) | 773.847 | 3681.004 | 1851.354 | 3809.106 |
| Main Stream Length (km) | 24.36 | 157.44 | 165.10 | 190.44 |
| Bifurcation ratio | 3.42 | 4.06 | 5.17 | 4.10 |
| Length of overland flow | 0.699 | 0.940 | 0.892 | 0.889 |
| **Areal Aspects** | | | | |
| Area (square kilometer) | 1082.04 | 6922.13 | 3302.70 | 6772.67 |
| Stream frequency | 0.256 | 0.211 | 0.226 | 0.207 |
| Drainage density | 0.715 | 0.532 | 0.561 | 0.562 |
| Drainage texture | 1.37 | 2.64 | 1.98 | 2.96 |
| Shape Factor | 0.55 | 3.58 | 8.25 | 5.36 |
| Form factor | 1.82 | 0.28 | 0.12 | 0.19 |
| Compactness ratio | 1.72 | 1.87 | 1.83 | 1.61 |
| Circularity ratio | 0.333 | 0.282 | 0.293 | 0.381 |
| Constant of channel maintenance | 1.398 | 1.880 | 1.784 | 1.778 |
| Time of consentration | 6.31 | 16.50 | 13.71 | 14.62 |
| **Relief aspects** | | | | |
| Basin relief (m) | 2336 | 3834 | 3914 | 5638 |
| Mean height (m) | 257.83 | 1231.58 | 1183.02 | 1755.75 |
| longest stream heigh (m) | 174 | 2484 | 2785 | 3562 |
| Ruggedness number | 1.671 | 2.039 | 2.194 | 3.171 |

### 3.1.1: The linear aspects of the sub-basins

### Basin Perimeter

The perimeter of a basin is the length of the drainage divide, which separates the watershed from the adjacent watersheds (Alizadeh 2008: 479). Like the area index, in the study area, the Neka-Tajan Sub-basin has the largest, and the Behshahr Sub-basin has the smallest perimeter.

### Stream Order

Several stream-ordering functions have been devised since Horton's original attempts (Horton 1932) but Strahler's modification of the Horton system is the most widely used (Graf 1975). Strahler's system has been followed because of its simplicity, where the smallest, unbranched fingertip streams are designated as 1st order, the confluence of two 1st order channels give a channels segments of 2nd order, two 2nd order streams join to form a segment of 3rd order and so on (fig.6). When two channels of different order join then the higher order is maintained (Waikar and Nilawar 2014). The highest order of streams in the Behshahr Sub-basin is 4, in the Talar-Babolroud Sub-basin is 5, and in the Neka-Tajan and Haraz Sub-basins is 6.

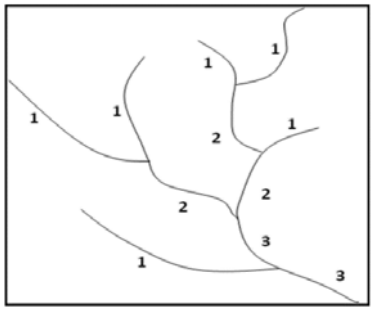

Fig 6: Strahler's Ordering Scheme (Kanti Ghose 2012)

**Bifurcation Ratio**

One of the most important effective factors in the Flood Hydrograph is the bifurcation ratio (Horton 1932). Theoretically, the bifurcation ratio is 2 and the natural drainage system has 3-5 in which geologic structures do not distort the drainage pattern (Strahler 1964). If the bifurcation ratio is less, it indicates plain terrain, permeable and soft bedrock where more water infiltrates, making for a better groundwater potential zone. The lower bifurcation ratios are also due to the presence of a large number of first and second-order streams in the sub-basins (Kumar et al. 2011). In addition, the smaller ratio indicates that the curve of changes in flood discharge related to time (hydrograph) will have a sharper peak compared to other basins (Alizadeh 2008: 472). The bifurcation ratio obtained from all the sub-basins varied between 3 and 5. The Behshahr sub-basin has the lowest and the Talar-Babolroud Sub-basin has the highest bifurcation ratio. The approximate lowness of this ratio in the study area could be the result of the existence of a large number of first and second-stream orders as well as the existence of extensive coastal and low-slope areas in the sub-basins. This ratio is almost the same in the Haraz and Neka-Tajan sub-basins, and the Talar-Babolroud sub-basin has a broader-shaped peak than the other sub-basins (table. 4).

**Length of Overland Flow**

It represents the length of the flow of water over the ground surface before it becomes concentrated in defined stream channels (Horton 1945). is one of the most important independent variables affecting the hydrologic and physiographic development of drainage basins. This factor is related inversely to the average slope of the channel (Waikar et al. 2014). The shorter length of overland flow indicates a quicker runoff process and vice versa (Aher et al. 2014). According to the results, the Behshahr Sub-basin has the quickest runoff process and the Neka-Tajan Sub-basin has the slowest runoff process (table. 4).

**3.1.2: The areal aspects of the sub-basins**

**Basin Area**

The most obvious feature of a basin is its area. The amount of runoff and flood discharge directly depends on the area of the basins (Alizade 2008: 478). Based on the obtained results, the Neka-Tajan Sub-basin is the largest, and Haraz, Talar-Babolroud, and finally the Behshahr Sub-basins are in the next rating (table. 4).

**Stream Frequency**

Generally, low classes of stream frequency mean high relief (Chandrashekar et al. 2015; Sukristiyanti et al. 2018). The highest stream frequency in the study area belongs to the Behshahr Sub-basin and on the contrary, the Haraz Sub-basin has the lowest one (table.

4). The reason is the existence of the least relief in the Behshahr versus the highest relief in the Haraz Sub-basin.

**Drainage Density**

Horton (1932) introduced drainage density as a pivotal indicator reflecting the linear scale of landform elements in eroded topography. This metric serves to gauge the proximity of channels, offering a quantitative measure of the average length of stream channels throughout an entire basin. Empirical observations from drainage density measurements across diverse geologic and climatic contexts have revealed that low drainage density is more likely to manifest in regions characterized by highly permeable subsoil material under dense vegetative cover and low relief. Conversely, high drainage density typically results from weak or impermeable subsurface material, sparse vegetation, and mountainous relief. The consequences of drainage density are observed in the drainage texture, with low drainage density yielding coarse texture and high drainage density yielding fine texture (Strahler 1964). Within the study area, the Behshahr Sub-basin stands out as the densest, while the Neka-Tajen Sub-basin exhibits the lowest density. The Haraz and Talar-Babolroud sub-basins display nearly identical drainage density. Upon initial examination of maps, there might be an inclination to perceive the drainage density of the Behshahr Sub-basin as weaker compared to other sub-basins. However, this apparent weakness is attributed to the significantly smaller area of the Behshahr Sub-basin in comparison to others, causing its density value to appear higher, as elucidated in Table 4.

**Texture Ratio (Drainage Texture)**

The texture ratio of any drainage basin depends on the climate, rainfall, rock types, relief, and stage of development (Horton 1945; Smith 1950). Horton identified permeability as one of the most important factors influencing the texture ratio of the basin. The less permeable the sub-basins, the more drainage lines, and the greater number of this index indicates the high probability of flooding in sub-basins. In the study area, the Behshahr Sub-basin has the coarsest and the Haraz Sub-basin has the finest drainage texture (Table 4).

**Basin Shape**

Shape is one of the most important topographic properties that can be measured with accuracy. This characteristic can affect the basin processes, particularly in that they may determine the potential efficiency of the basin, the network and also affects the streamflow hydrograph and peak flow rates (Gregory and Walling 1973; Linsley et al. 1988). In this study, the form and shape factors were used as measures of basin shape.

**Form and Shape Factor**

According to Horton (1932) the form factor indicates the flow intensity of a basin for a defined area and shape factor of a basin helps to analyze shape irregularity of the basin. These factors value range zero to one. The smaller the value of the form and shape factor, the more elongated shape of the basin (Yadav et al. 2014; Choudhari et al. 2018). In this study, all of the sub-basins can be characterized as elongated (Table 4).

**Compactness Ratio**

If the basin is perfectly circular, this ratio is equal to one. Otherwise, the value of this ratio will be greater than one, which indicates the deviation of its shape from the circle. This ratio is generally between 1.5 and 2.5 (Alizadeh 2008: 483; Harvey and Eash 1996). According to this equation, all studied sub-basins are elongated and the Neka-Tajan sub-basin is the most elongated one (Table 4).

**Circularity Ratio**

As the basin shape approaches a circle, the circulatory ratio approaches unity (Miller 1953; Chow 1964; Gregory and Walling 1973). The high value of the circularity ratio shows the late maturity stage (Waikar and Nilawar 2014) and the low value of that, indicates a young stage of topographic development (Choudhari et al. 2018). Moreover, the lower the circular ratio, the greater the elongation of the sub-basin. According to this equation, all the studied sub-basins are elongated and like the compression factor result, the Neka-Tajan sub-basin is considered the most elongated sub-basin. The low value of the circularity ratio of the sub-basins demonstrates the youth stage of the topography (Table 4).

**Constant of Channel Maintenance**

The number obtained from this equation indicates the degree of permeability and control of flow transfer to the outlet of the basin. The higher the value of C, the higher will be the permeability of the rocks of that watershed and vice versa. On the other hand, this constant decreases with the decrease in the basin area (Aher et al. 2014). Among the studied sub-basins, the lowest amount of this constant belongs to the Behshahr Sub-basin (Table. 4), which is due to the smaller area compared to other sub-basins.

**Time of Concentration**

The Time of concentration is the time required for a drop of rain to passes the longest path of the basin and reachs the discharge measurement station (Ziaei 1991). The results showed that the Behshahr Sub-basin has the lowest and the Neka-Tajan Sub-basin has the highest Time of concentration due to their areas (table. 4).

**3.1.3: The relief aspects of the sub-basins**

**Basin Relief**

Basin relief is the actual difference between the highest and lowest points of the drainage basin (Hadley and Schumm 1961). It is one of the morphometric parameters which helps to understand the denudational characteristics of the basin also it controls the stream gradient and influences the surface runoff and sediment also (Choudhari et al. 2018). Due to the presence of coastal and mountainous areas in all the studied sub-basins, there is a large height difference between the highest and lowest points, and in the meantime, the Haraz sub-basin has the highest and the Behshahr sub-basin has the lowest basin relief (Table 4).

**Mean Height**

As stated before, the elevation of the basins is one of the most important morphological parameters that affects the rate of erosion, sedimentation, and surface runoff because high and steep sub-basins have more potential energy than low-rise sub-basins. Among the studied sub-basins, Haraz, with an average elevation of nearly 1756 meters is the highest, and Behshahr with an average elevation of ca. 258 meters is the lowest sub-basin (table. 4).

**Ruggedness Number**

The greater the height difference and the higher the drainage density, the larger the roughness number (Strahler 1957). In the present sub-basins, the most ruggedness number belongs to the Haraz sub-basin and the least ruggedness number belongs to the Behshahr sub-basin (table. 4).

### 3.2: Preparation of Flooding Risk Map in the Sub-Basins

The results from the equations were transformed into layers in the ArcGIS software, and after fuzzification, the flooding risk map was prepared. The result showed that each of the four studied sub-basins has a different potential risk of flooding: The Behshahr sub-basin, with lower, the Talar-Babolrud sub-basin with moderate, the Neka-Tajan sub-basin with high and the Haraz sub-basin, with very high flooding risk (fig. 7).

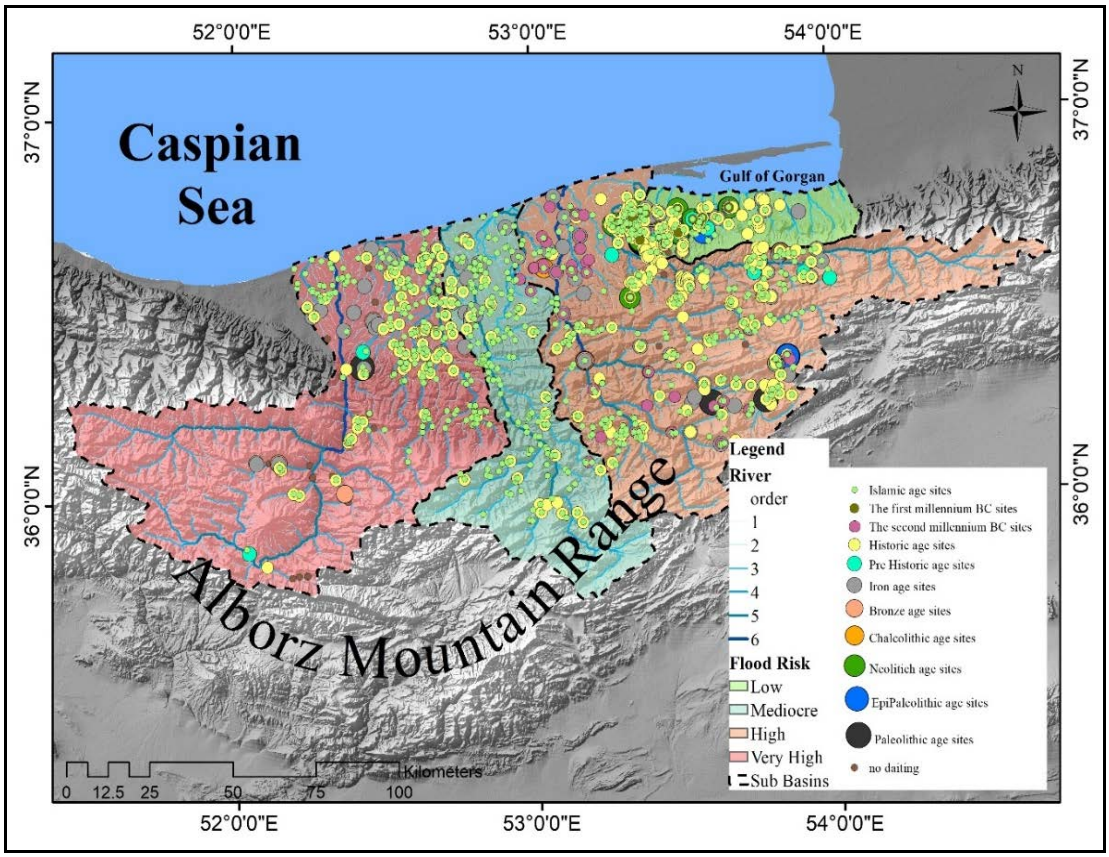


Fig 7: The flooding risk map in the sub-basins

The density of ancient sites at different distances from the rivers in relation to the flooding risk was also investigated. The results are notable and indicate the high relationship between these two factors. In the Behshahr sub-basin, where the flooding risk is lower than the other sub-basins, the density of ancient sites at a distance of 0 to 50 meters from rivers is highest, compared to other studied sub-basins. On the other hand, the Haraz sub-basin with the highest flooding risk has the least dense areas at 0 to 50 meters from waterways. The existence of this correlation is more obvious at a distance of 50 to 100 meters from rivers. The densest areas in this interval are in the Behshahr, then, the Talar-Babolroud, next, the Neka-Tajan sub-basins, and finally the Haraz sb-basin. And as the flooding risk of the sub-basins increases, the density of ancient sites in this interval has decreased (table. 5 & fig. 8).

Table 5: The density of ancient sites at different distances from the rivers in main sub-basins

| | density of ancient sites, in relation to the distance from the river (m) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sub basins** | 0 - 50 | 50 - 100 | 100 - 200 | 200 - 300 | 300 - 500 | 500 - 1000 | 1000 - 2000 | 2000 - 3000 | 3000 - 4000 | 4000 < |
| Behshahr Sub Basin | 0.244 | 0.326 | 0.444 | 0.020 | 0.149 | 0.178 | 0.224 | 0.155 | 0.059 | 0.032 |
| Neka-Tajan Sub Bsin | 0.225 | 0.143 | 0.096 | 0.178 | 0.125 | 0.101 | 0.085 | 0.073 | 0.063 | 0.026 |
| Talar-Babol Roud Sub Basin | 0.124 | 0.215 | 0.132 | 0.104 | 0.129 | 0.088 | 0.095 | 0.082 | 0.027 | 0.021 |
| Haraz Sub Basin | 0.083 | 0.111 | 0.125 | 0.126 | 0.082 | 0.062 | 0.052 | 0.038 | 0.003 | 0.000 |

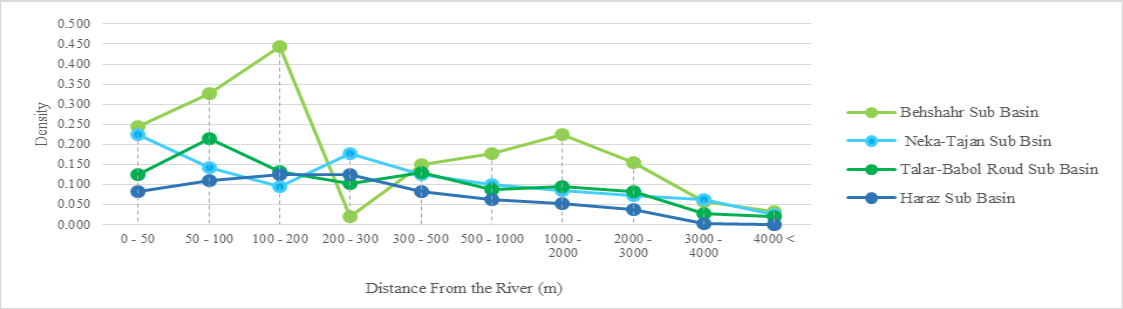


Fig 8: The density of ancient sites at different distances from the rivers in main sub-basins

In all of the sub-basins, more than half of the ancient settlements are located next to the first-order streams (Table. 6). What is more important, however, is the relationship between the order of streams adjacent to ancient sites and the flooding risk in the sub-basins, especially in relation to the location and frequency of settlements adjacent to roaring rivers and higher stream orders. The Behshahr sub-basin, which has a lower flooding risk, does not have fifth and sixth stream orders. In the other three sub-basins, the frequency of the sites located next to fifth-order streams is interesting, so the highest frequency belongs to the Talar-Babolroud, and as mentioned above, this sub-basin has less flooding risk than the other two sub-basins. The Talar-Babolroud sub-basin does not have the sixth order of stream, but the percentage of ancient sites adjacent to the sixth stream order has decreased sharply in the other two sub-basins. However, still, with a small difference, this frequency is higher in the Neka-Tajan sub-basin, which has a lower flooding risk than the Haraz Sub-basin (fig. 9).

Table 6: The Percentage frequency of ancient sites in relation to the stream orders in main sub-basins

| | Percentage Frequency of ancient sites, in relation to the stream order (Strahler) | | | | | |
|---|---|---|---|---|---|---|
| **Sub basins** | **1** | **2** | **3** | **4** | **5** | **6** |
| Behshahr Sub Basin | 64.02 | 23.81 | 9.52 | 2.65 | 0 | 0 |
| Neka-Tajan Sub Bsin | 57.42 | 20.76 | 11.21 | 6.36 | 3.03 | 1.21 |
| Talar-Babol Roud Sub Basin | 56.06 | 13.84 | 14.53 | 4.50 | 11.07 | 0 |
| Haraz Sub Basin | 52.42 | 18.24 | 9.93 | 12.01 | 6.47 | 0.92 |

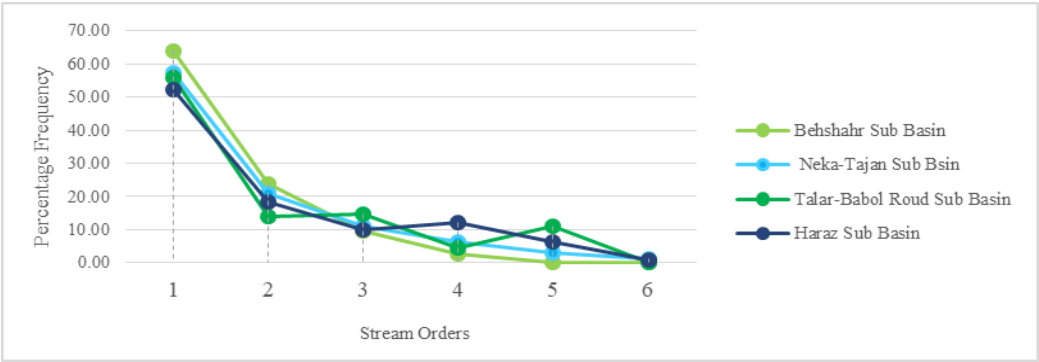


Fig 9: The Percentage frequency of ancient sites in relation to the stream orders in main sub-basins

### 3.3: Estimating the Flood Risk in the Smaller Sub-Basins

All the linear, areal, and relief aspects have been calculated (Tables 7, 8, 9, and 10) and after estimating the flooding risk, the settlement pattern of the ancient sites in relation to the distance from the rivers, the nearest order of stream as well as the flooding risk of all the smaller sub-basins was analyzed. After calculating the above aspects and creating the layer and finally, fuzzification of them, the flooding risk map of the study area was prepared (Fig. 10).

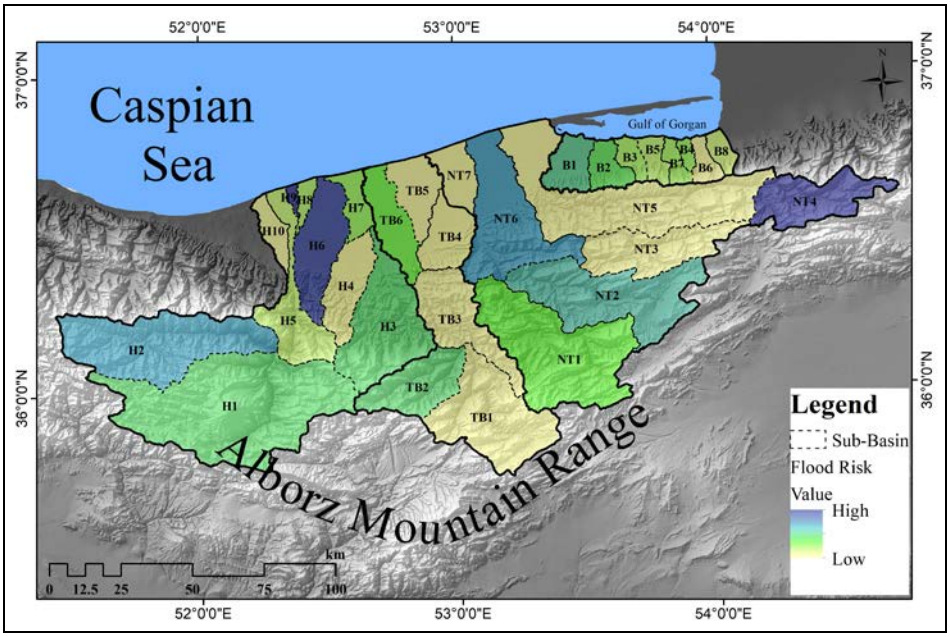


Fig 10: The flooding risk map in the smaller sub-basins

In the Haraz sub-basin (which is shown in the map with the abbreviation H), the highest flooding risk is for sub-basins number six and nine (Fig. 10). In H6, which has a larger area than H9, the least dense interval is between 0 and 50 meters, and the densest interval is 200 to 300 meters from the rivers. On the other hand, the majority of the ancient settlements of H6 (more than 36%) have been located near the first-order of streams, and only 1.5% of them are located near the streams of the sixth-order (Fig. 11). Since H9 is very small and expanded in the coastal area, and because the change of streams in these areas occurs very quickly and the subject under discussion is the relationship between ancient settlements and hydro geomorphological features, for the above reasons, the investigation discussed in H9 is not very scientific and defensible.

Table 7: Linear, Areal and Relief aspects of the morphometric analysis of the Haraz Sub-basin

| | Haraz Sub basin | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Aspects** | **H1** | **H2** | **H3** | **H4** | **H5** | **H6** | **H7** | **H8** | **H9** | **H10** |
| **linear Aspects** | | | | | | | | | | |
| Primeter (km) | 226.718 | 213.198 | 106.871 | 126.493 | 173.614 | 357.408 | 266.320 | 234.494 | 152.078 | 152.517 |
| Stream Length (km) | 516.422 | 330.436 | 263.946 | 248.616 | 300.546 | 1197.117 | 610.285 | 505.367 | 291.563 | 256.496 |
| Main Stream Length (km) | 77.314 | 69.444 | 45.439 | 39.144 | 53.485 | 113.075 | 93.787 | 71.849 | 52.480 | 49.315 |
| Bifurcation ratio | 3.931 | 4 | 3.150 | 3.939 | 3.675 | 4.435 | 4.175 | 3.590 | 4.230 | 4.986 |
| Length of overland flow | 1.023 | 0.980 | 0.692 | 0.702 | 0.688 | 0.956 | 1.055 | 0.958 | 0.732 | 1.092 |
| **Areal Aspects** | | | | | | | | | | |
| Area (square kilometer) | 1056.362 | 647.488 | 365.399 | 349.089 | 413.506 | 2289.917 | 1287.478 | 968.105 | 426.992 | 560.170 |
| Stream frequency | 0.228 | 0.202 | 0.227 | 0.232 | 0.213 | 0.222 | 0.228 | 0.187 | 0.222 | 0.220 |
| Drainage density | 0.489 | 0.510 | 0.722 | 0.712 | 0.727 | 0.523 | 0.474 | 0.522 | 0.683 | 0.458 |
| Drainage texture | 1.063 | 0.614 | 0.777 | 0.640 | 0.507 | 1.424 | 1.104 | 0.772 | 0.625 | 0.806 |
| Shape Factor | 5.659 | 7.448 | 5.651 | 4.389 | 6.918 | 5.584 | 6.832 | 5.332 | 6.450 | 4.341 |
| Form factor | 0.177 | 0.134 | 0.177 | 0.228 | 0.145 | 0.179 | 0.146 | 0.188 | 0.155 | 0.230 |
| Compactness ratio | 1.953 | 2.346 | 1.565 | 1.896 | 2.391 | 2.091 | 2.078 | 2.110 | 2.061 | 1.804 |
| Circularity ratio | 0.258 | 0.179 | 0.402 | 0.274 | 0.172 | 0.225 | 0.228 | 0.221 | 0.232 | 0.302 |
| Constant of channel maintenance | 2.046 | 1.959 | 1.384 | 1.404 | 1.376 | 1.913 | 2.110 | 1.916 | 1.464 | 2.184 |
| Time of consentration | 3.306 | 3.754 | 5.397 | 12.341 | 10.065 | 4.460 | 4.420 | 3.187 | 3.396 | 2.381 |
| **Relief aspects** | | | | | | | | | | |
| Basin relief (m) | 3227 | 3089 | 604 | 85 | 355 | 4876 | 3613 | 3715 | 2319 | 3493 |
| Mean height (m) | 2099.500 | 1633.780 | 278 | 1.525 | 137.508 | 3154.040 | 2520.166 | 1836.520 | 1131.723 | 2227.759 |
| longest stream heigh (m) | 2290 | 2012 | 267 | 59 | 167 | 2798 | 2787 | 3027 | 1393 | 2772 |
| Ruggedness number | 6.601 | 6.053 | 0.836 | 0.119 | 0.488 | 9.327 | 7.622 | 7.117 | 3.396 | 7.628 |

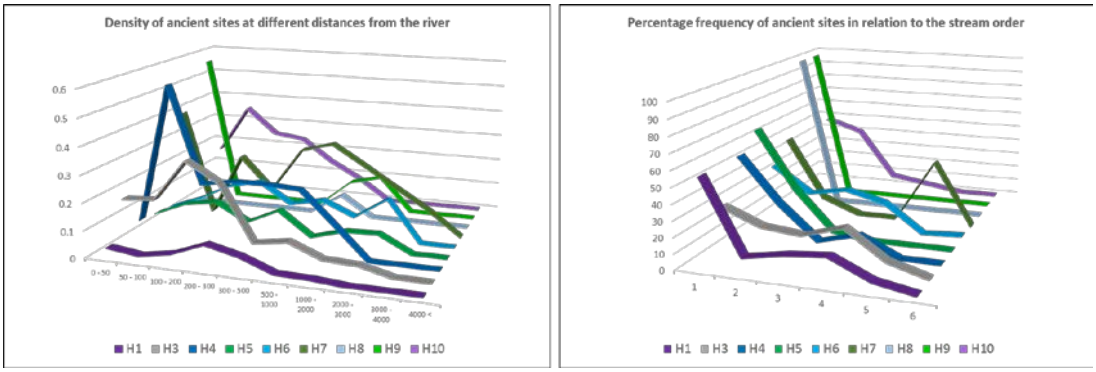


Fig 11: The Haraz Sub-basin, density of ancient sites at different distances from the rivers (right) and Percentage frequency of ancient sites in relation to the stream orders (left) in smaller sub-basins

Among the sub-basins of the Neka-Tajan (shown on the map with the abbreviation NT), NT6 has the highest flooding potential, and NT2 and NT1 are in the next ranks (Fig. 10). In NT6, the densest interval is the area with a distance of 200-to-300 meters from the rivers. Also, in the distance of 0-to-50 meters, after NT5, this sub-basin has the lowest density, and in the distance of 50-to-100 meters, it has the lowest density among all Neka-Tajan sub-basins. The relationship between the frequency percentage of ancient sites and proximity to the rivers is also noteworthy. In NT6, having the highest flooding risk, nearly 70% of the ancient sites are located near the first-order streams, which compared to the other sub-basins (with less flooding risk), this is the highest amount of ancient sites located near the first-order of streams (fig. 12).

Table 8: Linear, Areal and Relief aspects of the morphometric analysis of the Neka-Tajan sub-basin

| | Neka-Tajan Sub basin | | | | | | |
|---|---|---|---|---|---|---|---|
| **Aspects** | **NT1** | **NT2** | **NT3** | **NT4** | **NT5** | **NT6** | **NT7** |
| **linear Aspects** | | | | | | | |
| Primeter (km) | 302.952 | 315.336 | 221.572 | 200.423 | 424.286 | 278.912 | 111.130 |
| Stream Length (km) | 714.173 | 631.451 | 307.304 | 322.440 | 892.174 | 622.688 | 182.943 |
| Main Stream Length (km) | 87.413 | 94.529 | 65.442 | 52.809 | 149.215 | 93.150 | 33.831 |
| Bifurcation ratio | 3.997 | 3.975 | 4.884 | 3.813 | 4.052 | 4.124 | 2.788 |
| Length of overland flow | 1.040 | 0.949 | 1.086 | 0.947 | 0.909 | 0.842 | 0.741 |
| **Areal Aspects** | | | | | | | |
| Area (square kilometer) | 1485.494 | 1198.535 | 667.682 | 610.840 | 1621.616 | 1048.916 | 271.191 |
| Stream frequency | 0.207 | 0.213 | 0.181 | 0.226 | 0.201 | 0.205 | 0.258 |
| Drainage density | 0.481 | 0.527 | 0.460 | 0.528 | 0.550 | 0.594 | 0.675 |
| Drainage texture | 1.017 | 0.809 | 0.546 | 0.689 | 0.768 | 0.771 | 0.630 |
| Shape Factor | 5.144 | 7.456 | 6.414 | 4.566 | 13.730 | 8.272 | 4.221 |
| Form factor | 0.194 | 0.134 | 0.156 | 0.219 | 0.073 | 0.121 | 0.237 |
| Compactness ratio | 2.201 | 2.550 | 2.401 | 2.271 | 2.950 | 2.411 | 1.890 |
| Circularity ratio | 0.203 | 0.151 | 0.171 | 0.191 | 0.113 | 0.169 | 0.276 |
| Constant of channel maintenance | 2.080 | 1.898 | 2.173 | 1.894 | 1.818 | 1.684 | 1.482 |
| Time of consentration | 4.385 | 4.661 | 4.021 | 3.341 | 6.633 | 5.837 | 10.663 |
| **Relief aspects** | | | | | | | |
| Basin relief (m) | 3488 | 2967 | 2599 | 2304 | 2652 | 1464 | 97 |
| Mean height (m) | 1966.503 | 1689.141 | 1880.633 | 2653.055 | 1285.498 | 687.002 | -7.386 |
| longest stream heigh (m) | 2012 | 2205 | 1764 | 1627 | 1937 | 1148 | 57 |
| Ruggedness number | 7.255 | 5.632 | 5.647 | 4.365 | 4.820 | 2.466 | 0.144 |

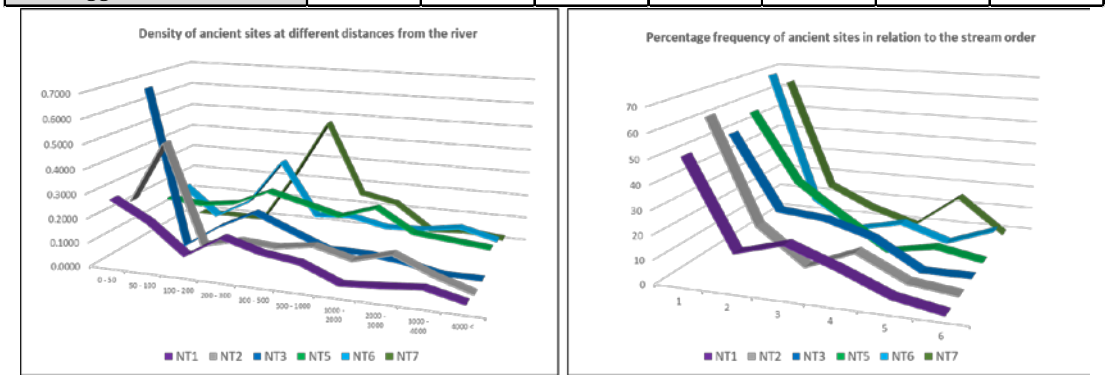


Figure 12: The Neka-Tajan Sub-basin, density of ancient sites at different distances from the rivers (right) and Percentage frequency of ancient sites in relation to the stream orders (left) in smaller sub-basins

The flooding risk estimation using linear, aerial, and relief aspects revealed that the Talar-Babolroud sub-basins (shown on the map with the abbreviation TB) have low or medium flooding risk. TB2 and TB6 have more flooding risk compared to others and the densest areas in these two sub-basins are located in distance of 200-to-300 and 1000-to-2000 meters from the rivers. While the densest areas in most sub-basins are located at a distance of 50-to-100 meters from the river, which is justified due to the low risk of flooding in the sub-basins (fig. 13).

Table 9: Linear, Areal and Relief aspects of the morphometric analysis of the Talar-Babolroud sub-basin

| | Talar-Babolroud Sub basin | | | | | |
|---|---|---|---|---|---|---|
| **Aspects** | **TB1** | **TB2** | **TB3** | **TB4** | **TB5** | **TB6** |
| **linear Aspects** | | | | | | |
| Primeter (km) | 248.213 | 187.640 | 122.057 | 73.580 | 45.737 | 103.915 |
| Stream Length (km) | 301.916 | 472.290 | 134.026 | 55.049 | 22.777 | 142.129 |
| Main Stream Length (km) | 72.427 | 64.638 | 44.755 | 23.089 | 11.893 | 38.797 |
| Bifurcation ratio | 3.571 | 3.289 | 5.786 | 4.25 | 2.5 | 2.881 |
| Length of overland flow | 0.916 | 0.635 | 0.722 | 0.700 | 0.707 | 0.591 |
| **Areal Aspects** | | | | | | |
| Area (square kilometer) | 552.946 | 599.787 | 193.588 | 77.074 | 32.208 | 167.910 |
| Stream frequency | 0.194 | 0.195 | 0.207 | 0.208 | 0.279 | 0.191 |
| Drainage density | 0.546 | 0.787 | 0.692 | 0.714 | 0.707 | 0.846 |
| Drainage texture | 0.431 | 0.624 | 0.328 | 0.217 | 0.197 | 0.308 |
| Shape Factor | 9.487 | 6.966 | 10.347 | 6.917 | 4.392 | 8.964 |
| Form factor | 0.105 | 0.144 | 0.097 | 0.145 | 0.228 | 0.112 |
| Compactness ratio | 2.956 | 2.145 | 2.456 | 2.347 | 2.257 | 2.245 |
| Circularity ratio | 0.113 | 0.214 | 0.163 | 0.179 | 0.193 | 0.195 |
| Constant of channel maintenance | 1.831 | 1.270 | 1.444 | 1.400 | 1.414 | 1.181 |
| Time of consentration | 3.943 | 4.480 | 15.610 | 8.387 | 5.834 | 5.763 |
| **Relief aspects** | | | | | | |
| Basin relief (m) | 3291 | 1750 | 58 | 81 | 38 | 497 |
| Mean height (m) | 1608.5 | 834.15 | -13.25 | 2.5 | -17 | 215 |
| longest stream heigh (m) | 1965 | 1217 | 31 | 48 | 26 | 248 |
| Ruggedness number | 6.027 | 2.222 | 0.084 | 0.113 | 0.054 | 0.587 |

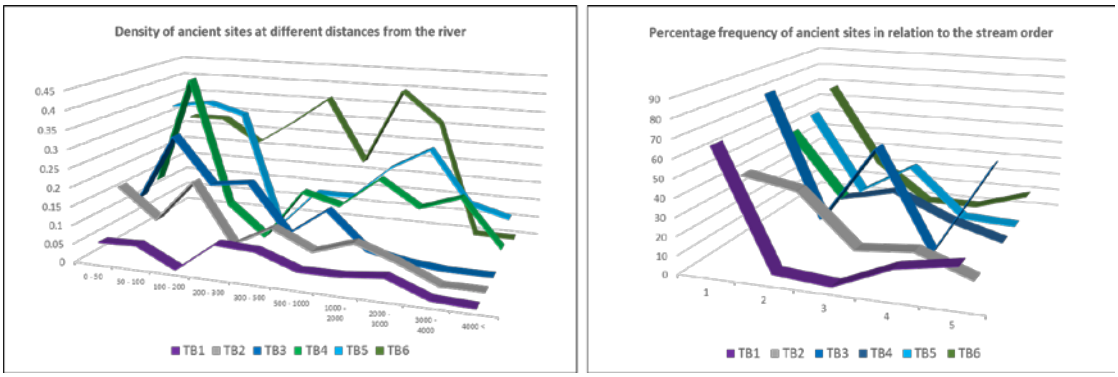


Fig 13: The Talar-Babolroud Sub-basin, density of ancient sites at different distances from the rivers (right) and Percentage frequency of ancient sites in relation to the stream orders (left) in smaller sub-basins

The results of flood zoning in the sub-basins of Behshahr (shown in the map with the abbreviation B), showed that the smaller area of the sub-basins has increased the flooding risk. Since the flood hydrograph reaches its peak faster in smaller basins than in large basins. B1 is more prone to flooding than other sub-basins, and on the other hand, the frequency of settlements close to different orders of streams in relation to the flood risk is very considerable. Because the majority of settlements (nearly 69%) in B1 are located near streams of the first order, this number is the highest among all the Behshahr Sub-basins. As you can see in Fig. 14, the percentage of settlements near to

1st order of streams in B5 and B6 is 100%, but this is due to the existence of only one ancient site in these two sub-basins.

Table 1: Linear, Areal and Relief aspects of the morphometric analysis of the Behshahr Sub-basin

| | Behshahr Sub basin | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Aspects** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **B8** |
| **linear Aspects** | | | | | | | | |
| Primeter (km) | 114.068 | 98.755 | 70.429 | 73.539 | 67.984 | 44.597 | 70.949 | 53.026 |
| Stream Length (km) | 196.098 | 145.523 | 71.151 | 89.620 | 67.434 | 37.056 | 74.018 | 82.796 |
| Main Stream Length (km) | 24.361 | 21.190 | 16.557 | 25.553 | 17.350 | 11.221 | 18.678 | 16.346 |
| Bifurcation ratio | 2.995 | 3.917 | 3.55 | 2.917 | 2.847 | 5.5 | 2.921 | 3.5 |
| Length of overland flow | 0.682 | 0.675 | 0.788 | 0.717 | 0.742 | 0.702 | 0.801 | 0.643 |
| **Areal Aspects** | | | | | | | | |
| Area (square kilometer) | 267.498 | 196.580 | 112.079 | 128.537 | 100.111 | 52.029 | 118.637 | 106.488 |
| Stream frequency | 0.217 | 0.209 | 0.268 | 0.257 | 0.350 | 0.250 | 0.295 | 0.301 |
| Drainage density | 0.733 | 0.740 | 0.635 | 0.697 | 0.674 | 0.712 | 0.624 | 0.778 |
| Drainage texture | 0.508 | 0.415 | 0.426 | 0.449 | 0.515 | 0.292 | 0.493 | 0.603 |
| Shape Factor | 2.219 | 2.284 | 2.446 | 5.080 | 3.007 | 2.420 | 2.941 | 2.509 |
| Form factor | 0.451 | 0.438 | 0.409 | 0.197 | 0.333 | 0.413 | 0.340 | 0.399 |
| Compactness ratio | 1.953 | 1.972 | 1.863 | 1.816 | 1.902 | 1.731 | 1.824 | 1.439 |
| Circularity ratio | 0.258 | 0.253 | 0.284 | 0.299 | 0.272 | 0.329 | 0.296 | 0.476 |
| Constant of channel maintenance | 1.364 | 1.351 | 1.575 | 1.434 | 1.485 | 1.404 | 1.603 | 1.286 |
| Time of consentration | 3.360 | 1.636 | 1.685 | 1.774 | 1.444 | 1.895 | 1.281 | 1.108 |
| **Relief aspects** | | | | | | | | |
| Basin relief (m) | 824 | 1375 | 1485 | 1642 | 1768 | 1037 | 2162 | 2336 |
| Mean height (m) | 379 | 641.45 | 691.48 | 780.04 | 853.01 | 481.83 | 1044.70 | 1129.63 |
| longest stream heigh (m) | 329 | 931 | 575 | 898 | 934 | 225 | 1302 | 1487 |
| Ruggedness number | 1.124 | 1.857 | 2.339 | 2.355 | 2.625 | 1.456 | 3.465 | 3.004 |

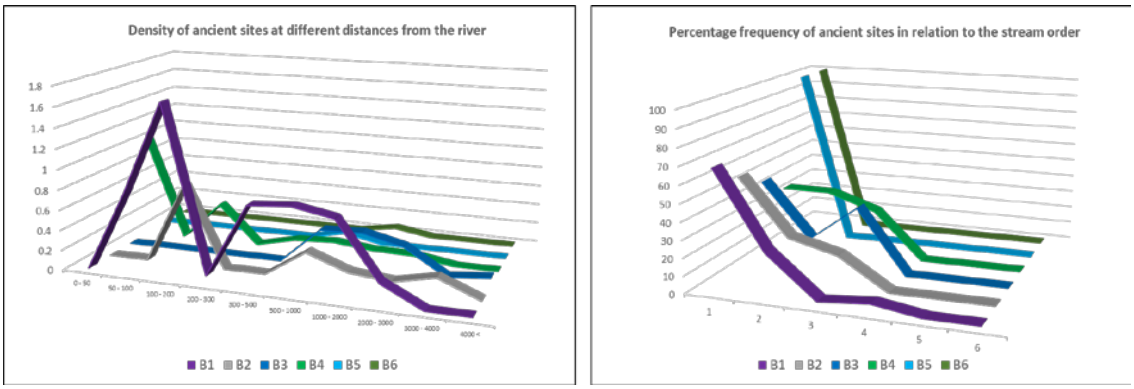


Fig 14: The Behshahr Sub-basin, density of ancient sites at different distances from the rivers (right) and Percentage frequency of ancient sites in relation to the stream orders (left) in smaller sub-basins

## 4.Conclusion

In contemporary archaeology, the exploration of settlement patterns and landscape-oriented approaches has become a prominent focus, as noted by Renfrew (2003) and Kowalewski (2008). A recent trend in interdisciplinary research involves investigating the influence of the natural environment on the settlement patterns of ancient sites. The settlement pattern is considered a direct reflection of natural environment characteristics, with water sources, particularly rivers, emerging as crucial determining factors (Saidi 2007: 43). Despite the numerous benefits of establishing settlements along rivers, it is essential to acknowledge the associated risks spanning from ancient times to the present.

This research delves into the southeastern areas of the Caspian Sea, specifically studying sub-basins and analyzing their physiographic and hydrological attributes. The primary objective is to discern, from an ancient human perspective, the most suitable locations for site selection based on stream order and distance from rivers. Initially, the investigation explores the correlation between settlement patterns of ancient sites and drainage networks. Subsequently, the research assesses the flooding risk of sub-basins by examining various linear, areal, and relief aspects. Notably, this study pioneers the analysis of the relationship between sub-basin flood risk and the settlement patterns of ancient sites.

The findings underscore the significance of proximity to rivers in site selection, revealing a notable optimal distance of 50 to 100 meters from rivers. This range provides relative immunity against river overflow and floods. Moreover, a noteworthy observation is that ancient sites predominantly cluster around first-order streams with seasonal water flow, as opposed to permanent rivers. The research scrutinizes the location of ancient sites at different intervals from rivers with varying stream orders concerning flood risk. For instance, in the Behshahr Sub-basin with lower flooding risk, ancient sites are densely concentrated at 0 to 50 meters from rivers, whereas the Haraz Sub-basin, with the highest flooding risk, exhibits the least density in this proximity. Additionally, an inverse relationship is noted, with higher flooding risk corresponding to a decrease in the concentration of ancient sites near higher-order streams.

To bolster result accuracy, the main sub-basins were further divided into 31 smaller sub-basins, confirming that the relationship between settlement patterns and flooding risk aligns with the outcomes from the larger sub-basins. In summary, the research concludes that areas close to lower-order rivers are most ideal for settlements. The decrease in settlement frequency near higher stream orders, coupled with increased frequency and density near first-order streams and at greater distances from rivers, reflects the ancient inhabitants' understanding of river flooding dangers. Notably, results obtained in mountainous sub-basins are deemed more authentic than those in coastal areas due to challenges in determining precise distances caused by changes in stream beds and high sedimentation rates. Specific intervals used in estimating this factor help mitigate errors in coastal and low-slope areas.

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# الگوی استقرار محوطه‌های باستانی در حوضه‌های آبخیز جنوب شرق دریای خزر، از دیدگاه هیدروژئومورفولوژی

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## چکیده

وجود منابع آب خصوصاً رودخانه‌ها، از مهم‌ترین عوامل در مکان گزینی محوطه‌های باستانی است اما از گذشته تاکنون، ایجاد سکونتگاه در کنار رودخانه‌ها، علیرغم مواهب بی‌شمار، دارای مخاطراتی نیز بوده است. در این پژوهش سعی شده است تا با مطالعه زیر حوضه‌های آبخیز نواحی جنوب‌شرق دریای خزر، در ابتدا رابطه بین الگوی استقرار سکونتگاه‌های باستانی و شبکه‌های زهکشی، بررسی‌شده و از طرف دیگر، با برآورد پتانسیل سیل‌خیزی زیر حوضه‌ها بر اساس ویژگی‌های خطی، سطحی و ارتفاعی، برای اولین بار، رابطه بین میزان سیل‌خیزی زیر حوضه‌ها و الگوی استقرار محوطه‌های باستانی، مورد تحلیل قرار گیرد. نتایج بازگوکننده اهمیت نزدیکی به آبراهه‌ها در مکان گزینی محوطه‌ها بوده و بر این اساس، فواصل نزدیک به آبراهه‌های رده‌های پایین‌تر، ایده‌آل‌ترین مناطق جهت برپایی استقرارگاه بوده‌اند. رابطه سیل‌خیزی و الگوی استقرا محوطه‌ها نشان داد که کاهش فراوانی استقرارگاه‌ها در کنار آبراهه‌های رده‌های بالاتر و از طرف دیگر، افزایش فراوانی و تراکم نقاط باستانی در جوار آبراهه‌های رده یک و در فواصل دورتر از آبراهه‌ها، همراه با افزایش خطر وقوع سیلاب در زیر حوضه‌ها، بازگوکننده درک ساکنان باستانی حوضه جنوب‌شرق دریای خزر از خطر طغیانی شدن رودخانه‌ها و در نتیجه، لحاظ کردن این امر در مکان گزینی است. به جهت افزایش دقت نتایج، چهار زیر حوضه اصلی به سی‌ویک زیر حوضه فرعی تقسیم‌شده و پس از برآورد پتانسیل وقوع سیلاب برای این زیر حوضه‌ها، رابطه بین الگوی استقرار و سیل‌خیزی زیر حوضه‌ها، موردبررسی قرار گرفت که نتایج در راستای نتایج به دست آمده از چهار زیر حوضه اصلی بوده است.

**واژه‌های کلیدی:** زمین‌باستان‌شناسی، الگوی استقرار، هیدرو ژئومورفولوژی، سیل، جنوب‌شرق دریای خزر.

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# Archaeobotanical Studies in Feyzabad Site, in Aran-o-Bidgol Town

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**Abstract**

Archaeobotany is one of the interdisciplinary sciences in archaeology. Archaeobotany studies plant remains in archaeological contexts. Based on plant findings, it discusses topics such as people's livelihood, agriculture, vegetation, climate changes, dating, etc. So, this course can reply to many questions archaeologists face about an ancient site and people. In recent years, archaeologists have paid a lot of attention to this field and tried to use experts in excavations. One of the excavations that has paid a lot of attention to archaeobotany, is Feyzabad site. This site has Islamic periods. During the excavation in 2022 in this site, some ovens were found, as well as some samples from them. In this research, we intend to answer questions such as the functioning of the sampled ovens and the identification of plant remains in the ovens. Finally, by combining the information found, we will shed light on the lives of the people of this period. By doing this research, our information about the life of the people belonging to this area, their livelihood and the common types of plant remains used in this area will increase. Also, micro information about climatic conditions will be obtained. After carrying out the necessary investigations and research, it was found that the ovens found in the trench D8 are related to cooking to the inner part of the royal citadel. Besides the more specialized work that is being done, animal husbandry and agriculture are popular. Some climate changes such as warmer weather and less humidity were also identified.

**Keywords**: Feyzabad, Archaeology, archaeobotany, Plants, Carbonization seeds.

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## 1. Introduction

Due to the formation of new archaeology in the past few decades, one of the most important branches to which it was linked to is Archaeobotany science. In Iran, due to the lack of attention to it, its name is still unknown to many people (Khan Fini, 2023). In all Islamic, historical and pre-historic periods, archaeobotanical studies are of special importance. Archaeobotanical analysis from Islamic period sites in the last 15 years has been slowly developing, adding much to our understanding of the landscape and diet during the medieval Near East. Yet, certain regions still remain infrequently studied, where excavations of Islamic levels are few and archaeobotanical recovery occurs in an even smaller percentage of those projects (Ramsay and Asa Eger, 2015). The proliferation of such botanical studies in the Islamic/medieval periods is necessary not only on a site-specific or even regional level, but to engage in newly appearing discussions of the intersections of environmental and Islamic studies with crucial archaeological evidence, which can, for example, counter- balance and nuance certain well-worn debated ideas, such as the nature of the Islamic Green "Revolution" (Watson 1974, 1983; Decker 2009; Bulliet 2010; Mikhail 2010). One of the Islamic sites in Iran is Feyzabad site in Aran-o-Bidgol city. This site was excavated by the Department of Archeology of Kashan University from 2012 under the title of educational excavation and continued until 2022 (except 2020). As a result of such excavations, a royal citadel was found in this area, which is located in the northern part of this settlement. This part is related to the privileged position of the city and there were other classes in the urban space part. Architectural evidence shows that the buildings inside the citadel are richer and more distinguished in terms of art and decorations than the buildings outside the citadel. In different years, different parts of this citadel were explored. There is an urban space around it. The space outside the citadel is related to the living space of ordinary people. Some of the worked spaces in the royal citadel had a dome cover. In the Royal citadel, all the buildings were made of clay wall and mudbrick, and only a few brick walls were found. The citadel has two different architectural phases in terms of time precedence. The evidence indicates that the brick building with plaster coating with a rectangular plan was built on the destroyed brick building. The founders of this building filled the empty spaces of the brick building with soil and garbage and made it into a platform and built the new building on a platform. Cladding can be seen in several phases, which shows the importance and continuous use of this building. Considering the lack of any object on the floor and the general poverty of the artifacts, this issue can be considered in connection with the conscious abandonment of this place during the mentioned period, which caused them to collect all the daily life items. Probably, due to environmental changes and worsening climatic conditions, the residents of this area consciously decided to leave this place (Nouri Shadmahani, 2018).

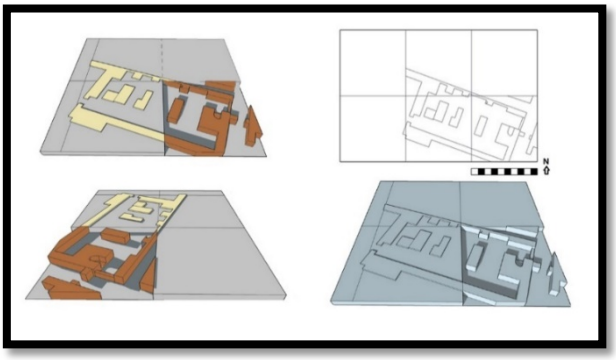

*Figure 1: Isometric plan, the excavated part of* the royal citadel (Nouri Shadmahani, 2018).

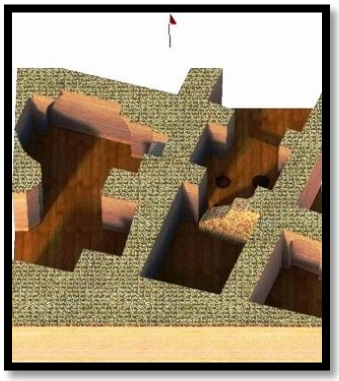

figure2: General plan of the trench The third season of excavation (Nouri Shadmahani, 2018*).*

## 2.Site Background

One of the largest settlements in the region with remarkable architecture is the Historical site of Feyzabad, which is located 10 kilometers north of Noushabad city and is based on surface findings and data from excavations, including pottery dating from the 13th to the 17th centuries CE. The historical site of Feyzabad is located at 91°, 71°, 24°N and 57°, 71°, 6E, in the northwest of Aran and Bidgol cities in Isfahan province. This area, which in the past (during its prosperity from the Ilkhanid period to the Safavid period) was a village on the way, is now abandoned and with the expansion of the Noushabad region, it has become a function of this city, which is now together with the city of Noushabad in the country divisions of Aran-o-Bidgol and are located in the north of Kashan In terms of climate, the area of Feyzabad, like its surrounding areas, has a hot and dry climate due to its proximity to the desert plain and distance from the Alborz Mountain range. Its annual rainfall is 741 mm on average (Nouri Shadmahani, 2019).

Today, the Vegetation of Feyzabad area mostly consists of Haloxylon and Tamarix shrubs, thorn bushes and pecan plants, which can be seen scattered on almost the entire surface of the area. Tamarix and Haloxylon shrubs have been planted in a large part of the area for desertification. The animal cover of this area mostly includes termites, cockroaches and rats, along with reptiles such as snakes and scorpions. The surface of the area is mostly composed of sand, which has a powdery texture that is easily moved by strong winds, and throughout the history, this wind has caused the burial of the area of Feyzabad. According to the contents of some historical texts, the city of Noushabad was formed in the Sassanid period and was named "Anushabad". With the passage of time, it became simple and easy and became "Nush Abad" (Afshar Sistani, 1392). According to the aforementioned conditions, settlements have been expanded towards the north of Noushabad and life has been going on in them in different Historical periods. There are also many aqueducts in Feyzabad Site (Nouri Shadmahani, 2020).

Four series of aqueducts are located parallel to each other in the northwest part of the area. An important distinction regarding the aqueducts is that the soil on which the aqueducts are placed on is made of soft soil with cracked layers and are covered with salt. This issue can indicate the existence of underground water sources in the past. But these aqueducts are unused and dry today. Unfortunately, in line with security and protection measures, after the completion of each excavation, the trench is filled with soil again. (Other measures: Covering exposed walls and floors using cotton sacks and the use of thatch to protect the walls) For this reason, despite many excavations in this area, it has not yet become a museum site.

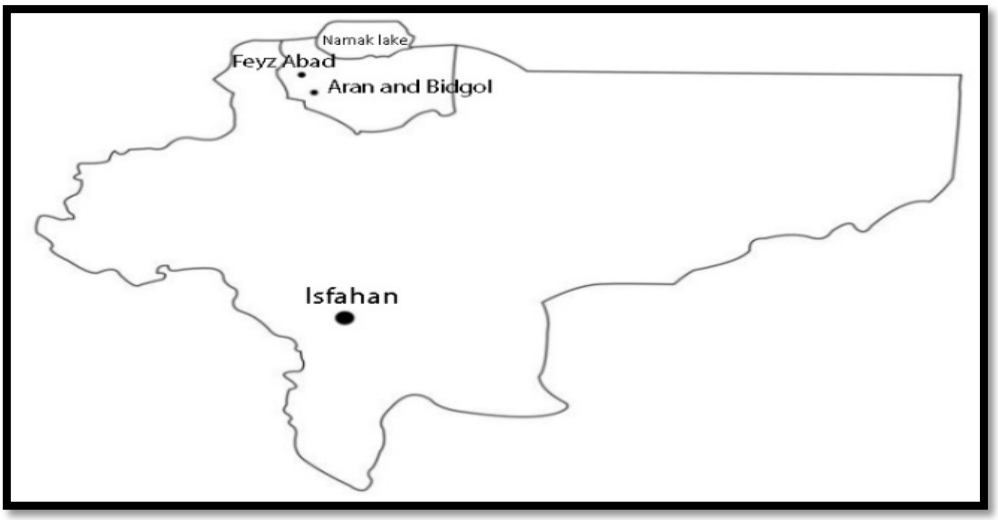


Figure 2: Location of Feyzabad Site (Nouri Shadmahani, Javeri, Sadraei, 2013).

**3.Materials and Methods**

The excavation of 2022 was carried out in Feyzabad area under the supervision of Dr. Reza Nouri Shadmahani and Dr. Mohsen Javari. In this excavation they worked on a trench with the name D8. This trench was created on the wall separating the royal citadel from the public part of the area, and the part where the ovens were found was related to the inner part of the citadel. All samples belonged to this trench. Soil samples were collected by the excavators in the site for archaeobotanical studies. All of the samples belonged to ovens. In this excavation 11 ovens were found in different parts of the trench, but the excavators only collected soil samples from 6 ovens. All ovens belong to the Islamic period and are named Ilkhani. The collected samples belong to the lower parts of the ovens, where most of the charcoal and ash are seen. All conditions related to sampling were recorded in special forms for archaeobotanical sampling. The most recorded conditions were related to soil type, visible remains, amount of soil sample, locus number and sample depth. Samples collected in site and for flotation were transfered to the Bioarchaeology center in the UK. The next place to be flotted were the Sialk hills where the flotation machine was located. Processing of samples was carried out by a machine flotation with 2 outputs: light fractions, which were found in 1 mm sieve sizes and heavy fractions. In general 207-liter soils were floted. All flotation samples were measured by weight(g) and all of the fractions were sorted under a Stereomicroscope. In the sort process all the seeds, charcoals, bones, snails and… were detached. Because no plant remains were found in the heavy fractions, the heavy fractions were kept separately for other studies. But all light fractions were studied. After flotation and drying of the plant remains at a balanced temperature, they were transferred to the Bioarchaeology Center. Then, identification, classification, photography and design of plant remains were done in the same center. All highly damaged seeds (unrecognizable) and healthy or even almost healthy seeds that could be identified were separated from each other. More plant remains were identified by seeds atlases and modern seed reference collections at the Bioarchaeology center. All the seeds were found in a good condition. All of them were preserved by charring and thats reasonable since they were found in an oven. Broken seeds with high damage were not

studied but they were all kept. Plant samples were identified in each locus with a specific volume of soil. (After completing the study of plant remains, some samples were selected as reference samples of the Islamic era in the Ilkhanid period in the central plateau of Iran).

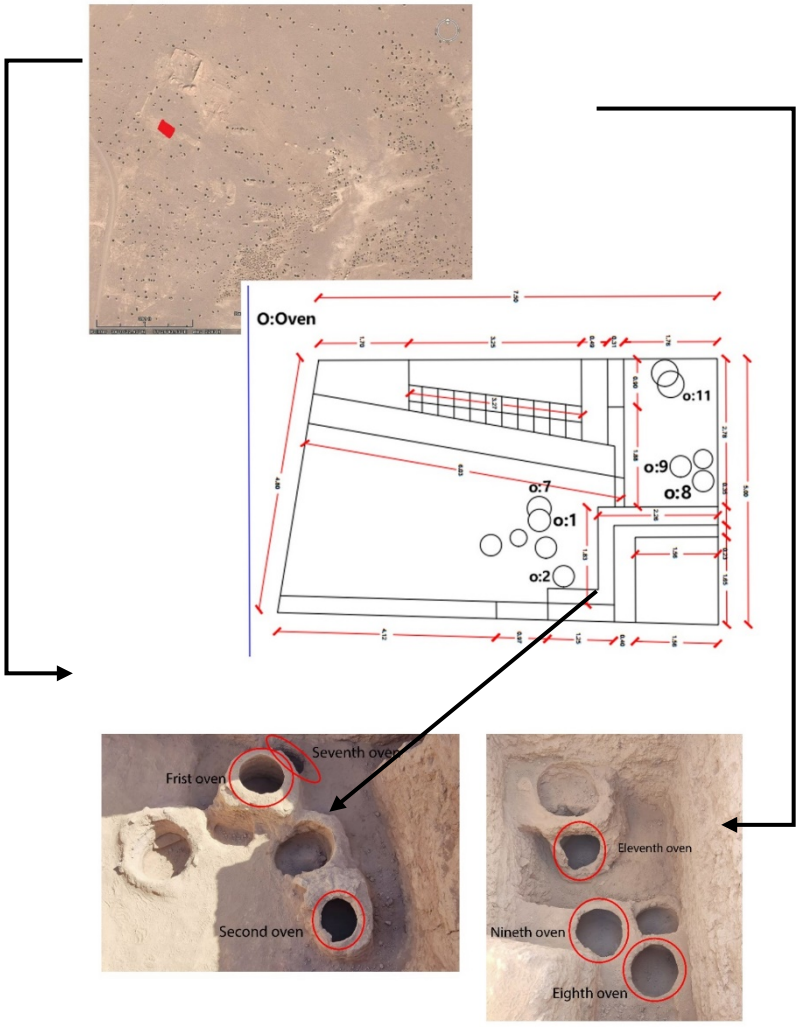


Figure 3: Satellite image of Feyzbad site, Trench plan 2022, ovens found and sampled (auther).

Figure 4: Team of flotation (author).

figure 6: works on seeds (author).

**4.Plant Remains from Ilkhani Deposits**

All ovens were found in Ilkhanid layers. Each of the 6 ovens selected for archaeobotany samples have carbonization seeds. In other ovens, the upper part debris is visible but in the lower parts ash and burnt soil are visible. To better understand the location and features of the ovens, we will describe each of them.

**Loc8032**

This locus belongs to the contents of locus 8019. Locus 8019 is the first oven found. In the upper part of this locus (8032) debris and brick were found but in the lower part ash and burnt soil was discovered. Sediment of locus was dry and burnt macro remains are visible with the naked eye. 54-liter soil selection was used for flotation from the lower part. Findings are visible in table 1. After sorting, Plant findings in this locus include 2 grape (V.vinifera) seeds, 1 Galium seed, 13 Barley seeds, 11 wheat seeds, 1 emmer wheat seed, 13 probably Quercus seeds, 1 Fabaceae seed, 18 Hulled Barley seeds, 4 Gramineae seeds, 20 Naked Barley seeds, 17 Bread Wheat seeds and 5 indistinguishable fragment seeds (Due to the severe damage, the seeds are not recognizable).

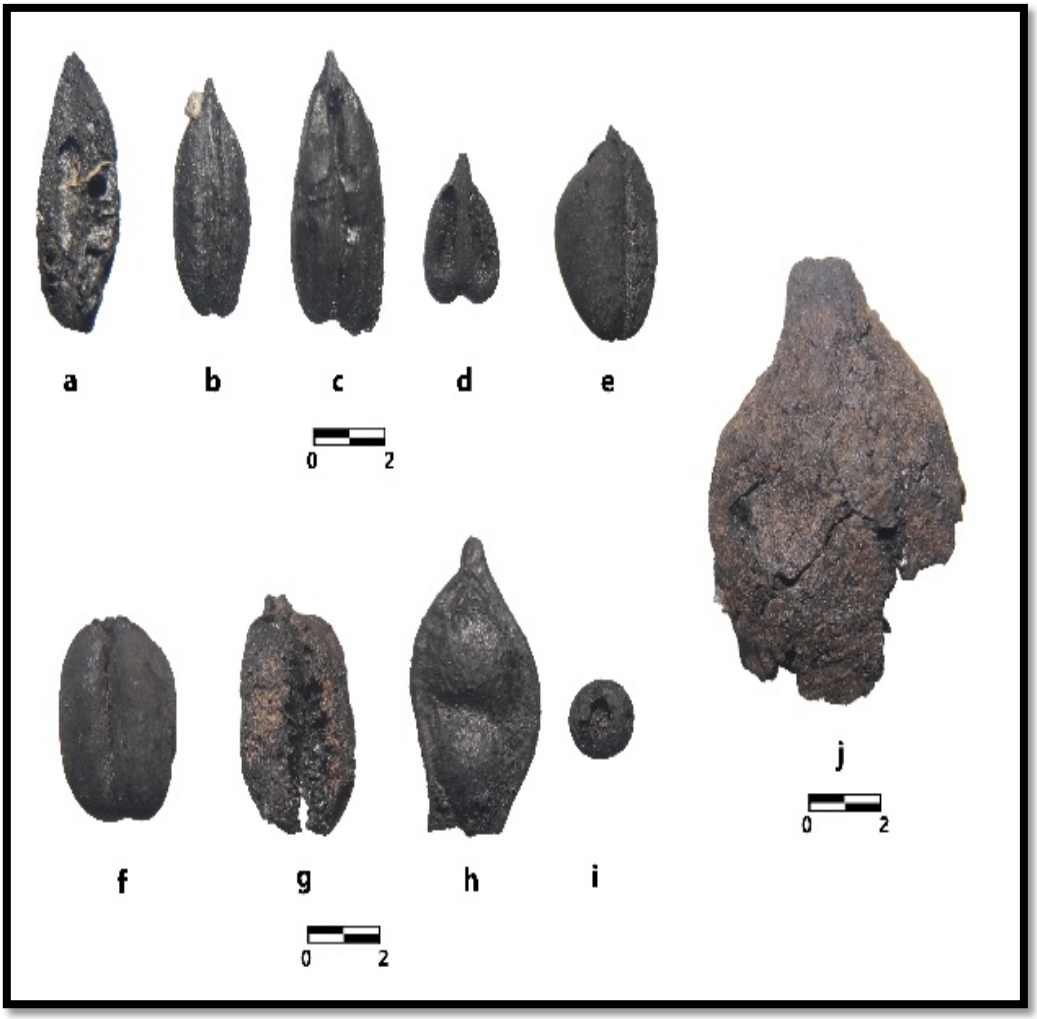


*Figure 7: plant findings in locus 8032, a: Barley, b: Hulled Barley, c: Naked Barley, d: Grape (V. vinifera), e: Wheat, f: Bread Wheat, g: Wheat, h: Fabaceae, i: Galium, j: probably Quercus (author).*

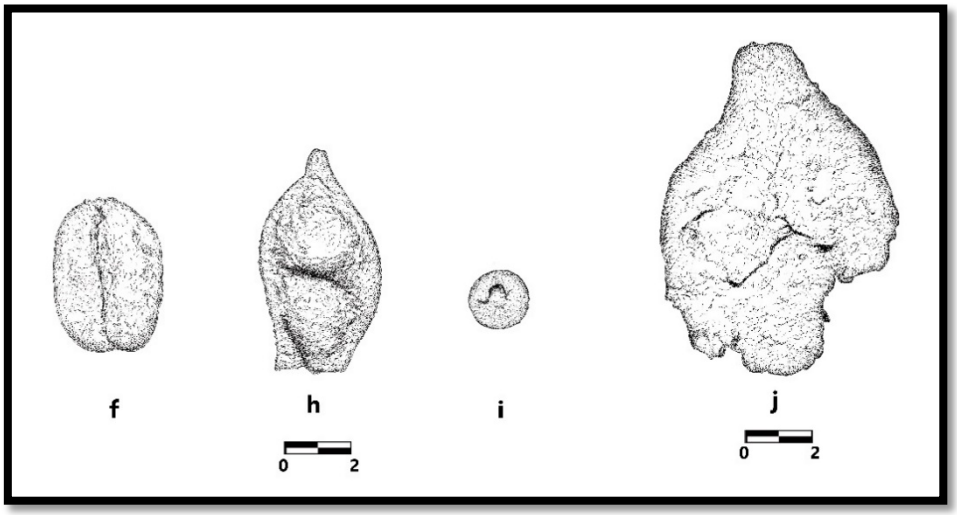


Figure 8: Designing a number of plant findings of Locus 8032, f: Bread Wheat, h: Fabaceae, i: Galium, j: probably Quercus (author).

**Loc8033**

This locus belongs to the contents of locus 8021. Locus 8021 is the second oven found. In the upper part of this locus (8033) debris and brick were found but in the lower part ash and burnt soil were discovered. The Sediment of locus was dry and burnt macro remains are visible with the naked eye. 57-liter soil selection was used for flotation from the lower part. Findings are visible in table 1. After sorting, Plant findings in locus 8033 included 20 Barley seeds and 1 indistinguishable fragment seed (Due to the severe damage, the seeds are not recognizable).

**Loc8043**

This locus belongs to the contents of locus 8042. Locus 8042 is the seventh oven found. In the upper part of this locus (8043) a little debris was found but in the lower part soft ash was discovered. The Sediment of the locus was dry and burnt macro remains are visible with the naked eye. 19-liter soil selection was used for flotation from the lower part. Findings are visible in table 1. After sorting, Plant findings in this locus included 1 Bread Wheat seed, 4 Naked Barley seeds and 2 indistinguishable fragment seeds (Due to the severe damage, the seeds are not recognizable).

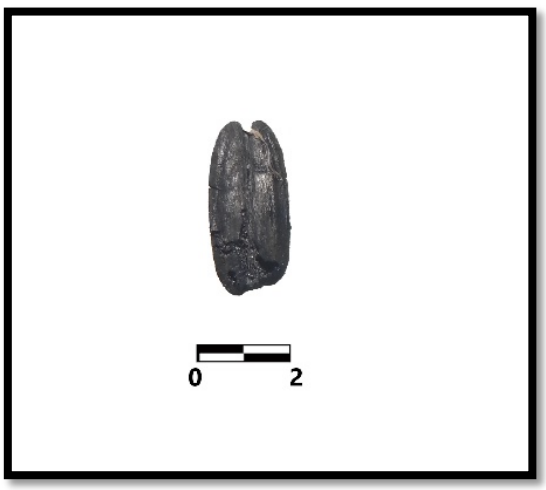


Figure 9: plant finding in locus 8033, Barley (author).

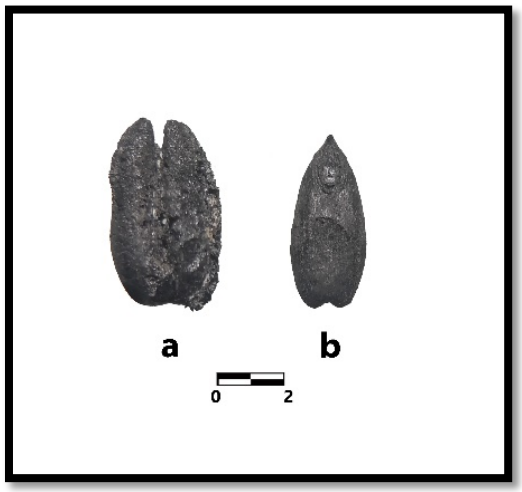


Figure 10: Plant finding in locus 8043, a: Bread Wheat, b: Naked Barley (author).

**Loc8047**

This locus belongs to the contents of locus 8046. Locus 8046 is the eighth oven found. In the upper part of this locus (8047) a little debris was found but in the lower part ash and burnt soil were discovered. The Sediment of the locus was dry and burnt macro remains are visible with the naked eye. 37-liter soil selection was used for flotation from the lower part. Findings are visible in table 1. After sorting, Plant findings in this locus included 5 Bread Wheat seeds, 7 Barley seeds, 2 Grape (V. vinifera) seeds, 1 Naked Barley seed and 1 Indistinguishable fragment seed (Due to the severe damage, the seeds are not recognizable).

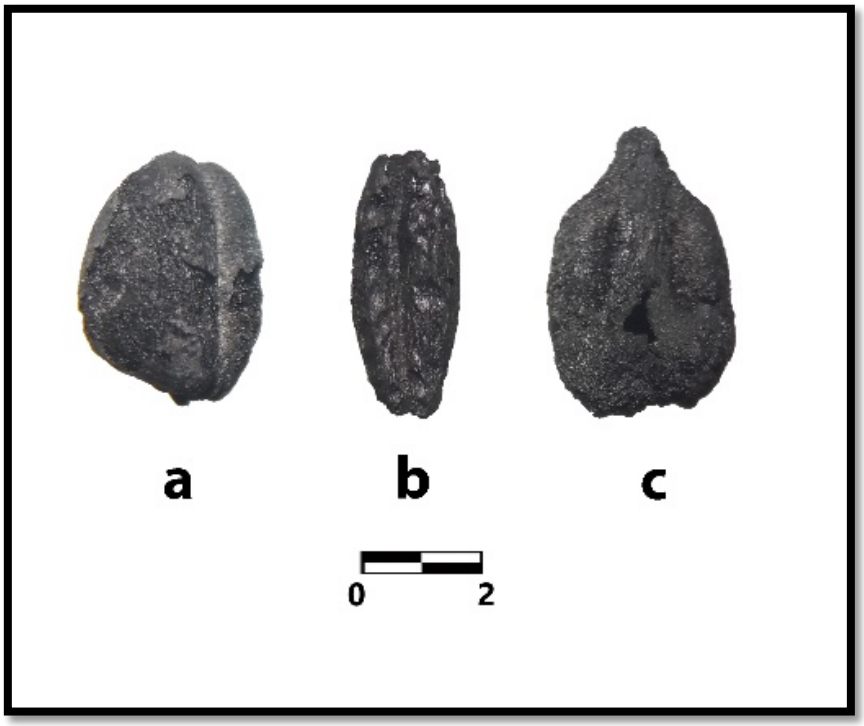


*Figure 11: Plant findings in locus 8047, a: Bread Wheat, b: Barley, c: Grape (V. vinifera) (author).*

**Loc8050**

This locus belongs to the contents of locus 8049. Locus 8049 is the nineth oven found. In the upper part of this locus (8050) found a little debris was found but in the lower part ash and burnt soil were discovered . The Sediment of the locus was dry and burnt macro remains are visible with the naked eye . 25-liter soil selection was used for flotation from the lower part . Findings are visible in table 1. After sorting, Plant findings in this locus included 5 Emmer Wheat seeds, 21 Gramineae seeds and 1 indistinguishable fragment seed (Due to the severe damage, the seeds are not recognizable).

**Loc8054**

This locus belongs to the contents of locus 8053. Locus 8053 is the eleventh oven found. Locus 8054 is full of ash. The Sediment of the locus was dry and burnt macro remains are visible with the naked eye . 15-liter soil selection was used for flotation from the lower part. Findings are visible in table 1. After sorting, Plant findings in this locus included 1 Grape (V. vinifera) seed, 2 Wheat seeds, 1 Pisum Sativum seed and 1 indistinguishable fragment seed (Due to the severe damage, the seeds are not recognizable).


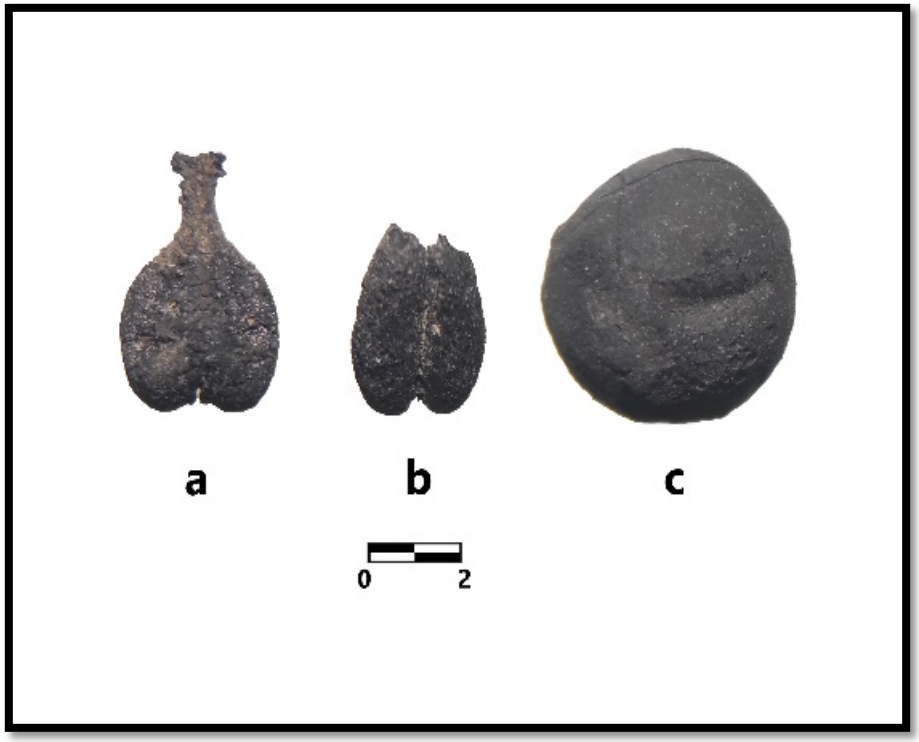


Figure 12: Plant finding in locus 8050, Emmer Wheat (author). *Figure 13: Plant findings in locus 8054, a: Grape (V. vinifera), b: Wheat, c: Pisum Sativum (author).*

Table 1: findings in different locus (author).

| Order | Light Floatation | Seeds | Snail | Charcoal | Soil Pack | Bones | Litre Collect |
|---|---|---|---|---|---|---|---|
| 1 | TR: D8-Loc8032 | ✓ | × | ✓ | ✓ | ✓ | 54 L |
| 2 | TR: D8-Loc8033 | ✓ | ✓ | × | ✓ | × | 57 L |
| 3 | TR: D8-Loc8043 | ✓ | × | × | × | × | 19 L |
| 4 | TR: D8-Loc8047 | ✓ | ✓ | ✓ | ✓ | ✓ | 37 L |
| 5 | TR: D8- Loc8050 | ✓ | × | × | ✓ | × | 25 L |
| 6 | TRD8-Loc8054 | ✓ | ✓ | × | ✓ | × | 15 L |
| | | | | | | | 207 L |

As you can see in the table above, there are very few animals bone remains in the collected samples. But what was found in all the ovens are the remains of plants. All the remains are kept in the heavy fractions from flotation, and the remains related to charcoals and snails will be studied separately by experts.

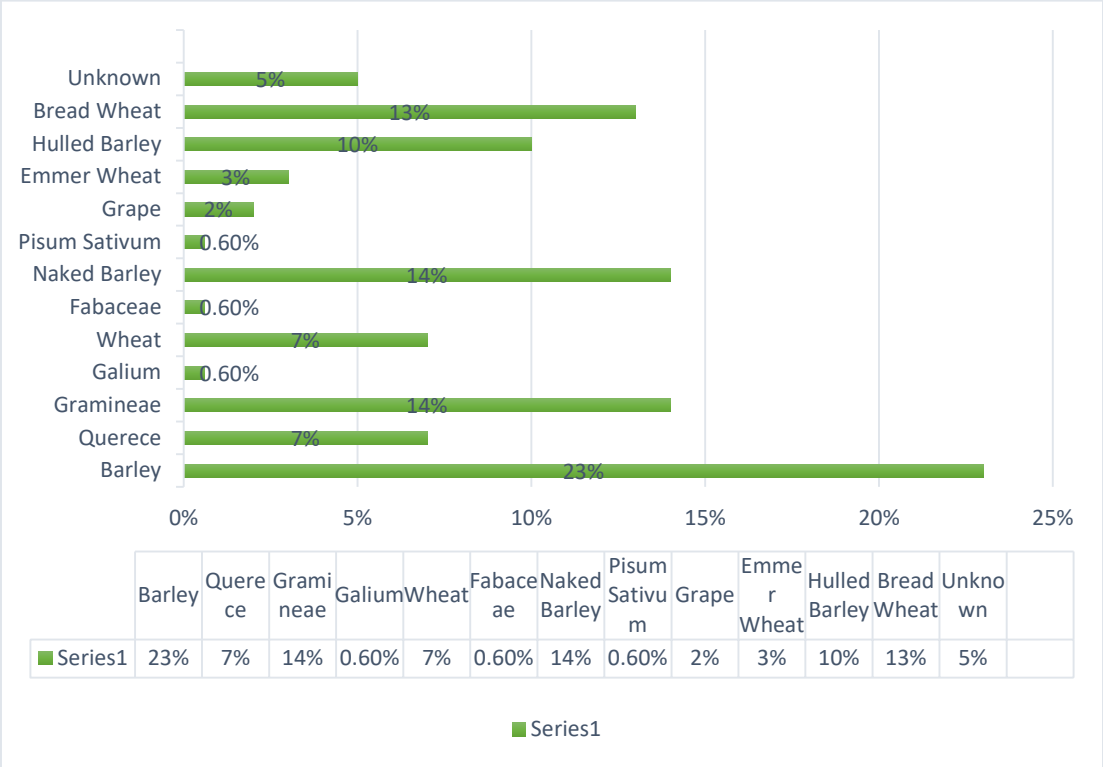


Figure 5: Total percentage of plant findings in Feyzabad area (author).

## 5.Results and Analysis

Even though only 6 ovens were studied out of the 11 existing ovens, the information obtained also gives us a better understanding of the Cereals, common weeds and other plant species in Feyzabad area during the Islamic era. Agricultural economics is clearly more complex than it is addressed in this study, but other investigations and researches such as Charcoal related studies, geology and studies related to climatic conditions should be done in order to provide more reliable results in this regard.

Before talking about the functionality of the stoves, it should be mentioned that a piece of a crucible was found in the small area where ovens 8, 9, and 11 are located.

Apart from what will be said in the results of this research, maybe in the future, by conducting further investigations, a number of stoves that have not been sampled will be related to metallurgy matters.

Now, based on the studies, we will answer the following questions:

The identified plant species includde Gramineae, Barley, Hulled Barley, Hulled Barley, Wheat, Bread Wheat, Emmer Wheat, Grape (V. vinifera), Quercus, Galium, Fabaceae, Pisum Stivum (Reinder, Cappers and Bekker, 2012).

Based on the high amount of plant finds in the ovens compared to other materials in them, it is possible that the sampled ovens were related to cooking and daily activities. Probably, this space, which is located inside the royal citadel, is related to cooking that adheres to the inside of the citadel. Among the ovens, the 8032 oven has more plant variety than the other ovens. If we consider that the plant remains found in the other ovens are limited to the same identified species (that is, other more diverse species have not been completely destroyed due to reasons such as high heat), then the 8032 ovens probably have more and more daily use than the others.

Based on what you saw, Bread Wheat was found only in two ovens, 8032 and 8043. Therefore, Bread or products consisting of Bread Wheat was probably baked mostly in these two ovens. The presence of the common Galium weed along with the grains in this oven can indicate the use of weeds for fuel supply or the agricultural work in the area itself and the accidental entry of this weed along with the grains in the oven. It is even possible that both assumptions are correct. Also, they probably used oak wood as fuel. Also, in general, Barley is found more than wheat. Regardless of the sampling method, this may indicate climate change. Although wheat is more popular among people, people grow more Barley when the humidity is low and the weather is warmer. Due to Barley's resistance to humidity, this plant is more economical for people. Hulled Barley and Naked Barley were found in close numbers. Therefore, barley in general has both human consumption and animal consumption. And probably animal husbandry has also been popular in this region due to the existence of this type of Barley for animals.

Probably, in the subsistence economy of this period, along with the specialized work of the people, agriculture and animal husbandry are still prevalent.

**6.Acknowledgements**

First of all, I would like to thank Mr. Alireza Sadeghzadeh and Mrs. Fatemeh Mojibian for their help in the flotation work. Also, I am grateful to Mr. Seyyed Mohammad Hosseini for presenting the trench plan (picture 2) and to Mrs. Mobina Gol Babaei for designing the plant seeds (picture 6).

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# مطالعات باستان شناسی در محوطه فیض آباد شهرستان آران و بیدگل

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## چکیده

باستان‌شناسی یکی از علوم میان‌رشته‌ای در باستان‌شناسی است. باستان‌شناسی به مطالعه بقایای گیاهی در بافت‌های باستان‌شناسی می‌پردازد. بر اساس یافته‌های گیاهی، موضوعاتی مانند معیشت مردم، کشاورزی، پوشش گیاهی، تغییرات آب و هوایی، قدمت گذاری و غیره را مورد بحث قرار می‌دهد. بنابراین، این دوره می‌تواند به بسیاری از سؤالات باستان شناسان در مورد یک محوطه باستانی و مردم پاسخ دهد. در سال‌های اخیر باستان شناسان توجه زیادی به این حوزه داشته و سعی در استفاده از افراد متخصص در کاوش‌ها داشته‌اند. یکی از کاوش‌هایی که به باستان‌شناسی توجه دارد، محوطه فیض‌آباد است. این سایت دارای دوره‌های اسلامی است. در حفاری در سال ۲۰۲۲ در این سایت تعدادی تنور پیدا شد که نمونه‌برداری از آنها انجام شد. در این تحقیق قصد داریم به سؤالاتی مانند نحوه عملکرد کوره‌های نمونه‌برداری شده، شناسایی بقایای گیاهی در کوره‌ها پاسخ دهیم. در نهایت با ترکیب اطلاعات به دست آمده، زندگی مردم این دوره را روشن‌تر خواهیم کرد. با انجام این تحقیق اطلاعات ما از زندگی مردم این منطقه، معیشت آنها و انواع بقایای گیاهی رایج مورد استفاده در این منطقه افزایش می‌یابد. همچنین اطلاعات خرد در مورد شرایط اقلیمی به دست خواهد آمد. پس از بررسی‌ها و تحقیقات لازم مشخص شد تنورهای یافت شده در ترانشه D8 مربوط به پخت‌وپز مربوط به قسمت داخلی ارگ سلطنتی است. در کنار کارهای تخصصی‌تری که در حال انجام است، دامداری و کشاورزی رواج دارد. برخی تغییرات آب و هوایی مانند هوای گرم‌تر و رطوبت کمتر نیز شناسایی شدند.

**واژه‌های کلیدی:** باستان‌شناسی، باستان‌گیاه‌شناسی، فیض‌آباد، گیاهان، دانه‌های کربن شده.

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# The Study of Mining and Metallurgy in the Central Part of Bam County Based on Archaeological Surveys and Historical Sources

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**Abstract**

The Kerman region stands out as one of the most significant mining areas globally, owing to its extensive and abundant mineral resources. Bam County, situated in the southeastern part of Kerman, has historically served as a crucial hub connecting the southeast of Iran with Sistan and Afghanistan, attributed to its distinctive geological and geomorphological characteristics. Enjoying considerable commercial and military importance since the Sassanid era, Bam County has garnered attention in archaeological research as a strategically vital region. The exploration of Bam's archaeological sites becomes imperative for historical governments, highlighting the need to investigate and comprehend ancient centers engaged in metal smelting and mining activities. Consequently, an archaeological survey of the central part of Bam County was initiated in 2018-2019 with the specific objective of identifying metal smelting workshops and ancient mines. This article presents the outcomes of a field survey conducted in the central part of Bam County, shedding light on evidence of metal smelting centers, furnaces, and historical mining activities. The primary research inquiries center around the chronology of mining evidence in the central part of Bam County, the types of metals extracted, and the processes involved in metal mining and metallurgy within this region. Employing field and documentary methods, the research adopts a descriptive-analytical approach. The study identified and examined eight sites showcasing evidence of smelting and slag, one ancient mine, and two active mines. These sites have been associated with the extraction and processing of metals and elements such as tin, zinc, lead, silver, iron, and, to a lesser extent, gold. Notably, the substantial volume of zinc and zinc oxide processing in seven sites holds significance. Although cultural materials for chronological dating were absent in the investigated sites, historical sources indicate that the extraction and smelting of these metals in the region date back to at least the 3rd century AH (9th century AD) and persisted until the Qajar period.

**Keywords**: Southeast Iran, Metallurgy, Central Bam County, Smelting, Ancient Mines.

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## 1. Introduction

The identification of metalworking sites, workshops, and the exploration of the origins of metals, as well as the methods employed in metalworking and metallurgical activities, constitutes a critical facet of archaeological studies. These investigations play a pivotal role in elucidating cultural evolutions, subsistence patterns, economic and political relations, and the dynamic interplay between humans and their environment within distinct regions. Furthermore, the imperative of introducing and documenting evidence and activities related to ancient mining and metallurgy is underscored by geological transformations, natural factors, threats, and contemporary human interventions, particularly in the context of current mineral economy plans.

The mineral-rich region of Kerman, encompassing approximately 50,000 $km^2$, spans the western, southern, and southeastern regions of Kerman province. This area, renowned for hosting the richest mineral deposits in Iran, has long been a focus of archaeological attention. Noteworthy sites such as Tal-i Iblis, Tepe Yahya, Sheikh Ali, and Khabis (Shahdad) have been documented, along with numerous smaller and larger mining centers, metal smelting locations, and accommodations for metalworkers, totaling over one hundred sites. Significant ancient mining activities are evident in locations such as Gol Gohar iron, Midok copper, Sarcheshmeh copper, lead and zinc deposits in Qanat Marwan, among others (Momenzadeh, 2009: 255). Excavations and surveys, such as those at Tel-i Iblis in Bardsir Plain, have yielded valuable evidence of ancient metalworking (Caldwell, 1967). Tepe Yahya and the adjacent ancient mine of Sheikh Aali (Emami & Parvaresh, 2016) exemplify extensive metalworking activities from prehistoric times to the Islamic era (Thornton and Karlowsky, 2001). Notable metal finds in Shahdad on the western edge of Lut Desert (Eskandari & Emami, 2022) and Darestan Bam on the eastern edge of Lut Desert underscore the historical use of metal and prosperity of metalworking in the area during prehistoric times (Garajian, 2008).

Despite these significant findings, the extent and quality of studies on mining and metallurgy in this region have not adequately matched its cultural-historical importance. The strategic location of the southeast of Iran as a passage and communication bridge between Central Iran, the Sistan area, Oman coasts, and the Indian peninsula heightens the importance of understanding ancient mining and metalworking activities in the Bam region. This led the authors to conduct a comprehensive survey in the central part of Bam County, with a particular emphasis on rural settlements as integral components of sustainable living in the region. The emphasis on villages in this research stems from their ancient and native names, often reflecting connections to metalworking activities. This comprehensive survey aims to elucidate the chronology of mining evidence in the central part of Bam County, identify the types of metals extracted, and comprehend the cycle of metal mining and metallurgy in this region.

Recognizing the economic significance of mining and its role in shaping settlements, the research endeavors to unravel the archaeological evidence of the production cycle. By understanding the potential of metalworking in this region and the residents' adept utilization of ecological facilities, such as water resources, vegetation, and mineral deposits, it becomes possible to gain insights into the historical exploitation of natural resources and the development of local communities.

## 2. Methodology

In order to collect the findings, first a comprehensive survey was conducted with an emphasis on rural settlements as an ancient part of sustainable living in the Bam region.

Based on this, the distribution of archaeological data and mining features in each site was separately investigated step by step. Then, some of the findings (such as slag and other metallurgical remains) were transferred to the Department of Geology and Mineral Exploration for laboratory studies, in order to have a better look to the chemistry and mineralogy of the objects studied in this research. Furthermore, part of the information was collected from documentary sources. Finally, after classifying and describing the results, all investigations have been done on the selected samples.

## 3. The Background of Archaeological Research

Among the initial field surveys conducted in the Bam region, Ali Akbar Sarfaraz's brief visit to Tel-i Atashi in 1966 marked an early exploration. Subsequent to Sarfaraz, Ahmad Mostowfi, affiliated with the Department of Geography at the University of Tehran, directed attention to Bam County in 1973. In his study on the Lut Desert, Mostowfi published concise yet valuable reports encompassing natural geography, historical geography, and archaeological evidence specific to Bam County. Following the destructive earthquake in January 2002, comprehensive archaeological research in Bam and its vicinity commenced under the guidance of the late Shahriar Adl, the cultural representative of UNESCO. The inaugural survey season of Bam County transpired under the supervision of Mohammad Taghi Atai in 2013. Subsequent visits to the Lut Desert and the Daristan Bam region, supervised by Omran Garajian in 2007, contributed to the understanding of the area. A subsequent survey season in Bam County, overseen by Shahram Zare in 2008, encompassed the wider territorial limits, including Narmashir, Farhaj, and Regan. Shahriar Adl subsequently identified Tel-i Atashi as the prehistoric cultural landscape of Bam County during the pre-pottery era, culminating in excavations in 2008 under the leadership of Omran Garajian's Daristan Prehistoric Archaeology Research Team.

In 2012, Asadollah Jodaki identified evidence of three ancient mines near the village of Karak on the Bam-Nartij road, leading to the analysis of mineral samples from this site. The subsequent surveys included the collection and analysis of rock samples from the Bam citadel and the natural rock beneath it (Atai and Zare, 2016). The research trajectory continued with magnetometric surveys by Mohammadkhani and Garajian in the Daristan region in 2011, followed by Garajian and Moten's successive seasons of surveys and excavations from 2016 to 2018. In the summer of 2008, Shahram Zare excavated Afraz/Gosal, Darzin, Bidaran, and Bam sites. Additionally, Zare conducted the third-season survey of Bam County in 2012. The exploration of the cultural landscape of Bam persisted through Shahriar Adl and Leila Fazel's collaborative efforts from 2012 to 2015, encompassing the four counties of Bam, Narmashir, Fahraj, and Regan. In 2012, Asadollah Jodaki identified evidence of three ancient mines around the village of Karak on the Bam-Nartij road, and two samples of minerals from this site were analyzed. In subsequent surveys, samples of the rocks from the Bam citadel and the natural rock below it were collected and analyzed (Atai and Zare, 2016).


Figure 1. Two samples of metal artifacts discovered from site B.5 of Daristan, Bam County (Daristan Archaeology Board, 2008)

## 4. Geographical and Geological Location of the Study Area

The city of Bam (58˚20′E, 29˚6′N, 1060 masl) is located about 190 km southeast of Kerman City (Fig. 2). The natural boundary of Bam County is limited from the north to the Kaboudi Mountains and Lut Desert, from the east to Lut Zangi Ahmad and the Nayband fault (Afraz, 4 Km east of Bam City), from the south to the Bam Plain and the Pishkohs, and from the west to the Darzin Plain and the Darzin fault (Nabawi, 1976: 61).

The political boundaries of Bam County are limited from the north to Kerman County, from the east to Narmashir and Regan counties, from the south to Regan and Anbarabad counties, and from the west to Jiroft County. Between the two provinces of Kerman and Sistan-Baluchistan and besides their only communication route, Bam is the only city that has maintained its social and political centrality from the past to the present day. The location of Bam is very important because it is located on the four major communication routes between Hormuz (present-day Minab) and Bandar Tays (near Chabahar), Sistan, and Gwashir (present-day city of Kerman). Bam connected the Oman Sea and the coasts of India and the caravans that were passing through thousands of kilometers of desert roads to the northern cities such as Kerman, Yazd, Tabas, "Nishapur", and Rayy. In fact, it connected the spice and pepper routes to the Silk Route (Bastani Parizi, 1992). In the past, Bam was called Dar al-Arba’ah (the place of Arba’ah) and the reason for that was the presence of four prestigious cities in a limited area that was under the supervision of a governing area. In some historical sources, these four cities are mentioned as “Bam, Narmashir, Nessa and Regan” and in others as “Bam, Narmashir, Nessa and Ghazan Khasat”. Nowadays, Bam is known as the gateway to southeastern Iran because the only communication route to southeastern Iran passes through Bam. This city is the most reliable and valuable historical and ancient city between Kerman and Sistan and has maintained its economic and administrative centrality from the past to the present (Vaziri, 1983).

The volcanic-sedimentary belt of Dehj-Sardoueyeh, with a length of about 955 km and a width of about 45 km, is completely located within Kerman province. This belt starts from Anar and Dehj regions in the northwest-southeast direction and ends at Jebel Barez of Jiroft. The activity of this belt started intensively from the Eocene era and continued until the Quaternary. The Eocene formations occupy the most important and extensive geological units of this zone (Aghanabati, 2004).


Figure 2. Location of Bam County, Kerman province (Statistical Center of Iran, 2014)

## 5. Ancient Mines and Metalworking Sites

Archaeological surveys were conducted in the central part of Bam County, which includes the two regions of Abareq and Deh Bakri, with the aim of introducing metal smelting and mining centers (Fig. 3).

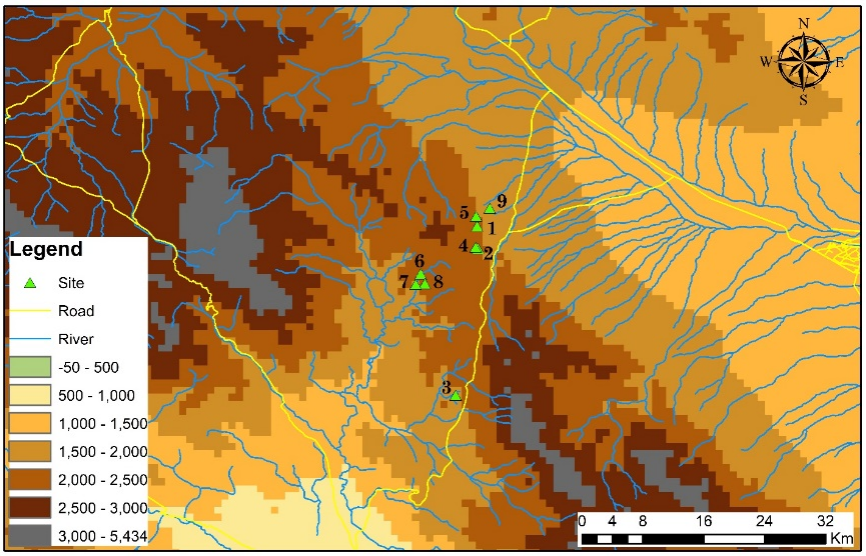


Figure 3. Location of surveyed sites in the Marqak and Dehbakari areas: 1-Kooh Chāh, 2-Marqak, 3-Kahno, 4-Se Darān, 5-Bāgh Gooni, 6- Pāy Chenārha, 7-Zeryā, 8-Asiyākadeh, 9-Khlthā

## 5-1. Abareq/Awaraq area(1)[1]

Awaraq, Abareq, or Abarik, located 50 km northwest of Bam County, which some also call Awaraq, is an old village in the Bam region. This village is limited to Mount Kol-e Gavi from the north, Mount Deh Bakri from the south, Mount Red from the west, and Mount Kabudi or black gold from the east. The seasonal river Tahroud flows in the southwest of the village. Mount Shah Chehel Tan is located in the northwest and Mount Red is located in the west of the village. The hot water that originates from Mount Shah Chehel Tan flows in the west of the village (Assaadpour Behzadi, 2002: 54).Stone Castle or Zangi Castle of Abareq[2] (2) is located about 46 km northwest of Bam County and about 500 m east of the Posht Qale village of Abareq. The bed of the Tahroud seasonal river is located in the west and southwest of it, and the Kerman-Bam road passes 2 km east and northeast of the castle. The castle is built on top of a rocky ridge about 30 m high and its plan is similar to the English letter L. The castle facilities start from the slope of the rocky ridge and continue to its top. Parts of the walls and several towers of this castle with a height of 3 to 4 m remain. The walls around the castle are 2 m thick. There was a well on top of the ridge in the heart of the rock, which is closed today (Zare, 2015).The active zinc, lead, and silver mine of Khan Khatun is situated 30 km from Abareq. Another active mine in this area is the Sarvestan Bam marble mine, which is located on the Bam-Jiroft side road (Fig. 4 & Fig. 5).

Figure 4. Abareq Castle, view from the south and north (Khojasteh Behzadi, 2019)

1. In his travelogue, General Sykes mentioned various samples of lead and zinc in the northwestern mountains of this region (Sykes, 1984: 251). Firouz Mirza Farmanfarma (1963: 6) in his travelogue of Kerman and Baluchistan mentioned the hot spring of this region, and Professor Haynes Gobeh (1991: 367) also mentioned this settlement.

2. In the south of Abareq, you can find ruins and an old castle. “When we go from Tahroud Valley towards Sarvestan, it is visible a large castle and a ruined building on a high hill overlooking the riverbed. A huge fence made of thick Sasanian mud and clay is the exterior of the castle” (Mostowfi, 2005).

Figure 5. General view of the distribution of slags and clay cylinders (Khojasteh Behzadi, 2019)

### 5-1-1. Abareq-Keshit Road

One of the surveyed places in the Abareq district is the Abareq side road towards the Keshit village (a part of Kuhbanan, Kerman). In this area, between many mounds and vegetation, a 200-meter-wide surface is covered with many traces of clay cylinders, coal, and furnace slag. On the way back from the mentioned road, on the south side, there is a structure made of clay, mud, and bricks, which the local guide referred to as a furnace (Fig. 6). In general, the Abareq region and the mountains around it (Nero, Kaput, and Siyahkuh) all have traces and metal deposits, including zinc, copper, and iron.

Figure 6. Pottery found from the Abareq site (Khojasteh Behzadi, 2019)

### 5-1-2. Marqak and Deh Bakri

Marqak and Deh Bakri are mountainous areas of the western region of Bam Plain. Firouz Mirza Farmanfarma (1963:80) mentioned this village as the “Eighteenth Station” in his travelogue of Kerman and Baluchistan. Syeks also mentioned this region in his travelogue. 54 km west of Bam and 4 km west of the Jiroft-Darzin asphalt road, the Marqak River, which originates from the Jamali and Bakhtiari mountains, flows in the south of the village. Mount Ab Cheko is located in the north and northeast of the village. Among the villages related to this large village are Dahaneh Marqak, Gol Malek, Deh Redin (Darreh Din), Shirkash, Se Darān, Bidkhon, Ab Shuro, Tafiat, Do Jangan, Deh Nou, Zaria, Kohanu, Kohan Ab, Gbaro, Gezma, Gol Abad, Gol Andaz, and Do Gol. The Deh Bakri River, which originates from Degu and Barez mountains, flows in the east of the village. Mount Shir is in the east and Mount Red is in the west of the village. This river has divided Deh Bakri into two eastern and western parts. Deh Bakri is a region with an area of about 70 $km^2$ (Assadpour Behzadi, 2002: 65, 69).The Kerman

mountains with high and snow-capped summits such as Mount Hazar (4500 masl), Mount Chihltan, and Mount Lalehzar as well as rivers such as Halilroud, Tahroud, Chari, Bampur, and Lalehzar have provided favorable conditions for the establishment of human societies since the Epipalaeolithic era. As a corridor between two dry deserts, they have linked ancient civilizations together. Tepe Sialk Kashan is located near the end of the northern part of the Kerman mountain chain, Tel Iblis is located in its central part, and Bampur Valley is located near its southern end (Abbas-Nejad, 1994).The slopes of Jebal Barez are the most suitable part of the region in terms of pastures. The vegetation of the slopes includes mesquite (a shrub with leaves similar to Konar and covered with sharp thorns), Konar (cedar tree), and Astabraq, which is from the family of Arab-Indian plants. In Jebal Barez, there are also plants such as Gavan (Astrog jluss), Artemisijberby (Artemisijberby), and pistachio (Pistaeiazeera). In the past, Baneh (Pistacia Atlantica) forests covered vast mountainous areas, but today it is being destroyed.The remains of Deh Bakri Castle are located about 30 km southwest of Darzin and about 50 km southwest of Bam on a mountain overlooking Deh Bakri Pass. The castle was built on the west side of Deh Bakri Pass on the right side of the Deh Bakri-Jiroft asphalt road and above the tunnel. The Deh Bakri area is one of the strategic communication points on the road from Bam to Jiroft, and the location of the castle is important from this point of view. The castle is built on a flat surface on top of one of the ridges of the pass, which is about a 20 × 50 m area. On this flat surface, a lot of building materials such as rubble and bricks are scattered. The vegetation of the mountain is Pistacia Atlantica, thorny shrubs, artichoke bushes, and wild plants, which partially cover the surface and surroundings of the castle (Zare, 2015).

**5-1-3. Kooh-e Chāh**

At the beginning of the Bam-Deh Bakri road, along Jebal Barez, on the left side of the road, there is a village called Gavan Gargi, on its slope and on the way of the river, there is a mountain called Kooh Chāh (2122 meters above sea level). On the outer surface of the mountain slope towards the peak, there is a large scattering of slag and traces of metal melting. Near the peak, a deep and square-shaped well with dimensions of approximately 2 × 2 m shows the effects of mining ore over the years. On the right side of this main tunnel, smaller and interconnected tunnels can also be seen (Fig. 7 & Fig. 8).

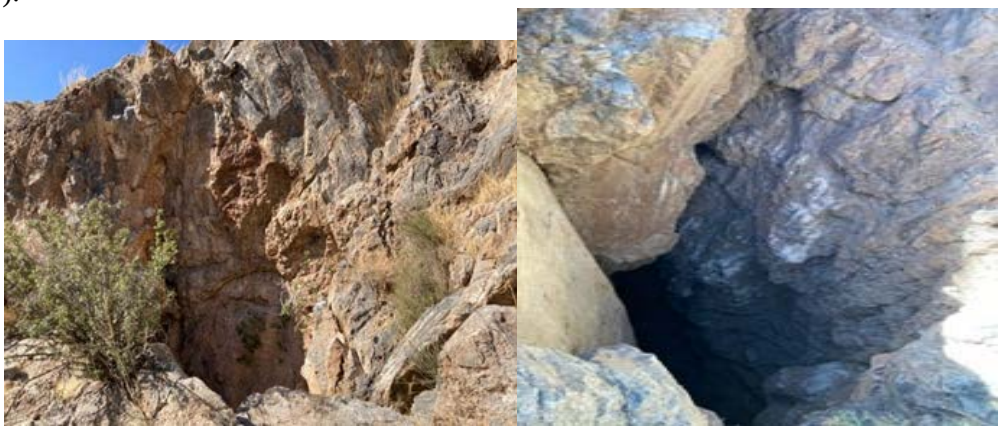

Figure 7. Stone Samples of Kooh Chāh (Khojasteh Behzadi, 2019)

Figure 8. Sub-tunnel (Khojasteh Behzadi, 2019)

### 5-1-4. Marqak

There is a bathhouse known as the hundred-year-old bathhouse in the Marqak village. In addition, traces of clay cylinders can be found in the gardens and under the roots of the trees that appeared due to the flood (Fig. 9).

Figure 9. Marqak village (Deh Redin) (Khojasteh Behzadi, 2019)

### 5-1-5. Kahno forest

On the right side of the Deh Bakri- Jiroft road, after the first tunnel, there is a dirt road that passes through a dense forest called Kahno (2123 masl). After traveling for almost 3 km, it reaches a village called Chanar Sokhteh (2141 masl). In the middle of this path and in a large area of this forest, traces of metal melting furnaces with an area of 1×1m can be seen. Iron slag, cylindrical, and conical clay pieces related to the furnace are scattered on the surface of the Kahno forest. A small number of iron ore pieces and brick pieces can also be seen on the site. There is a circular space of stones and mud on the site. A part of the site is slightly hollow, which looks like a furnace. In another part of the site, the remains of the furnace building can be seen. This place is located approximately 200 m from the first point.

In the west of the Kahno village, in the central part of Bam County and Deh Bakri area, and in the northern part of the river bed known as Darbadi Valley, there are traces of furnaces. The effects of the furnace are visible in the form of layers of ash and charcoal. In a large part of the river bank, which fell due to the flood, the traces of furnaces are visible. Among the layers of coal and ash, cylindrical pieces related to the

furnace and metal slag can be seen (fig 10). There are stones with cup patterns in its vicinity.

Figure 10. Scattering of remains of furnace on the Kahno forest site (Khojasteh Behzadi, 2018)

### 5-1-6. Castles of Se Darān

In the Se Darān village (1993 masl) located in the central part of Bam county, in the upper Marqak area, on the heights known as the Se Darān Castles in the southwest of this village, there are few remains of a historical building. In a place in the middle of the Se Darān village, next to a garden and on the river bank, there are many clay cylinders of the furnace. At the foot of this mountain, the bed of three rivers is visible. Vegetation of the site is Baneh trees, Kahkom (Acer monspessulanum), and at the bottom, fir trees (Fig 11).

Figure 11. Remains of metal smelting furnaces in the Seh Darān village (Khojasteh Behzadi, 2018)

### 5-1-7. Bāgh Gooni

The Bāgh Gooni site (1359 masl) is located in the west of the Hassan Abad village, in the middle of mountains. On the surface of this site, fine cone-shaped works (clay cylinders), slags, iron ore, copper ore, and parts of the furnace building are scattered. Surrounding the site is a dense forest of Baneh trees (Fig. 12).

Figure 12. Remains of furnace in the Hassan Abad village (Khojasteh Behzadi, 2018)

### 5-1-8. Pāy Chenārha

In the Deh Bakri area, located in the central part of Bam county, in the north of the Anaran village and among the pomegranate orchards known as Bagh Zir Mazar, on the hillside, a square-shaped structure made of rubble with lengths of 1.5 m. A large rock forms part of this wall. The space has no roof and entrance on the north side. In the middle of the space is a natural rock with an irregular geometric shape and no pattern, which is called the Ghadamgah stone. The lands around the shrine of Imam Reza (a.s.) are called Pāy Chenārha (or Pāy Chenālha) lands. On the surface of the land around this shrine, there is a significant amount of clay pieces related to the furnace in cylindrical and conical shapes. In this site, a millstone with a diameter of one meter is located among a pile of rubble (Fig 13).

Figure 13. Remains of mill and smelting furnace in the Anaran village (Khojasteh Behzadi, 2018)

### 5-1-9. Zeryā village and Asiyākadeh

In more than 25 hectares of agricultural lands of the Zeryā village and its surroundings (2074 masl), cylindrical pieces of clay and metal slag are scattered. In addition, in the west of the Zeryā village, there are traces of furnaces and metal smelters on a site called Asiyākadeh (1870 masl). This site is surrounded by mountains and the Anaran River flows from its edge. In a major part of the site, spaces have been built with stone rubble. The remains of the furnace can be seen on the surface of these spaces, and cylindrical and conical pieces and metal slag are scattered around them to a considerable extent. Besides, there are small pieces of copper ore on the surface of the site. Natural factors such as river flooding have destroyed parts of the site. The Anaran River, Pelengo Qanat, and the springs of Kalil and Pelengo are located in the southwest of the site, and the spring of Imam Hosseini is in the south of it (Fig. 14 & Fig. 15).

Figure 14. Remains of Furnace on the Asiyākadeh site (Khojasteh Behzadi, 2018)

Figure 15. Remains of Furnace in the Zeryā village (Khojasteh Behzadi, 2018)

### 5-1-10. Khlthā

59 km northwest of Bam and north of the Hashr Abad village, there is a small site with dimensions of approximately 10 × 10 m, covered with metal stones and slag, which the nomads call Khlthā (1804 masl). Green and red stones can be seen on the surface of this site. The water sources of the Hashr Abad village are qanāts and seasonal rivers (Fig. 16).

Figure 16. Artifacts found from the Khlthā site (Khojasteh Behzadi, 2018)

## 6. Discussion

A noteworthy discovery in the surveyed vicinity within the central part of Bam County pertains to the identification of clay cylinders present in multiple sites, with the notable

exception of the Kohan Kooh Chāh mine. These clay cylinders are presumed to be associated with the extraction process of zinc and zinc oxide (ZnO), commonly known as Tūtiyā. While the isolation of pure zinc metal was credited to Baraslus in the 17th century AD, research by Loufer suggests that zinc oxide and lead monoxide (PbO), resultant from zinc and lead smelting furnaces, were exported from Iran during the Sassanid era, predating the discovery of the elemental form of zinc by at least a millennium. Consequently, zinc was utilized in its impure state since at least the Sassanid period. The challenge in obtaining zinc in its elemental form lies in the necessity to regenerate zinc oxide at temperatures ranging from 1200°C to 1400°C in proximity to coal, within closed containers. It should be noted that zinc metal evaporates at 906°C, and beyond this temperature, it is available in vapor form, requiring careful cooling without exposure to air (Craddock, 2018). However, historical constraints, where the entire process occurred in open-air conditions, resulted in the production of zinc oxide as the final product. Remnants of ancient furnaces utilized for zinc oxide production, still discernible today, are typically situated in valleys near water sources but have suffered significant deterioration over time due to erosive factors (Ghorbani, 2000).

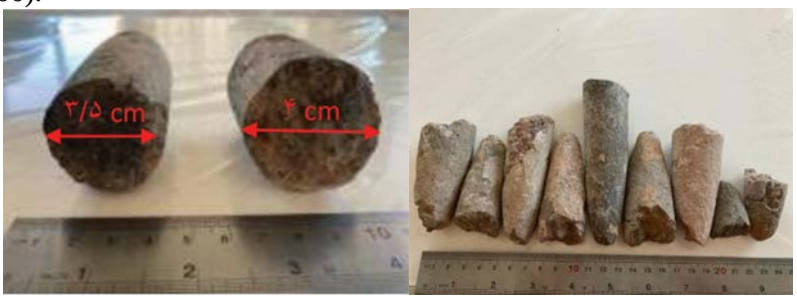


Figure 17. Broken clay cylinders in different sizes (Khojasteh Behzadi, 2019)

Regarding the method of extracting zinc oxide from ore, historical sources offer valuable insights, with Aghili Khorasani's account being particularly comprehensive and accurate. He delineates two types of two-story furnaces employed in zinc oxide production: (1) the long type furnace and (2) the short and narrow head type furnace, both featuring an oven-like space or fireplace in the lower part (Aghili Khorasani, 2003). The short version of these furnaces can be observed in Kuhbanan of Kerman. Al-Taha reported the presence of clay pens or nails around old zinc oxide mining mountains, ranging from 10 to 30 cm in length and 3.52 cm in diameter (Al-Taha, 1996: 56). Additionally, he elaborates on the method of extracting zinc oxide, involving the creation of pens and long ingots from sticky soil, colloquially known as rust soil in Iraq. These objects, with slightly narrowed ends, are dried, salted, and subsequently placed in furnace floors in various orientations. The coagulation of lead smoke during melting ensures the preservation of the smoke, preventing its dissipation. Once a significant amount of coagulated smoke is observed, the pens are broken, and the solidified smoke is separated from them (Al-Taha, 1996).

Clay cylinders resembling the pens described by Aghili Khorasani are abundantly found around zinc oxide production furnaces. Crafted in varying sizes, these cylinders measure between 10 and 30 cm in length and 2 to 3.5 cm in diameter, with their dimensions seemingly not affecting their functionality (Al-Taha, 1996). While Hamdollah Mostowfi mentions the length of these rods as one yard (Mostowfi, 2002), no rods of this length have been reported thus far. It is apparent that the clay cylinders

identified in Bam metallurgical sites likely served a similar purpose to these rods in the extraction of zinc oxide. The mineralization observed indicates the presence of baked clay, corroborating Aghili Khorasani's account. For the separation of zinc oxide, the rods were halved, and in the studied sites, all the nails are broken, with no complete samples found among them. The furnaces associated with zinc oxide extraction in different regions of Iran, as revealed through archaeological excavations, exhibit a wide, two-story structure. The lower floor takes the form of a vault, functioning as the heating space for zinc oxide production. The furnaces' fuel played a critical role in achieving the requisite temperature (960°C). Zinc oxide, produced in the form of steam, was conveyed through openings between the two floors to the upper part, where clay cylinders were positioned on the floor. Due to the lower temperature in this upper section compared to the zinc evaporation temperature, the vapor sublimated and solidified, covering the cylinders. The furnace was subsequently extinguished, and the clay cylinders, now coated with solid zinc oxide, were removed. The solid zinc oxide adhering to the head of the cylinders was deemed lighter and of superior quality. Zinc oxide obtained through this method likely retained its cylindrical shape (Ghorbani, 2000). Consequently, it appears that zinc oxide extraction was more prevalent than the extraction of other metals in the surveyed sites. Given that zinc is commonly found in association with lead and silver in minerals, the extraction of these metals was widespread in the region from Bam to Jiroft.

While this study did not yield indicative artifacts for determining the chronology and interrelationships between sites, historical sources play a crucial role in establishing the relative chronology of the examined metallurgical sites. Notably, Istakhri's descriptions from the 3rd century AH about Jiroft to Bam mines hold significant importance. In his work "Masalek and Mamalek," Istakhri notes the presence of numerous mines in the cities of Kerman, specifying iron mines in the Jebal Barez mountains. Silver mines were reported in the mountains stretching from Jiroft to Darbai branches, emphasizing the abundance of silver mines in Darbai's blessed valley (Istakhri, 1968). Consequently, it is evident that metals, particularly zinc or Tutia (zinc oxide), were extracted in the region since at least the 3rd century AH. In the 4th century AH, the author of "Hodud Al-Alam" references lead mines in the Bam and Jiroft areas (Hodud Al-Alam, 1961), indicating the simultaneous extraction of zinc alongside lead in the region during the 4th century AH. Maqdasi openly speaks about the extraction of zinc oxide from the Jebal Barez mines in the 4th century AH, underscoring the wealth and prosperity of the region (Maqdasi, 1983). The exploitation of mines and metallurgical activities persisted in the following centuries, with Abdulqasem Kashani referencing Tutia (zinc oxide) near Kerman in the 8th century AH (Kashani, 1966). Additionally, Abulqasem Kashani provides insights into the extraction process, mentioning the construction of a furnace with terracotta nails in its wall and the use of Tutia stone in conjunction with a strong fire for extraction (Kashani, 1966). The mining of lead, zinc, and silver continued in the region until the Qajar period, as indicated by Abdul Hossein Mirza Farmanfarma's account of the Abareq lead mines in Bam (Farmanfarma, 1981).

In summary, the Kerman area, particularly around Bam County, has served as a significant hub for ancient mining and metallurgical activities since at least the 3rd century AH. Beyond lead, zinc, and silver mines, the extraction and processing of various metals, non-metallic materials, and precious stones have been widespread in this region, contributing to metalworking activities. The iron mines in Jebal Barez have

attracted attention since the 3rd and 4th centuries AH (Istakhri, 1968; Ibn Hoqal, 1987). The book "Javahernameh Soltani" notes the exploitation of impure gold and jade mines in some southern mountains of Kerman. Even in the 8th century AH, jade extraction continued in these areas, as documented in the books "Geography of Minerals" and "Arais Al-Javahir," as well as "Lajevardi Kermani" (Mostowfi, 2002).

## 7. Conclusion

The central part of Bam County, particularly in the Sarvestan and Abareq regions, boasts substantial mineral potential. Presently, active marble mines operate in these areas, contributing to extraction and export activities. The Abareq area, characterized by surrounding mountains with abundant vegetation, water resources, and operational zinc and copper mines, presents favorable environmental conditions conducive to metallurgical pursuits. Geologically, the region is endowed with abundant mineral deposits within its encompassing highlands. The presence of metal smelting furnaces is indicative of extensive mining and metalworking activities, traceable at least from the Sassanid period to the Islamic era. Additionally, it holds strategic importance, situated along historical communication routes, enabling the facilitation of extra-regional product distribution through the Center-Southeast Iran communication highway. Beyond Sarvestan and Abareq, the Deh Bakri area serves as a connecting point between the cities of Bam and Jiroft. The area's extensive vegetation and seasonal rivers have historically rendered it a suitable locale for human habitation and industrial endeavors.

All the sites scrutinized in this research exhibit remnants of smelting furnaces and metal extraction activities. The prevalence of evidence such as slag, underground mining, and numerous tunnels surrounding the area attests to the extensive and sustained use of metals in this region. Remarkably, artifacts like clay cylinders, enduring environmental changes and river flooding, provide tangible indicators of copper, lead, and zinc metal extraction. Despite the absence of definitive cultural materials to establish the chronology and interrelationships among the sites, historical sources prove instrumental in constructing the relative chronology of the studied metallurgical sites. According to historical, geographical sources, and travelogues, the extraction and utilization of metals—lead, zinc, silver, iron, and to a lesser extent, gold—have been ongoing activities in these regions since at least the 3rd century AH. Consequently, considering the geological context of the region, archaeological evidence, and historical documentation, it becomes evident that the indigenous populations of this area extensively and consistently exploited the natural resources and mineral deposits in their vicinity. The substantial underground mining at Kooh Chāh, located at the inception of the Deh Bakri section and approximately at the center of the surveyed area, strengthens the likelihood that this locale served as a central supply hub for the neighboring sites.

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# مطالعه معدن کاری و متالورژی در بخش مرکزی بم ، با تمرکز بر بررسی‌های باستان شناسی و منابع تاریخی

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## چکیده

جنوب‌شرق ایران در دوره پیش از تاریخ یکی از منشأهای فلزگری جهان شناخته شده است، امروزه نیز منطقه کرمان با دارا بودن منابع عظیم و غنی معدنی یکی از استان‌های مهم معدنی به شمار می‌آید. در این میان شهر بم در جنوب‌شرق کرمان به دلیل شرایط خاص زمین‌شناسی و زمین‌ریخت‌شناسی از دیرباز به‌عنوان مرکزی برای پیوند مسیر جنوب خاوری ایران با سیستان ، افغانستان و بلوچستان بوده است و بر اساس مطالعات انجام‌شده این شهر از دوره ساسانیان اهمیت بازرگانی و نظامی زیادی داشته است. با توجه به این مهم، بررسی باستان‌شناختی بخش مرکزی شهرستان بم ، با هدف شناسایی مراکز ذوب فلز و معادن کهن در طول سال‌های ۹۷-۹۸ آغاز شد. در این مقاله، ۸ محوطه با آثار ذوب و سرباره ، یک معدن کهن و دو معدن فعال که مورد بازدید قرار گرفت ، معرفی می‌گردد تا با استناد به نتایج بررسی پیمایشی در بخش مرکزی بم ، به شواهد و نشانه‌های یافت شده از مراکز ذوب فلز ، کوره‌ها و معدن‌کاوی کهن بپردازد. شواهد و مدارک حاصل از یافته‌های به‌دست‌آمده از فلزگری باستانی و معرفی مراکز ذوب فلز در این ناحیه از شرق کرمان موجب معرفی و نشان دادن چشم‌انداز جدیدی از فعالیت‌های فلزگری باستانی در منطقه است .گرچه جهت تاریخ‌گذاری شواهد سطحی چندانی به دست نیامده ، اما با توجه به منابع مکتوب تاریخی میدانیم که منطقه بم در ادوار تاریخی و اسلامی به شکوفایی صنعتی رسیده است.

**واژه‌های کلیدی:** جنوب‌شرق ایران ، متالورژی، بخش مرکزی بم، بررسی باستان‌شناختی، فلزگری باستانی، معادن کهن.

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# A Mineralogy and Elemental Analysis of Sasanian-Early Islamic Potsherds from the Jahangir Archaeological Monument in Ilam Based on Petrography, XRF, ICP, and TL Methods

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**Abstract**

To date, no experimental investigations utilizing petrographic, XRF, ICP, or TL methodologies have been undertaken for the analysis of Sasanian and Early Islamic pottery in Western Iran. Consequently, the findings of this study are anticipated to contribute valuable insights into the pottery production processes prevalent during this historical period in Western Iran. To achieve this objective, eight pottery specimens retrieved from the excavations of the Jahangir monument were submitted to the Research Institute of Cultural Heritage and the Geological Survey for petrographic analysis, while two samples each were designated for XRF, ICP, and thermoluminescence assessments. The primary research inquiries pertain to elucidating the composition and structure of the pottery, determining the firing intensity in the kiln, and discerning whether the pottery is of indigenous or imported origin. The outcomes of the experiments indicate the presence of three predominant compounds—quartz, iron oxide, and calcite—in the majority of samples procured from the Jahangir monument. Nonetheless, certain pottery specimens incorporate mica particles or chert stone in the clay composition. With few exceptions, the pottery is ascertained to be domestically manufactured, denoting its local provenance within the region. The texture of the selected pottery samples is characterized as silty, porphyritic, and inhomogeneously silty. The identification of calcite in the clay of all Jahangir pottery suggests a maximum kiln temperature of 800°C during the firing process. Furthermore, notwithstanding a limited number of exceptions, the scarcity of soil variations in the majority of pottery specimens implies a shared geographical origin.

**Keywords**: Pottery, Petrography, XRF, ICP, Thermoluminescence Dating, Jahangir.

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## 1. Introduction

In contemporary archaeological research, the pursuit of more precise scientific insights has become commonplace through the integration of interdisciplinary sciences, such as experimental mineralogy employing techniques like petrography, and chemical experiments involving methodologies like X-ray fluorescence (XRF) and inductively coupled plasma (ICP). Experimental studies serve as a foundational approach for the identification of minerals and elements constituting archaeological artifacts, notably pottery (Sardari et al., 2017: 66). The investigation of clay materials, referred to as elemental analysis of pottery, is executed through geochemical methods like XRF, inductively coupled plasma mass spectrometry (ICP-MS), and mineralogy employing polarized light microscopy. Archaeometric research, conducted over several decades on pottery, is introduced in the context of pottery analysis, aiming to apply systematic methodologies and facilitate the proper classification of studied objects based on scientific and experimental data. The classification of information often reveals similarities and differences in pottery manufacturing methods across distinct regions (Emami, 2012: 323).

Chemical studies traditionally consider the constituent elements and compounds of a substance, while phase studies focus on identifying the crystalline structure and minerals of the material (Pourmomeni, 2018: 146). Over four seasons of excavation at the Jahangir monument between 2015 and 2019, it was observed that a substantial portion of the extant cultural material comprises pottery shards. The examination of these shards holds significant potential for enhancing our understanding of the cultural developments within the region. This investigative task was undertaken through an experimental study designed to address inquiries arising during the research on selected pottery samples. Petrographic studies were conducted with the specific objective of furnishing precise information about the characteristics and mineral composition of selected pottery recovered from the Jahangir monument, as well as from other Sassanian-Islamic sites in Western Iran.

## 2. Research problem

The questions for this research are: (1) What are the mineralogical characteristics of Jahangir pottery, and (2) Based on the results of the analysis performed on the selected pottery of this monument, were they local or imported?

## 3. Research methods

The methods used in this research are petrographic-mineralogical and geochemical X-ray diffraction (XRF) experiments and inductively coupled plasma mass spectrometry (ICP-MS). These were done in order to help us understand the change and continuity of pottery technology and the main source of pottery production. In this research, eight pottery sherds discovered during the excavation of the Jahangir monument were selected, examined, and sent to the Research Institute of Cultural Heritage and the Geological Survey for petrographic testing, two samples for XRF and ICP, and two samples for thermoluminescence.

## 4. Background

The background can be expressed and analyzed in the form of archaeometric studies. To date, no scientific research using experimental methods on Sasanian-Early Islamic pottery in Western Iran has been published, and the existence of this research gap necessitates such studies more than ever.

## 5. Geographical location of the Jahangir monument

Jahangir monument is located at UTM: 606595m E, 3752695 m N, in Zarneh District in Eyvan County, 70 km northwest of Ilam Province in Western Iran, near the Kangir Border River (Fig.1).

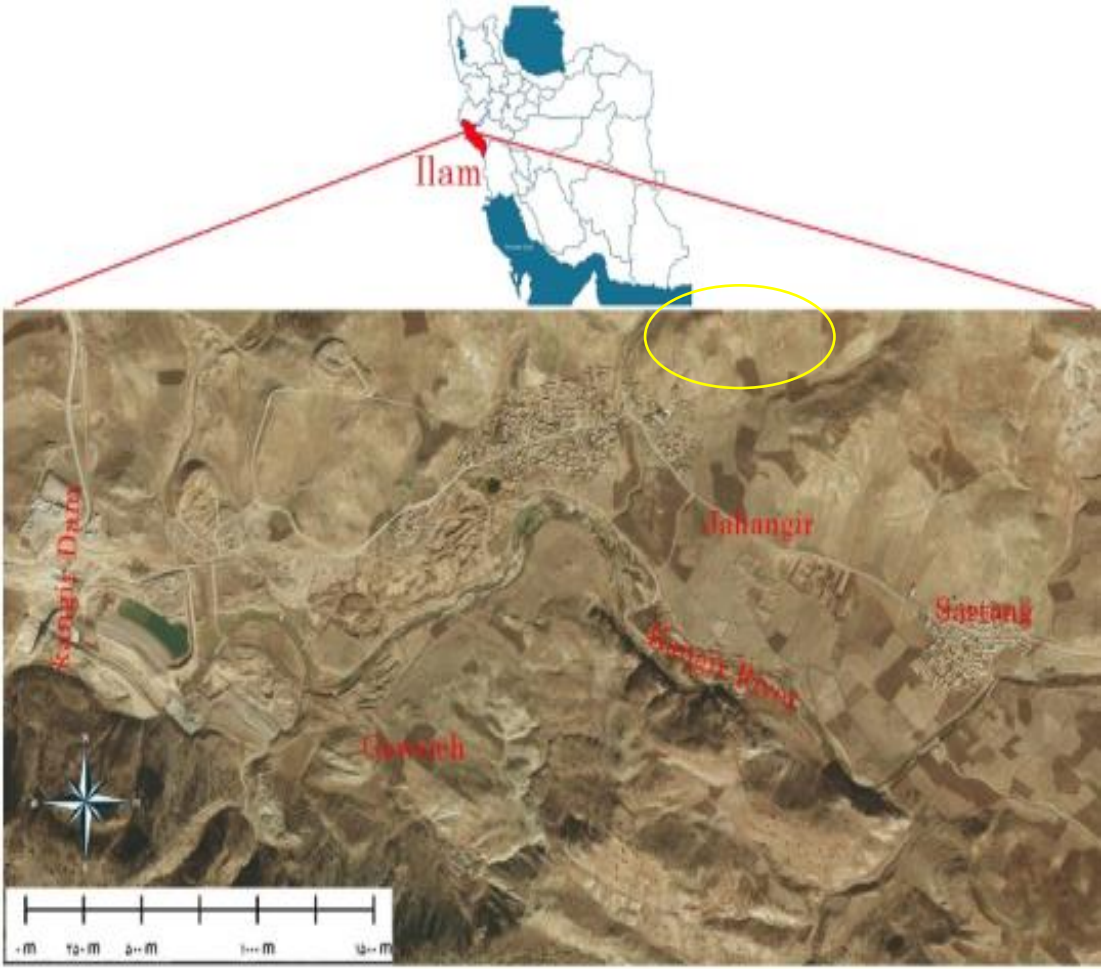



Figure 1. Geographical location of Jahangir in Ilam Province (Khosravi and Baghsheikhi 2019)

The monuments belong to the Sasanian era, which was also used during the early Islamic period. Their architecture, like other structures of the Sasanian period, includes a hall, eyvan, stoop, rooms, etc., which are all situated around an open space (courtyard). In these monuments, piers, round or rectangular columns, and arches have been used. They have been constructed using mortar immersion with riprap and half-baked and beaten gypsum mortar (Khosravi 2017; 2020, 2021a, 2021b)(Fig. 2).

.Figure 2. Rooms at Jahangir after excavations

Geology of the region In accordance with the geological classifications of Iran, the region (Stoeklin, 1968; Nabavi, 1976; Eftekharnejad, 1980) falls within the tectonic framework of the Zagros Folded Belt or Outer Zagros, thus exhibiting stratigraphic-tectonic characteristics attributable to the tectonic unit of the Zagros Folded Belt. The Zagros Folded Belt, situated in the southwest of Iran, features a northeastern unit corresponding to the well-known tectonic zone identified as the Main Recent Fault. From a global tectonic perspective, the Zagros Folded Belt constitutes a passive continental margin, in contrast to the Sanandaj-Sirjan zone, which constitutes an active continental margin. The Neo-Tethys ocean, extending northwest-southeast from Kermanshah to Central Lorestan and Eastern Khuzestan and further to Kharg Island in the Persian Gulf, is integral to this geological setting. Given Ilam Province's location within this delineated zone, the exploration of the geological history of this region in Iran is contingent upon the discernment of events occurring during the formation of the Zagros (Aghanabati, 2006: 19).

The Quaternary formations in Ilam Province are outcomes of the erosion of exposed formations within the province, with a predominant presence of fine-grained limestones in the structure of most clays. The significant synclines in the province, including Eyvan-e Gharb, Shirvan, Chardavol, and Mehran, are enveloped by quaternary sediments, constituting agriculturally fertile areas within the province (Geological Survey, 2016). On geological maps, a substantial portion of Eyvan City comprises calcareous formations, recognized as vital sources of water supply. The surrounding regions of these formations hold importance for residential settlements due to the availability of water resources. Given these circumstances, the area of Eyvan County has maintained historical significance for human habitation, attributed to the presence of calcareous formations and accessible water resources (Fig. 3).

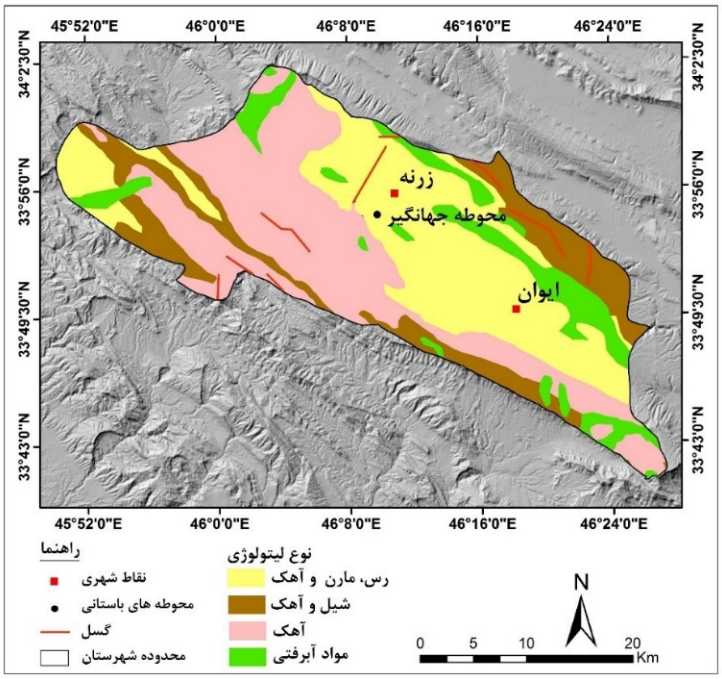



Figure 3. Geological map of Ivan and the location of Jahangir. Type of lithology: Yellow: clay, marl, and lime, Brown: shale and lime, Pink: lime; green: alluvial material (Khosravi and Baghsheikhi 2019).

## 7. Petrographic examination of pottery

Petrography is a common method in geology and archeology. It is used in geology to study rocks and minerals, but in archeology it is used not only in the study of stone objects and materials but also in the study of pottery. In general, the application of petrography for the study of pottery can provide archaeologists with a variety of information, some of the most important of which include: geological information about the origin of the clay used in pottery production, geological and technological information about materials added to the clay, technical information regarding pottery baking including temperature and firing conditions, information about the potter's actions while making pottery (Naghshineh et al., 2013: 68).

For petrographic examination, eight samples obtained from Jahangir were selected (fig. 4). Regarding the technique of manufacture, one is handmade and the rest are wheel-made. As for the degree of firing, except two samples, all are well-baked. The craft quality of the samples is mostly mediocre and the three pieces are rough. The temper of all samples is mineral. The color spectrum of the clay of this pottery is buff, greenish buff, gray, brown, light brown, orange. The color spectrum of some of the glazed pieces is blue, green and brown. Wet hand smoothing has been done on the inner and outer walls of some samples.

In the petrographic method, each piece of pottery is mounted to a glass plate (slide) and to pass light through the sample in order to identify minerals in the pottery, the size of the grains, their roundness or angularity, the thickness of the pottery is reduced to 30 micrometers (Shepard, 1956: 139-140). At this thickness and under the polarizing microscope, the minerals in the clay show special optical properties (Amanollahi, 2009: 127). With this method, three aspects of the structure of pottery can be examined: (1) detailed information on the composition of mineralogy for determining the origin of clay, (2) determining the nature and characteristics of non-plastic components and (3)

certain properties of those components such as particle size and distribution and their relationship to each other in order to help us understand the potter's method for preparing and forming the clay, and estimating the firing temperature based on changes that occur in minerals at high temperatures (Bakhtavar et al., 2021: 155).


Figure 4. Samples of selected pottery for petrographic analysis (Khosravi and Baghsheikhi 2019).

For petrographic analysis, eight thin-section samples with a thickness of 30 microns were taken from Jahangir pottery. The specimens were then examined by a James Swift (Prior) polarizing microscope (Table 1). In the following table, each component of the pottery is marked with an asterisk (*), and if a component is not present, it is separated by a dash (-) (Beheshti, 2019).

Table 1. Results of the petrographic examination of Jahangir pottery (Khosravi and Baghsheikhi 2019)

| SAMPLE CODE | QZ (CLEAN) | QZ (CLOUDY) | FE-OXIDE | CC | PL | AM & PX | V.R | GROG | CHERT | TEXTURE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * | * | * | * | * | * | * | - | - | Inhomogeneous (Porphyritic) |
| 2 | * | * | * | * | - | - | - | - | - | Inhomogeneous Silty |
| 3 | * | * | * | * | * | - | - | - | * | Inhomogeneous (Porphyritic) |
| 4 | * | * | * | * | - | - | - | * | - | Inhomogeneous (Porphyritic) |
| 5 | * | * | * | * | - | - | - | - | - | Inhomogeneous (Porphyritic) |
| 6 | * | * | * | * | - | - | - | * | - | Inhomogeneous (Porphyritic) |
| 7 | * | * | * | * | * | - | - | - | * | Inhomogeneous Silty |
| 8 | * | * | * | * | - | - | - | * | - | Inhomogeneous (Porphyritic) |

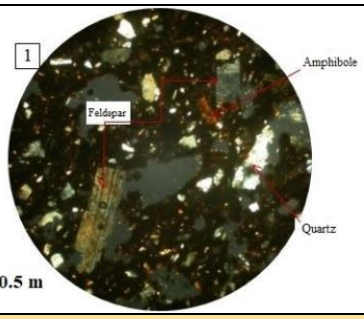
Qz (Clean) = clear quartz and phenocryst; Qz (Cloudy) = cloudy quartz and polycrystalline; Fe-oxide = iron oxide; Cc = calcite; Pl = plagioclase; Grog = previous clay and pottery pieces; AM & PX = amphibole and pyroxene; Chert = chert stone pieces; V.R = igneous rock.

According to the results, the filler components based on metamorphic origin include quartz, plagioclase, pyroxene, and chert stones. Fossil fragments were also observed in one sample. The texture of most specimens is porphyritic or coarse. In silty texture, the components of the sample do not exceed 0.5 mm, and in porphyritic texture, the size of macrocrystalline pieces is between one and two millimeters. The most common minerals in all samples are clear quartz and polycrystalline. The samples were divided into three groups based on mineralogical similarities and differences (Table 2).

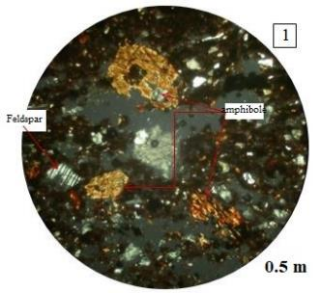
Table 2. Grouping of Jahangir pottery samples based on petrography (Khosravi and Baghsheikhi 2019)

| Group | Specimen No. | Petrographic Characteristics of Pottery |
|---|---|---|
| 1 | 1 | Igneous rock, iron oxide, amphibole, quartz, plagioclase and calcite |
| 2 | 3, 7 | Quartz, iron oxide, chert stone, calcite and plagioclase |
| 3 | 2, 4, 5, 6, 8 | Quartz, iron oxide, calcite and grog |

**Group 1:** Sample No. 1 is in this group. The sample has an inhomogeneous texture, or porphyry (the presence of large pieces in the clay paste). The main ingredients of the clay are many parts of amphibole minerals, along with quartz and plagioclase. Amphibole and plagioclase minerals are the major constituents in igneous rocks. A limited amount of igneous rock remnants were also observed in the clay. Amphibole, plagioclase, and quartz were found in almost equal proportions, with a frequency of 5% in the clay. Calcite is also present in coarse form and has limited dispersion in the clay. It seems that in this sample, igneous rock has been used as filler and temper, and considering the formations of the region, this sample may not have been native to the region and was produced elsewhere and used here (Fig. 5).




Photomicrograph, sample no. 1, XPL light, length of field of view 2.7 mm, porphyritic texture, another view of the sample. Quartz and feldspar minerals in pottery clay are reminiscent of the igneous rock used in the form of temper.




Photomicrograph, sample no. 1, XPL light, length of field of view 2.7 mm, porphyritic texture, quartz minerals, feldspar, and amphibole are observed in the section.

Figure 5. Section of pottery samples no. 1 from Group 1 of Jahangir (Khosravi and Baghsheikhi 2019)

**Group 2:** Includes samples no. 3 and 7. This type of pottery has a carbonate and homogeneous clay that is seen in a light cream color. Pieces of chert stone and quartz mineral have been used as temper. This type of pottery differs from other samples in terms of clay composition, minerals used as fillers, and temper. Due to the existence of

chert, sandstone, and quartz sources in the region, however, the indigenousness of the pottery is quite clear. The chert stone is about 10%, and the calcite mineral constitutes 5% of the sample volume. The pottery clay is wholly homogeneous and carbonate-rich (Fig. 6).

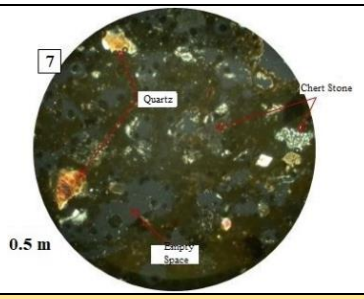
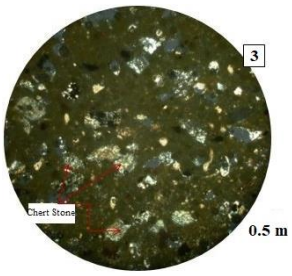
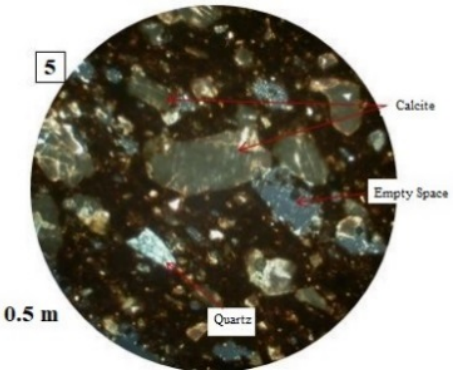
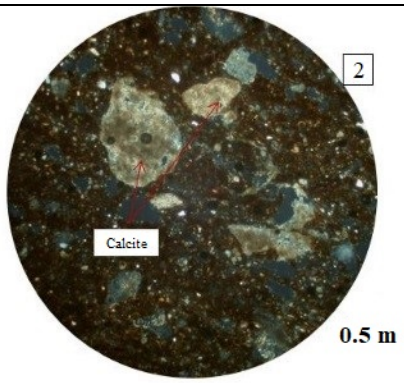
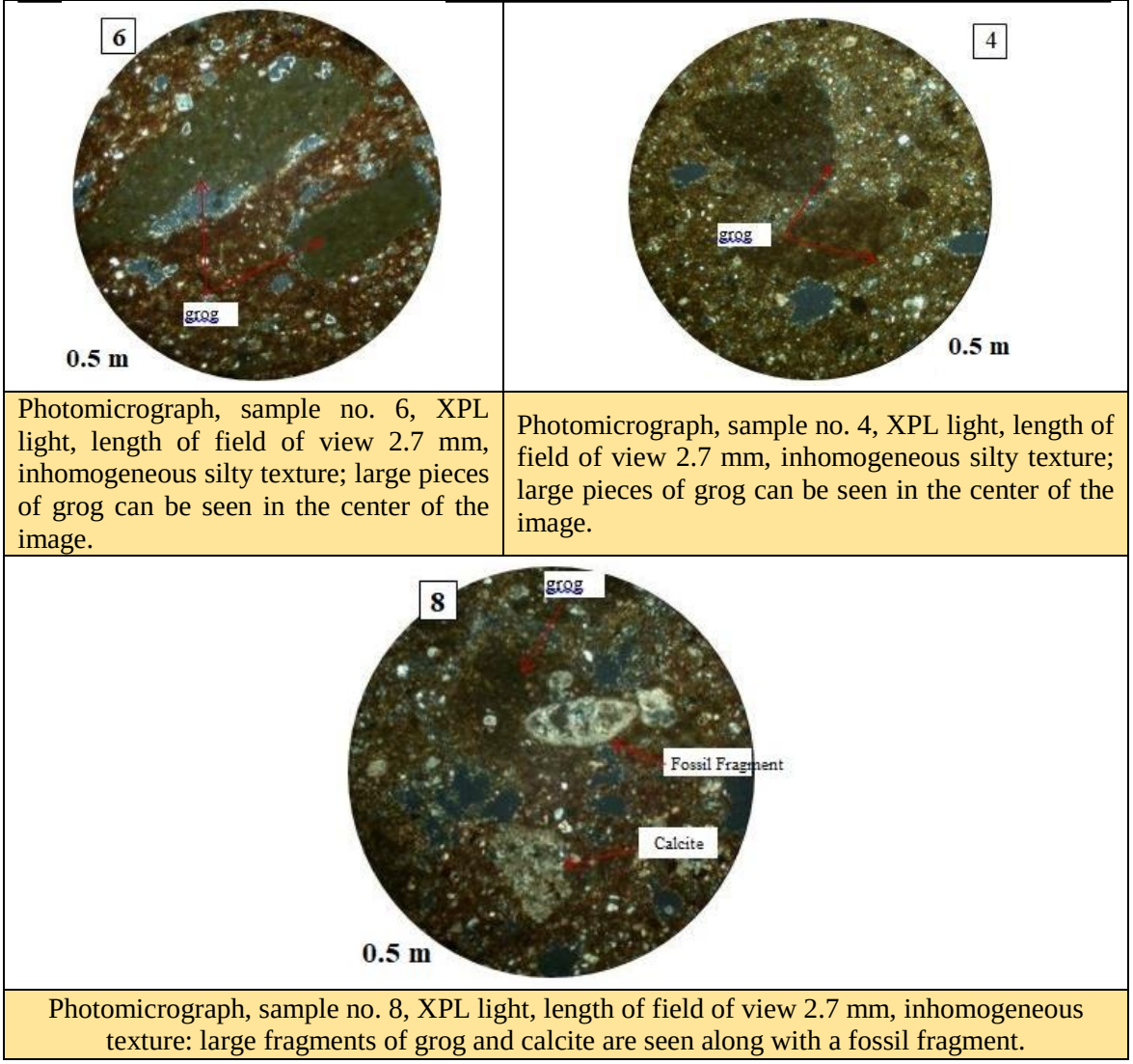
| | |
|---|---|
|  |  |
| Photomicrograph, sample no. 7, XPL light, length of field of view 2.7 mm, inhomogeneous silty texture. Chert and quartz fragments are found in the carbonate clay. There are lots of voids in the clay. | Photomicrograph, sample no. 3, XPL light, length of field of view 2.7 mm, inhomogeneous silty texture. There are many pieces of chert and quartz minerals in the carbonate clay. |

Figure 6. Sections of pottery samples no. 3 and 7 from Group 2 of Jahangir (Khosravi and Baghsheikhi, 2019)

**Group 3:** Includes samples nos. 2, 4, 5, 6, and 8. Calcite and grog pieces have been used as temper, either separately or in combination. The microscopic texture of the samples is porphyritic (inhomogeneous), and the minerals are seen in the form of temper in the pottery clay. In samples no. 2 and 5, large pieces of calcite are used as a temper. Calcite is their major mineral and has formed about 30 to 40% of the sample volume. In samples nos. 4, 6, and 8, grog parts, along with calcite, have been used as a temper. These samples are similar to Nos. 2 and 5, with a slight difference in the percentage of components. Grog fragments found in the pottery are the remnants of dark clay minerals that can be seen as coarse-grained particles in the paste. The clay of this group is non-carbonated (Fig. 7).

| | |
|---|---|
|  |  |
| Photomicrograph, sample no. 5, XPL light, length of field of view 2.7 mm, inhomogeneous silty texture; large pieces of calcite mineral can be seen in the center of the image. | Photomicrograph, sample no. 2, XPL light, length of field of view 2.7 mm, inhomogeneous silty texture; large pieces of calcite mineral can be seen in the center of the image. |




Photomicrograph, sample no. 6, XPL light, length of field of view 2.7 mm, inhomogeneous silty texture; large pieces of grog can be seen in the center of the image.

Photomicrograph, sample no. 4, XPL light, length of field of view 2.7 mm, inhomogeneous silty texture; large pieces of grog can be seen in the center of the image.

Photomicrograph, sample no. 8, XPL light, length of field of view 2.7 mm, inhomogeneous texture: large fragments of grog and calcite are seen along with a fossil fragment.

Figure 7. Sections of pottery samples no. 2, 4, 5, 6, and 8 from Group 3 of Jahangir (Khosravi and Baghsheikhi, 2019).

### 7.1 The firing temperature

The most important part of pottery manufacture is the baking process, which turns the soil into a strong and durable product. The baking process depends on the nature of the raw materials, the reactions, and the transition of materials between the minerals (Noghani & Emami, 2013: 56). Calcite or carbonate-based minerals disappear at a temperature of 800° C, and due to the geology of the region, carbonate formations and exposures are abundant, and calcite was observed in the samples. Therefore, all Jahangir pottery is baked at less than 800°C.

### 7.2 The voids

As mentioned, examining the voids in the pottery clay can be useful for analyzing the quality of their craft. As a result, in microscopic studies of the 8 samples of Jahangir pottery, only two limited voids were observed in circular and oval shapes (Fig. 8).

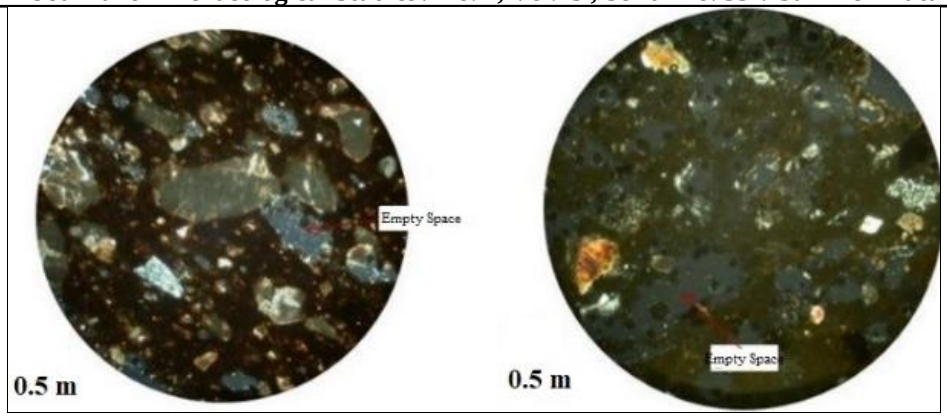



Figure 8. Voids in Jahangir samples, PPL light and 4x magnification (Khosravi and Baghsheikhi 2019)

## 8. Geochemical studies of Jahangir pottery

Chemical examination is a tool for the study of the constituent elements and the presence of rare elements in the body of an instrument, or more commonly, the study of quantitative data in the chemical texture of an instrument. This method is commonly used in comparative studies that require knowledge about the source of archaeological findings. XRF and ICP-MS analysis methods were used for the geochemical study of Jahangir pottery. For this task, two samples of Jahangir pottery were selected for analysis (Fig. 9).

The samples were analyzed in the XRF and ICP-MS laboratories of the Geological Survey. One of the physical methods for analyzing the chemical composition of elements is spectrographic analysis (Shepard, 1956: 143). X-ray fluorescence spectroscopy is one of the elemental methods of material analysis that is used today in industry and research centers in the fields of mine exploration, processing of materials and minerals, extraction, and smelting of metals (Golestani, 2004: 93).

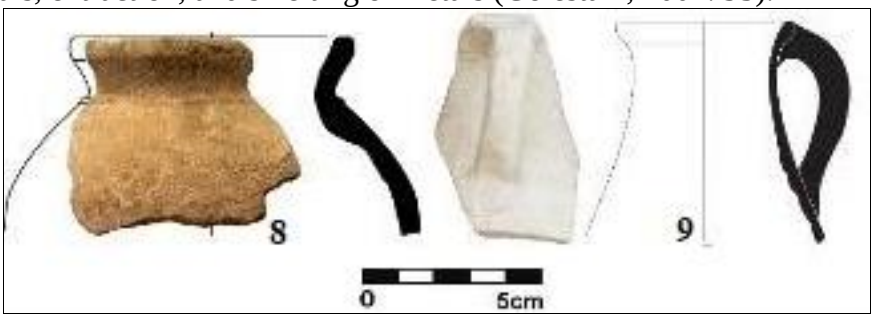



Figure 9. Selected pottery for XRF and ICP experiments of Jahangir (Khosravi and Baghsheikhi 2019)

In petrographic examination of the pottery, it was found that the major phase of this pottery samples is quartz mineral, calcite and iron oxide. The pottery clay has two compounds, carbonate and non-carbonate. Non-carbonate (clay) composition is the result of erosion processes, weathering of rocks and sediments in the region during different geological periods. Therefore, formation of clay minerals can be considered as the result of alteration and erosion of feldspar minerals (sodium-bearing, potassium-bearing and calcium-bearing). Other minerals and components in the body of pottery include amphibole and pyroxene, mica, chert and metamorphic rock. Each of these can be the concentration zone of trace elements, all of which are affected by processes occurring in the area on rocks and sediments (Tables 3 and 4).

Table 3. XRF analysis of Jahangir pottery samples (based on PPM) (Khosravi and Baghsheikhi 2019)

| **S.N XRF** | **8** | **9** |
|---|---|---|
| S.N Petrography | **3** | **5** |
| Formula | (%) | (%) |
| Na2O | 0.83 | 0.44 |
| MgO | 3.65 | 2.09 |
| Al2O3 | 9.91 | 7.78 |
| SiO2 | 40.55 | 27.56 |
| P2O5 | 0.19 | 0.10 |
| SO3 | 0.16 | 0.28 |
| K2O | 1.38 | 1.55 |
| CaO | 25.13 | 33.11 |
| TiO2 | 0.83 | 0.95 |
| MnO | 0.17 | <.1 |
| Fe2O3 | 8.03 | 8.68 |
| As2O3 | - | - |
| SrO | 0.13 | 0.07 |
| PbO | - | - |
| ZrO2 | 0.05 | <.1 |
| L.O.I* | 9.00 | 17.40 |

Table 4. ICP-MS analysis of Jahangir pottery samples (based on PPM) (Khosravi and Baghsheikhi 2019)

| **S.N ICP** | **8** | **9** |
|---|---|---|
| **S.N Petrography** | **3** | **5** |
| Ag | 0.8 | <0.5 |
| As | 21.8 | <2 |
| Ba | 411.9 | 299.2 |
| Be | 1.3 | 1.4 |
| Cd | 0.2 | 0.3 |
| Ce | 44.7 | 44.6 |
| Co | 24.1 | 24.4 |
| Cr | 137.2 | 123.0 |
| Cu | 24.2 | 24.7 |
| Dy | 3.8 | 2.2 |
| Er | 4.0 | 4.2 |
| Eu | 0.7 | 1.3 |
| Ga | 13.7 | 10.6 |
| Gd | 4.5 | 4.9 |
| Ge | 1.7 | 2.4 |
| Hf | 18.6 | 2.6 |
| Ho | 0.6 | 0.7 |
| La | 26.1 | 28.0 |
| Li | 22.5 | 17.0 |

| | | |
|---|---|---|
| Lu | 0.3 | 0.3 |
| Mn | 715.1 | 263.3 |
| Mo | <0.5 | 4.1 |
| Nb | 16.2 | 18.2 |
| Nd | 21.5 | 23.2 |
| Ni | 103.8 | 75.8 |
| P | 1275.5 | 852.7 |
| Pb | 29.1 | 14.2 |
| Pr | 5.3 | 6.4 |
| Rb | 55.6 | 68.9 |
| Sc | 14.5 | 12.8 |
| Sm | 4.7 | 4.5 |
| Sn | 2.7 | 2.8 |
| Sr | 679.8 | 383.9 |
| Ta | 1.4 | 1.5 |
| Tb | 0.4 | 0.2 |
| Te | 0.1 | 0.2 |
| Th | 18.5 | 18.2 |
| Ti | 3749.1 | 3933.6 |
| Tl | 0.6 | 0.6 |
| Tm | 0.2 | <0.2 |
| U | 3.3 | 2.9 |
| V | 100.1 | 121.2 |
| Y | 20.0 | 20.2 |
| Yb | 2.5 | 2.5 |
| Zn | 69.5 | 60.4 |
| Zr | 317.4 | 309.6 |

In petrographic studies, calcite, quartz and iron oxide minerals were observed as the major components added to the pottery clay. For instance, the density and frequency of calcite in samples no. 5 of Jahangir is about 30%, and in sample no. 3 of Jahangir, quartz is the major constituent and has the highest density in the pottery clay. In the geochemical study of pottery, the composition of the clay has an important role in the abundance of elements that cannot be detected by petrography due to the fineness of the components (Diagram 1).

In the change process of rare earth elements shown in the following diagrams, samples of Jahangir are consistent and represent a common origin. In addition, two samples of Jahangir are different from other samples in terms of the abundance of rare earth elements.

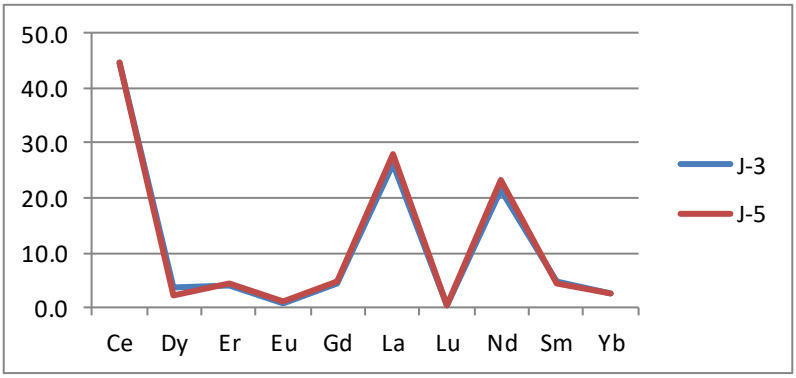



Diagram 1. Multi-element diagram of Jahangir pottery samples (Khosravi and Baghsheikhi 2019)

On the whole, considering the geology of Iran, the genetic origins of the examined pottery of Jahangir are very similar in many cases. The minerals in the pottery clay are the main cause of the concentration of rare elements. For instance, the presence of minerals such as quartz is the main factor in the concentration of light rare elements, and the presence of iron oxide and similar compounds is the main factor in the abundance of heavy rare elements.

## 9. Dating results

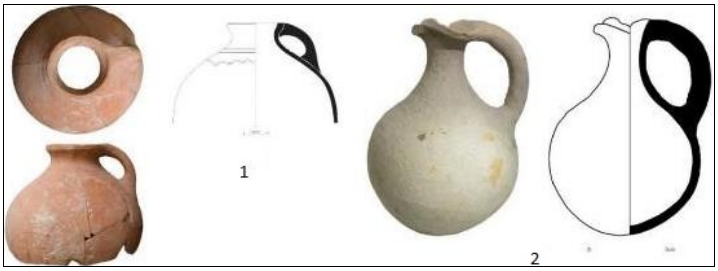



Figure 10. Descriptions of pottery sherds from Jahangir samples for thermoluminescence (Khosravi and Baghsheikhi 2019)

From the samples sent to the laboratory, two were selected that were likely to respond to the experimental process. The luminescence spectra obtained from the three samples are shown in Figures 11 and 12. The chronological values obtained from these spectra are also presented in Table 5. Experimental results suggest the dating of the Sasanian period for this site (Bahroloulomi, 2018) (Table 5) (Diagrams 2 and 3).

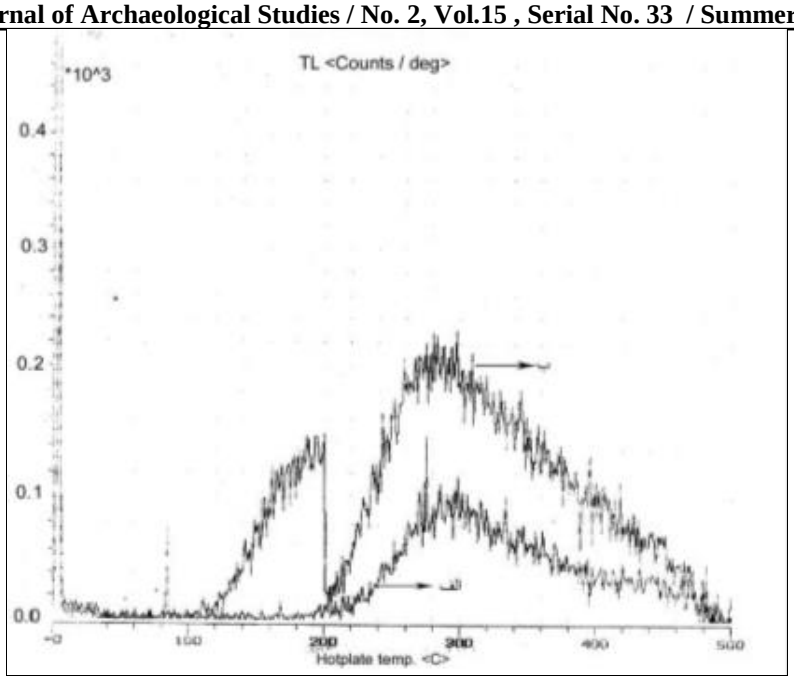
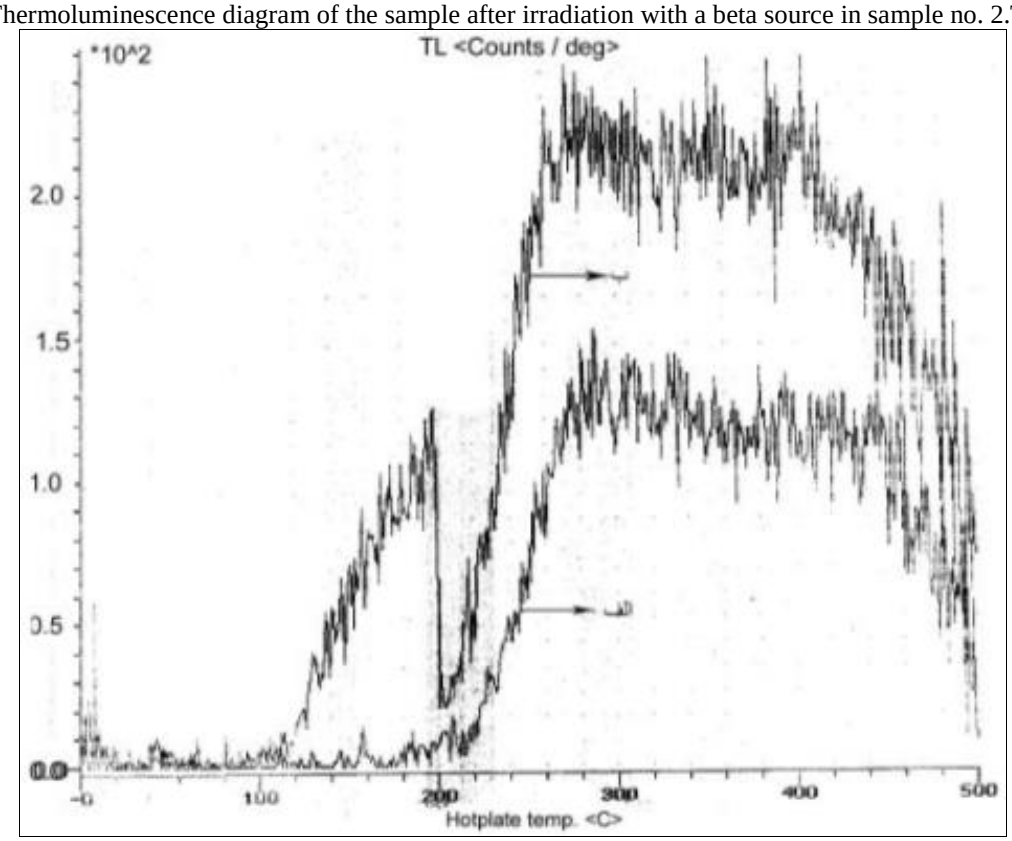



Diagram 2: A: Natural thermoluminescence diagram of the sample,
B: Thermoluminescence diagram of the sample after irradiation with a source in sample no. 1.

Diagram 3: A natural thermoluminescence diagram of the sample
B: Thermoluminescence diagram of the sample after irradiation with a beta source in sample no. 2.Table



5:Dating results for three slag samples (Khosravi and Baghsheikhi 2018)

| Sample | Depth | Percentage of potassium oxide (K20%) | Thorium concentration (ppm) | Uranium concentration (ppm) | Gregorian Date | $^{14}C$ Age BP |
|---|---|---|---|---|---|---|
| **1** | -180-250 cm | 2.07 | 3.21 | 40.04 | 551 CE (496-606 CE) | 1468±55 |
| **2** | -25 cm | 50.77 | 3.52 | 5.97 | 549 CE (489-609 CE) | 1470±60 |

## 10.Conclusion

The outcomes derived from petrographic experiments conducted on selectively chosen pottery samples from the Jahangir monument revealed a consistent silty and porphyritic texture across the samples. Predominantly, the samples exhibit three compounds—quartz, iron oxide, and calcite—suggesting uniform composition and structure, indicative of a shared provenance. Nevertheless, structural variations are discernible in specific samples, such as the presence of chert in samples no. 3 and 7 of Jahangir. Sample no. 1 of Jahangir displays distinct characteristics, incorporating clay minerals of igneous origin, specifically amphibole and plagioclase, which, according to geological maps, are not indigenous to the region (Table 6). The pottery from Jahangir manifests a firing temperature below 800 degrees, implying insufficient firing. Furthermore, to ascertain the major, trace, and rare earth elements present in the pottery from the Jahangir monument, geochemical analyses were conducted using X-ray fluorescence (XRF) and inductively coupled plasma (ICP) methods. The investigation into the rare earth elements in Jahangir pottery demonstrates compatibility and signifies a shared origin, as evidenced by consistent alterations in these elements across all samples. Notably, changes in rare earth elements were observed universally across all examined samples.

Table 6. Minerals of the Jahangir pottery clay (Khosravi and Baghsheikhi 2019)

| | Mineral Type | Presence | Absence |
|---|---|---|---|
| **Jahangir** | Clear Quartz & Phenocryst | * | |
| | Cloudy Quartz & Polycrystalline | * | |
| | Iron Oxide | * | |
| | Calcite | * | |
| | Plagioclase | * | |
| | Clay & Previous Pottery | * | |
| | Amphibole & Pyroxene | * | |
| | Chert Stone | * | |
| | Igneous Stone | * | |

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# بررسی کانی‌شناسی و تحلیل عنصری سفال‌های ساسانی - آغاز اسلامی بنای جهانگیر ایلام با استفاده از روش‌های پتروگرافی، XRF ،ICP و T.L

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## چکیده

تا به امروز هیچ مطالعه آزمایشگاهی با استفاده از روش‌های پتروگرافی، XRF، ICP و T.L برای تحلیل سفال ساسانی و آغاز اسلامی در غرب ایران انجام نشده است. بنابراین، نتایج این پژوهش اطلاعات بیشتری را در خصوص فرآیند تولید سفال در این دوره تاریخی از غرب ایران آشکار خواهد کرد. بدین منظور ۸ قطعه سفال به دست آمده از کاوش های بنای جهانگیر برای انجام آزمایشات پتروگرافی به پژوهشگاه میراث فرهنگی و سازمان زمین‌شناسی و ۲ نمونه برای XRF و ICP و ۲ نمونه برای ترمولومینسانس انتخاب و مورد بررسی قرار گرفت. سؤالات این پژوهش در مورد چگونگی بررسی ترکیب و ساختار سفال (؟)، درجه پخت در کوره (؟) و بومی یا وارداتی بودن (؟) است. بر اساس آزمایشات انجام شده می توان نتیجه گرفت که در اکثر نمونه های به دست آمده از این اثر سه ترکیب کوارتز، اکسید آهن و کلسیت مشاهده شده است. اما در برخی از سفال ها از ذرات میکا یا سنگ چرت در خاک رس استفاده شده است. به استثنای تعداد کمی، تمام سفال‌ها تولید داخل هستند. به عبارتی محلی هستند و متعلق به خود منطقه هستند. بافت سفال در نمونه‌های منتخب سیلتی، پورفیریتی و سیلتی ناهمگن است. وجود کلسیت در خاک رس همه سفال های جهانگیر نشان می دهد که در دمای بیش از ۸۰۰ درجه سانتی گراد در کوره پخته نشده است. همچنین به استثنای چند نمونه، تغییرات نادر خاک در اکثر سفال ها نشان دهنده یک منشاء مشترک است.

**واژه‌های کلیدی:** سفال، پتروگرافی، سالیابی ترمولومینسانس، XRF، ICP، جهانگیر

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# Archaeological Lnvestigation of Administrative Documents and Records within the Chalcolithic Societies of Northwestern Iran

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**Abstract**

Analyzing administrative documents holds significant importance within the realms of archaeology and sociology, akin to the study of other archaeological evidence. These examinations play a pivotal role in reconstructing various systems, encompassing management, social dynamics, economic structures, and political frameworks. Delving into administrative management within prehistoric societies unveils the intricate social intricacies and the supervision exercised by a designated leader or head over a subordinate group, representing an internal control mechanism. Notably, seals, impressions on seals, and diverse accounting artifacts serve as pivotal administrative documents. However, the exploration and investigation of such cultural data in northwestern Iran remain relatively scarce. Therefore, the current study endeavors to present, evaluate, and scrutinize the administrative records of Chalcolithic societies in northwestern Iran, employing a descriptive-analytical approach. Numerous inquiries persist without resolution regarding the administrative records and evidence pertaining to the later prehistory of northwest Iran. Ambiguity surrounds the quantification of Chalcolithic administrative documents within this region. Furthermore, the methodology for analyzing and evaluating the ownership and managerial evidence from the later prehistoric era in this area remains unclear. Addressing these uncertainties can establish a definitive framework and a solid foundation for investigating these matters in northwest Iran. Leveraging administrative data obtained from various sites including Tepe Chay Khoy, Chakhmaqluq, Tepe Kulyeri (Tepe Caravanserai), Sohachay Tepe, and others, the authors conduct an assessment of managerial evidence in the northwestern region of Iran. Furthermore, utilizing extant cultural artifacts and drawing upon the outcomes of prior studies facilitates an exploration into phenomena such as long-distance trade, economic endeavors, social intricacies, and cultural exchanges with neighboring areas.

**Keywords**: Northwest Iran (Azerbaijan); Administrative documents; Chalcolithic; Economic-commercial interactions; Neighboring areas.

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## 1.Introduction

Seals and their imprints on clay tablets represent some of the most valuable remnants from the prehistoric and historical societies situated on the Iranian plateau. Systematically analyzing and studying these artifacts serves as an effective method for archaeologists and art historians to delve into the material and spiritual dimensions of ancient cultures (Tala'i, 2018: 1). These seals and carved works stand as significant historical objects contributing profoundly to the identification of various aspects of past epochs. The examination of such artifacts can elucidate many lingering mysteries from ancient times (Melkzadeh Bayani, 1971). The impressions left by seals, along with their patterns spanning different eras, unveil numerous facets of daily life, activities like hunting and warfare, religious practices, and more, surpassing the scope of insight provided by other available documents (Motarjem, 1996). The use of seals became widespread across the Iranian plateau as early as the 5th millennium BC, extending through the Neolithic and Chalcolithic periods and persisting till modern times (Tala'i, 2018: 37). The oldest known examples of seals, based on existing records, were discovered at ancient sites located in Syria, Palestine, Lebanon, and Turkey (Rashad, 1990: 235). Seals, bullae, and tokens offer multifaceted interest from various perspectives. Primarily, each of these artifacts stands as an autonomous archaeological piece associated with legal transactions or commercial dealings. Essentially, they symbolize authority and social standing, signifying the transfer and prolonged safekeeping of goods. Furthermore, owing to their engravings, incised effects, and patterns, they serve as tangible evidence for the study of the art of engraving (Mohammadi Far et al., 2013: 94). Excavations conducted in the northwestern regions of Iran and neighboring areas have unearthed cultural artifacts such as seals, seal impressions, and counting objects, which constitute fundamental tools in administrative management. Examining this category of data assumes significance as it offers insights into management practices, distinguishing between local indigenous (exported goods) or non-local (imported goods), and delineating commercial activities, whether proximate or distant. Consequently, long-distance trade has emerged as a competitive engagement involving the sources of raw materials and the distribution of finished products (Sherratt & Sherratt, 1991: 355).

Stamp seals have served as pivotal artifacts dating back to the 7th millennium BC in prehistoric Western Asian sites. Initially crafted from materials such as stone and mud/clay, these early seals boasted multifaceted functions, notably signifying prestige, social standing, symbols of status, and delineating individual and collective identities. With the evolution of management needs, these seals transformed into administrative tools, employed to secure warehouses and goods. This transition showcases the shift in their utilitarian role, illustrating their significance in administrative practices and organizational systems.

Seals have held a historical presence in the South Caucasus since the early 4th millennium BC. Excavations at Böyük Kəsik in Azerbaijan, dating to the Chalcolithic period, unveiled two button-shaped clay seals featuring flat surfaces. The emergence of seals with diverse styles and patterns came to prominence during the Kura-Araxes culture in the Southern Caucasus, beginning in the mid-fourth millennium BC (Shanshashvili & Sherazadhshvili, 2013: 7-25). Noteworthy neighboring sites like Böyük Kəsik in Azerbaijan and Orchosani in Georgia have yielded an array of significant administrative documents. These artifacts, crafted from baked clay, exhibit circular,

semi-circular, and oval shapes, equipped with suspension holes, and adorned with motifs depicting animals and geometric designs. The earliest documentation of seals originating from northwestern Iran traces back to the Early Bronze Age and the Kura-Araxes period. These early instances encompass discoveries of both cylinder and stamp seals unearthed from sites like Kul Tepe Gargar, Kohneh Shahr, and Yanik Tepe (Abedi 2022).

This study pursues several primary objectives. Initially, it aims to comprehensively review and scrutinize the evidence pertaining to administrative management practices during the Chalcolithic period in Northwest Iran. Secondly, it seeks to investigate the social and economic advancements alongside examining the evidence of administrative management in Northwest Iran, focusing on cultural exchanges with neighboring regions. Additionally, the paper endeavors to analyze and explore the significance of administrative management techniques in Northwest Iran during the Chalcolithic period, shedding light on both intra-regional and extra-regional developments, and elucidating communication methodologies prevalent within prehistoric societies during this era.

## 2.Methodology

The methodology employed in this research is structured upon descriptive-analytical studies involving cultural data sourced from fieldwork and extensive library research conducted at excavation sites. Subsequently, analyses are conducted utilizing administrative data obtained from prehistoric societies of the Chalcolithic period situated in northwestern Iran.

## 3.Research Background; The Currently Available Corpus of Seals in NW Iran

According to archaeological investigations, there exists a scarcity of data and analyses concerning administrative management within Chalcolithic societies in northwest and western Iran. Such analyses encompass artifacts like seals and their impressions, which serve as reflections of the intricate social and economic dynamics of the era. Predominantly, the available data related to administrative documents predominantly stem from the cultural sites situated in the Ghezel Ozan River basin of Zanjan province. Notable sites contributing to this information include Soha Chay Tepe (Rahimi-Sorkhni, 2007), Chakhmaq Luq (Ali Beigi et al., 2012: 11-19), Tepe Kul Yeri (Caravanserai) (Ali Beigi et al., 2014: 239-235), Qeshlaq Chehel Amiran (Sharifi 2020; Motarjem, 2013), Kalnan (Saed Mucheshi et al., 2016: 48), Talwar site No. 11 (Valipour et al., 2016), Kul Yeri clay casting mold (Khosravi & Niknami, 2021: 60-61), Gerdi Ashowan (Sharifi, 2019: 239), and Tepe Chay Khoy (Gravand et al., 2022: 151-152), where various administrative artifacts have been unearthed, such as stamp seals, seals, tokens, and other significant materials. Notably, only three cylindrical and stamped seals have been documented from Bronze Age sites in northwest Iran, two from Kul Tepe Gargar (Abedi, 2016: 102; Abedi 2022), and one from Kohneh Shahar site (Alizadeh et al., 2018). Additionally, administrative documents from the South Caucasus region have been sourced from sites like Alkhan Tepe (Axundov, 2021: 724), Böyük Kəsik in Azerbaijan (Museyibli, 2009:16), Orchosani with its circular and semi-circular clay seals (Gambashidze et al., 2010: 284 & 439), and Kaghchaghbiur site in Georgia with its stamp-shaped seals (Shanshashvili & Sherazadhshvili, 2013: 20; Abedi 2022).

## 4.North-Western and Western Iran and Southern Caucasus; Sites and Data Studied in This Research

The study encompasses the northwestern provinces of Iran, focusing on reported administrative evidence from notable sites such as Soha Chay, Tepe Koulyeri, Tepe Chay, and Chakhmaqluq. Furthermore, the research will also explore significant sites in the South Caucasus region as part of its investigation (Figure 1).

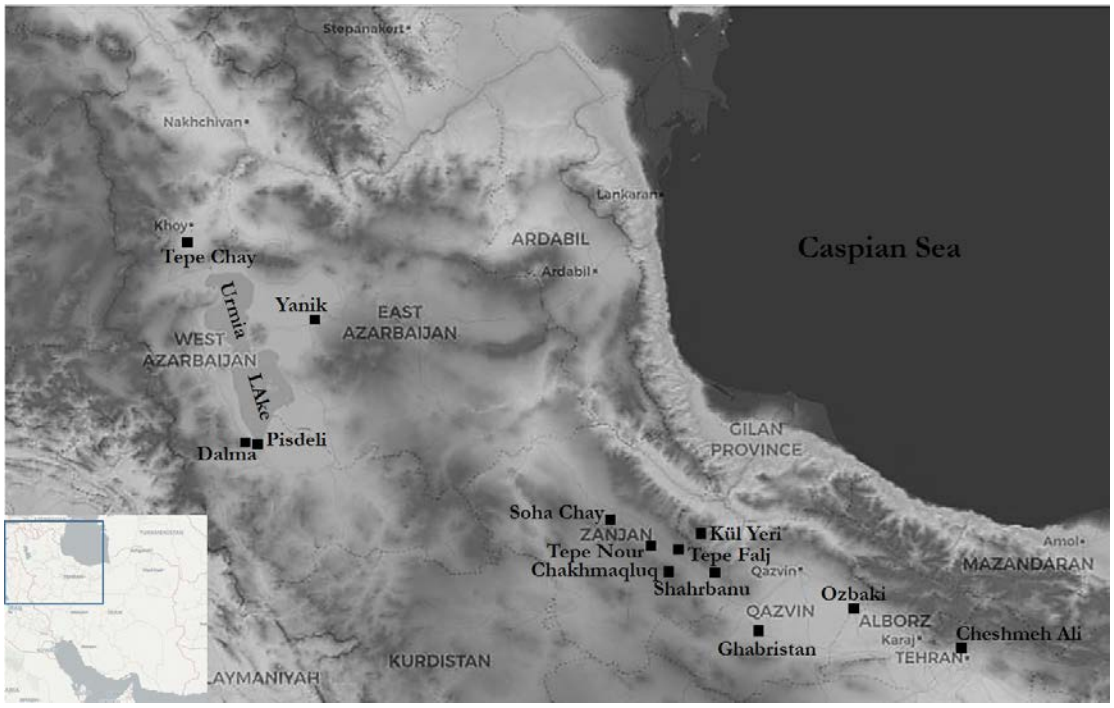



Fig. 1. Geographical location of the study area (authors, 2023)

In northwestern Iran, the fifth and fourth millennia Chalcolithic culture of this region is delineated into two periods: firstly, the Dalma culture identified as Hasanlu IX, and secondly, the Pisdeli culture classified as Hasanlu VIII (Dyson, 1965, 1968). Recent research has proposed updated chronologies for the Chalcolithic era, specifying the Dalma period (500-4600/4500 BC) and LC 1-3 (4500-3700 BC) (Khazaee et al. 2011; Abedi et al. 2014; Abedi et al. 2015; Abedi and Omrani 2015; Abedi 2016; Abedi 2017). Archaeologists note that the Chalcolithic period coincided with the initial phases of copper metallurgy (Bakhshaliyev and Marro, 2015: 5). The northwestern region of Iran and the Caucasus have long held significance in West Asian archaeology due to their proximity to influential cultural areas like Anatolia, Zagros, Mesopotamia, and Central Asia. Specifically, the northwest of Iran is recognized as a crucial cultural and geographical area in the prehistory of the Iranian plateau (Tala'i, 2010: 63-64). During the Chalcolithic era, early village societies experienced a zenith of prosperity, signifying a gradual departure from Neolithic patterns and the emergence of Chalcolithic cultures across a vast geographical expanse (Ibid.: 1). Key components characterizing Iran's Chalcolithic period include technological advancements in metallurgy, amplified agricultural production facilitated by irrigation, specialization in professions, extensive trade networks, augmented complexity in religious and ritual practices, new social hierarchies, and evolving burial customs (Matthews & Fazeli Nashli, 2022: 111).

Excavation projects yield diverse data encompassing ceramics, bone remnants, botanical specimens, metals, and more. Archaeologists and multidisciplinary scientists conduct extensive research on these findings, exploring aspects such as socio-economic structures, ceramic compositions, osteology, botany, identification of indigenous and foreign metal mines/ores, and dietary diversity. Alongside these sources, crucial insights are gleaned through administrative management techniques, internal control mechanisms, interactions with neighboring regions, and commercial transactions involving seals, seal impressions, tokens, and similar artifacts. Seals and their impressions are commonly discovered in conjunction with other archaeological remnants like pottery shards and animal remains, notably within storage spaces, residential areas, ritual sites, and excavated pits. Seal impressions stand as pivotal evidence of administrative procedures employed to seal clay containers, baskets, bags, and bundles for storage purposes, functioning as a form of authentication and safeguarding against tampering (Wright & Johnson, 1975: 271). From an iconographic perspective, seals, seal impressions, and symbols have been identified and dated back to the early stages of the Neolithic period (Amiet, 1997: 83).

**4-1.Tepe Soha Chay:** In the northwest region of Iran, a significant collection of administrative documents has been sourced from the Ghezal Ozan cultural realm within Zanjan province. Sohachay stands as a quintessential Chalcolithic site meticulously studied for its rich data. Tepe Sohachay represents a singular-period settlement, linked to the concluding phase of the 5th millennium BC. Positioned within the Sohachay Valley in southwestern Zanjan, the site rests at an elevation of 1,650 meters above sea level, predominantly yielding pottery data. Beyond pottery, excavations unveiled seals, seal impressions, metal lids, bone tools, clay artifacts, figurines, stone tools, obsidian, plant remains, and small bones (Rahimi and Eslami, 2018). Despite its modest dimensions, Sohachay exhibits substantial evidence of seals and seal impressions (Refer to Figure 2), signifying its prominence during the Chalcolithic era. Radiocarbon dating estimates the settlement's duration at approximately 300 years, relying significantly on the nearby river and fertile environs for sustenance. Absolute dating places this historical site within the period of 4369-3964 BC. Analyses conducted by Rahimi-Sorkhani suggest connections and parallels between the materials retrieved from this site and artifacts related to the Dalma period found in various locations, including the Urmia Lake basin, Lavin Tepe in the Little Zab basin, Kalnan Tepe in Kurdistan province, Ghosha Tepe in Meshginshahr, Cheshmeh Rajab in Simareh, and Dalma pottery discovered in the Kangavar plain (Ibid).

Fig. 2. The seal and seal impression of the Dalma period from Sohachay Tepe (Aali, 2006)

**4-2.Chakhmaghluq Tepe:** Among the array of sites revealing management evidence, the Chakhmaghluq Abhar site stands out, situated within the Abhar Rud River basin. A total of 25 sites linked to the Chalcolithic era have been documented in this basin. This noteworthy increase in site numbers during this period denotes a substantial rise in population and settlement growth compared to preceding eras. The Chalcolithic sites span diverse terrains, encompassing both plains and mountainous regions. Elevations of these sites range between 2,150 and 1490 meters above sea level, exhibiting a wide altitude spectrum. Spatially, these Chalcolithic sites predominantly cluster around water sources, frequently within distances of less than 200 meters (Khosravi et al., 2012: 131-154). Notably, among the significant cultural artifacts discovered within these sites, a pottery piece bearing a seal impression from the Late Chalcolithic period was excavated at Chakhmaqluq (Figure 3) (Ali Beigi et al., 2011: 11-19).

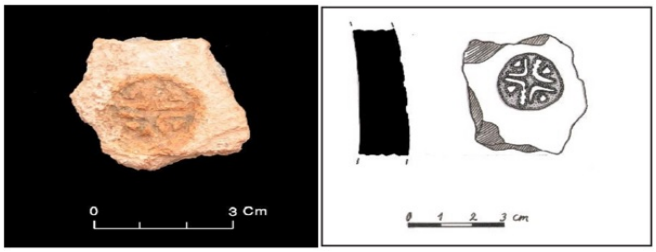



Fig. 3. A piece of pottery with a seal impression from Chakhmaqluq – Late Chalcolithic (Khosravi et al., 2012: 144)

The prevalence of Chalcolithic sites is notably more pronounced in the southern basin of Abharchay and along the western edge of the Ghezel Ozen river in Zanjan's western region compared to its northern basin. This distinction may be attributed to the discernibly distinct environmental conditions prevailing between the northern and southern banks of the Abhar Rud basins. Most of these sites comprise small settlements, likely serving as temporary habitation, relying primarily on agriculture, animal husbandry, and hunting for sustenance. Notably, settlements situated above 1700 meters suggest a probable association with nomadic pastoral communities. Scholarly investigations indicate that the prehistoric cultures in this area share commonalities with those found in the northwestern, western, and central plateau regions of Iran (Khosravi et al., 2008: 37-52; Saed Mucheshi, 2012: 41).

**4-3.Tepe Kulyeri:** The archaeological site of Kulyeri (Tepe Karvansara) situated in the eastern region of Zanjan is notable for its stratigraphic data detailing distinct cultural periods (Figure 4). This site underwent excavation in 2012 under the direction of Sajad Alibeigi. The exploration and surveying efforts unveiled a significant collection of Dalma pottery tradition (manipulated, impressed, scratched, and horn-handled). Additionally, several valuable items were discovered, including a stamp seal, two seal impressions, numerous counting objects (tokens), two copper awls, a metalworking mold, an animal figurine, as well as chipped stone and two stone beads. Occupied during the Early and Middle Chalcolithic periods, this site likely served an industrial purpose and was possibly re-inhabited during the Iron Age. The documented seals and seal impressions found here suggest administrative and supervisory evidence conceivably linked to ancient metallurgical activities in the highland regions west of the central plateau of Iran and the eastern area of Zanjan province during the late 5th millennium BC (Ali Beigi et al., 2013: 235-239). Scholars have acknowledged the

significance of seals (bullae) as administrative artifacts, indicative of administrative, managerial procedures, and monitoring mechanisms prevalent within ancient administrative offices and institutions (Zettler, R. L., 1987). The administrative documentation recovered from Kulyeri notably includes stamp seals and seal impressions.

During the excavation conducted in Trench 1, a flat seal crafted from soapstone, specifically Steatite, was unearthed. This seal bears a geometric motif etched with deep lines on one of its surfaces. The motif comprises five nested rectangles with a simple line running through the center of the smallest rectangle (Figure 5). Although similar specimens of this seal were not directly retrieved from the excavations at Kul Yeri (Tepe Karvansara), analogous seals have been found at sites like Qeshlaq Chehel Amiran (Motarjem, 2013), Kalnan (Saed Mucheshi et al., 2010, Fig. 17: 48), Sohachay Tepe (Rahimi Sorkhani et al., 2015), Chakhmaqluq (Ali Beigi et al., 2011: 15 and 17) (Figure 3), and Talwar No. 11 (Valipour et al., 2010). These settlements exist within the same historical period as Kulyeri and exhibit resemblances in terms of such artifacts. The discovery of two seals within the site holds substantial significance, implying notable implications. One of these seals exhibits a circular shape measuring 26-29 mm in diameter, adorned with checkered motifs covering its surface. The seal features four square rows of nearly identical size arranged across its surface, creating a distinct and clear impression. Additionally, there is a thread passing through the hole in the seal, presumably used for sealing vats or jugs. Traces of these threads indicate their role in sealing and securing the lids of the containers. Another seal impression, also circular and embellished with checkered motifs, was retrieved from Context 004 within Trench 1 (Figure 6) (Khosravi, 2015: 192).

Fig. 4. A general and close view of the excavations from the Kulyeri site (Khosravi & Niknami, 2021: 59)


Fig. 5. Stamp seal made of soapstone obtained from Kulyeri site (Khosravi, 2014: 191)

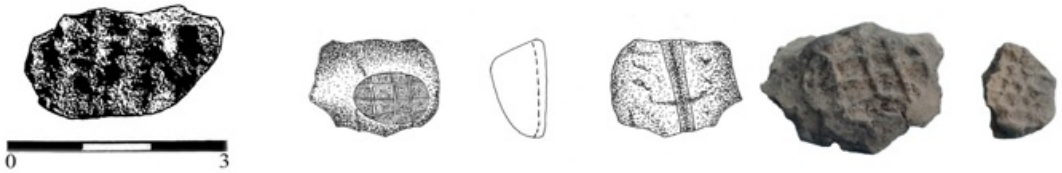



Fig. 6. A seal impression with open checkered motifs from Kulyeri site (Khosravi, 2015: 192)

Six small clay tokens were recovered from Contexts 001 and 007 within Trench 2, retrieved from the surface context. These clay artifacts exhibit a buff and dark buff coloration, measuring 15 to 25 mm in diameter and possessing a thickness ranging from 5 to 8 mm. Similar token samples have been documented from various sites across the central Iranian plateau. These pieces manifest a cone-shaped structure (Figure 7). The presence of seals, seal impressions, and tokens within the site likely suggests a system of exchange and trade between sites sharing the same historical context in the broader region. This presence also signifies the potential existence of economic management, or more broadly, management systems, possibly pertaining to economic or political structures (Khosravi, 2014: 192; Khosravi, 2015: 192). Moreover, clay and stone tokens akin to those found at Kulyeri were excavated from Tepe Qeshlaq Bijar, exhibiting diverse shapes and found abundantly (Sharifi, 2020: 236, Figs. 1-6; Sharifi, 2019: 236-239). These symbols, such as seals, seal impressions, and bullae, possibly facilitated the transfer of abstract mental-auditory concepts into visual-tactile representations. This pragmatic application allowed individuals to perceive and touch these concepts. Furthermore, the utilization of these symbols facilitated the inspection of goods, aiding in categorizing merchandise, laying the groundwork for organizing hierarchical commercial management techniques (Motarjem and Sharifi, 2013: 46-27).

During the comprehensive surface survey conducted at the site, various significant artifacts were discovered, including a clay casting mold, raw copper stones, and copper fragments. These items were found scattered among several pits and excavated sections within the area. Considering the challenges associated with transporting relatively large and weighty pieces of copper ore, it can be inferred that the site is situated in proximity to primary deposits of copper ore, a supposition supported by geological maps. However, the specific mine responsible for the extraction of the copper ore has yet to be definitively identified. Moreover, among the findings are stone objects such as anvils (Figure 8) (Khosravi & Niknami, 2021: 62), akin to those recovered from the Arisman site (Helwing 2011), which were likely utilized in the copper metal extraction process. Regarding the noteworthy discoveries linked to industrial and metallurgical activities at Kulyeri, mention can be made of the copper awls and hand stone. The clay molds found, measuring 22 cm in length and 7 cm in width, exhibit six relatively parallel rows of grooves, likely employed in the shaping of narrow bars (Figure 9) (Khosravi & Niknami, 2021: 60-61).

Regarding its chronological classification, Kulyeri is proposed to correspond to the Dalma/Early Chalcolithic period (Khosravi, 2015: 194). Conversely, excavations at Tepe Gerdi Ashowan unearthed copper, obsidian, and shell artifacts dating back to the Late Chalcolithic period. These findings underscore the existence of management activities, internal control systems, and trade-economic relationships with distant or nearby neighboring regions (Sharifi, 2019: 239).

Analogous clay molds used for casting purposes, akin to these samples, have been documented at the Qalayeri site in the Republic of Azerbaijan (Figure 10) (Museyibli, 2019) and Orchusani in Georgia (Figure 11) (Gambashidze et al., 2018) within the South Caucasus region. Through analysis of the cultural data acquired, these artifacts are believed to be associated with the Leyla Tepe culture. Further comparison and examination of these findings may illuminate their connections with regions including Eastern Anatolia, Northern Mesopotamia, and the Maikop culture in the North Caucasus during the 4th millennium BC (Museibli, 2019: 63-76).

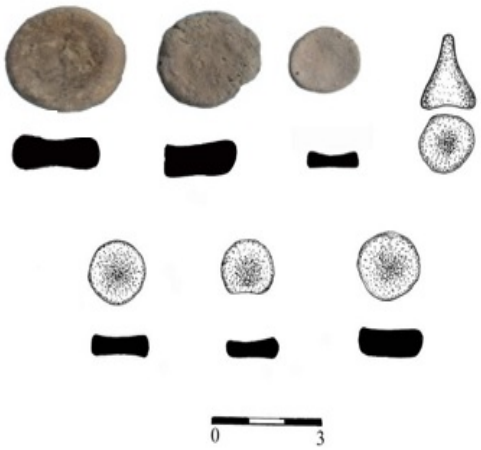



Fig. 7. Clay tokens discovered from the Kulyeri (Khosravi, 2015: 194)

Fig. 8. stone objects from the Kulyeri (Khosravi & Niknami, 2021: 62)

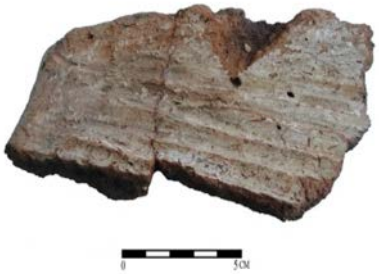


Fig. 9. Blacksmithing crucible from the Kulyeri (Khosravi & Niknami, 2021: 62)

Fig. 10. Four-groove clay mold from Qalayeri (Museibli 2019: 74)

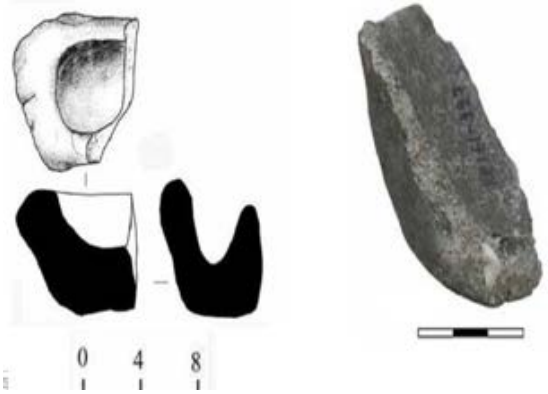



Fig. 11. Stone molds from Orchusani (Gambashidze et al. 2010: 441 & 442)

**4-5.Tepe Chay Khoy:** Tepe Chay stands as a multi-period archaeological site positioned approximately 10 kilometers southeast of Khoy city, situated at an elevation of 1181 meters above sea level. Unearthed findings at the site, including obsidian chipped stones, mud-brick remnants, and variously sized pieces of furnace welds, strongly indicate Tepe Chay's utilization as an industrial site during prehistoric eras. Through excavations, researchers have delineated four distinct occupational periods, with the stamp seal associated with the fourth period categorized under the Late Chalcolithic 3 phase (LC3). The discovery of the stamp seal signifies the intricate social and economic fabric of the communities dwelling within the site. Furthermore, it suggests that the society was at the precipice of transformation, transitioning into novel cultural complexities (Garavand et al., 2022: 151-152). In the northwestern region of Iran, only two seal samples—a cylinder and a stamp seal—have been documented thus far, originating from the Bronze Age sites at Kul Tepe Gargar (Abedi, 2015: 102; Abedi 2022). The Tepe Chay clay stamp seal measures 30 mm in length and 25 mm in width. It features a straightforward carved excised decoration on its surface, housing a 3-mm hole at its center designed for suspension. The seal's surface is segmented into two parts, followed by seven horizontal lines etched below this division line (Figure 12). Alongside the stamp seal, various cultural artifacts, including stone beads, polished stone objects, obsidian tools, among others, have been documented at Tepe Chay (Garavand et al., 2022). Moreover, the excavation at Tepe Qeshlaq yielded an array of administrative artifacts, including clay and bone flat and cylindrical seals, along with seals and tokens displaying diverse shapes such as round, button, horn-shaped, disk, oval, spherical, conical, barrel, and hyperbolic forms. Predominantly, these administrative materials were recovered from phase IV. The absolute dating of this phase indicates a timeframe around 3915 ± 270 BC (LC2-3). The geometric motifs engraved on these seals and

impression seals signify their role in facilitating regional and foreign trade activities. By comparing the tokens, stamp seals, and obsidian stones, parallels have been drawn between the pottery discovered at Tepe Qeshlaq and those found in sites across the Urmia Plain (West Azerbaijan), southwest Iran, and Mesopotamia. This correlation suggests that the inhabitants of Tepe Qeshlaq engaged in commercial and economic interactions with individuals from Chalcolithic societies (Sharifi, 2019).

Fig. 12. Stamp seal of Tepe Chay (Gravand et al., 1401: 157)

**4-6.Gerdi Ashowan:** The recently excavated Gerdi Ashowan site in Piranshahr yielded cultural artifacts such as obsidian tools, shell fragments, and copper pieces, primarily indicative of commercial activities and internal control mechanisms. These findings suggest a cultural affinity between the Late Chalcolithic pottery collections from Gerdi Ashowan and sites in northwest Iran, Anatolia, Caucasus, Mesopotamia, and Syria. Research outcomes illustrate the coexistence of communities in Gerdi Ashowan with cultural resemblances to regions in Northwest Iran, North Mesopotamia, Caucasus, and Anatolia, suggesting cultural similarities. The geographical positioning of the Urmia Lake basin has historically served as an interconnecting route, with Gerdi Ashowan potentially playing a role as a midpoint and communication hub, a notion supported by the discoveries of obsidian, shell, and metal artifacts. During the 4th millennium BC, the Late Chalcolithic 2 and 3 Chaff-faced Culture (CFW) expanded on this site, later succeeded by the influence of the Kura-Araxes culture at the beginning of the 3rd millennium BC, replacing the former (Sharifi, 2019: 488-488). Additionally, shells and obsidian from the Tepe Qeshlaq area, particularly the obsidians, suggest origins from Caucasian and Anatolian regions (Sharifi, 2020: 305, fig: 87-6; Sharifi, 2019: 305-298). The vicinity of Tepe Qeshlaq boasts abundant mineral resources, including chert and high-quality river flint. Notably, findings include a sample of copper sulfate rock and a stone mold for copper molding (Table 1) (Ibid., 2019: 317).

The inception of archaeological investigations in the South Caucasus traces back to the 19th century, wherein the Chalcolithic period was denoted as the Eneolith cultural era. Within this period, archaeologists have discerned two distinctive cultures, the Kura-Araxes and Maikop cultures, existing within the North Caucasus geographical area. Hence, the Kur and Aras rivers within the Caucasus basin are often referred to as the Mesopotamia of the Caucasus. Notably, prominent archaeologists like Kuftin, Issen, and Səlimxanov conducted investigations and scholarly examinations of this region in the 19th century (Avşarova & Pirquliyeva, 2010: 51-52). The field of prehistoric archaeology within the Caucasus region has gained favor among Western archaeologists' field projects (Lyonnet & Quliyev, 2010: 85-98). Among the sites in the South Caucasus, the Alkhan Tepe site has yielded administrative documents. Seals recovered from this site exhibit semi-circular forms, perforations, polished texture, and are crafted from raw clay. Notably, these seals feature 11 irregularly placed small dimples on their surface

(Fig. 13), suggesting plausible associations with counting or possibly indicating the sealing of specific items (Axundov, 2021: 724).

Furthermore, notable administrative records were recovered from the Böyük Kəsik site in the Republic of Azerbaijan, attributed to the Leyla Tepe culture, which stands as a crucial site within the South Caucasus. Within this site, two clay seals, circular and semi-circular in shape, were unearthed. These seals were designed with a hole to allow thread passage for hanging. As depicted in Figures 14 and 15, these seals exhibited engraved animal motifs and nail-shaped lines (Museyibli, 2009:16). Orchosani, situated in the southwest of Georgia, represents a site dating back to the Chalcolithic and Bronze Age periods, revealing typical administrative artifacts like seals. Positioned at an elevation of 1200 meters above sea level and situated alongside the Poteskhoy River, Orchosani presented perforated rhombic seals (Figure 16), dome/stamp-shaped with grid motifs (Gambashidze et al., 2010: 284 & 439). Furthermore, Figure 17 illustrates significant stamp-shaped seals acquired from Kaghchaghbiur, regarded as crucial administrative documents (Shanshashvili & Sherazadhshvili, 2013: 20; Abedi 2022).

Fig. 13. Clay seals from Alkhan Tepe (T.İ.Axundov, 2021: 724)

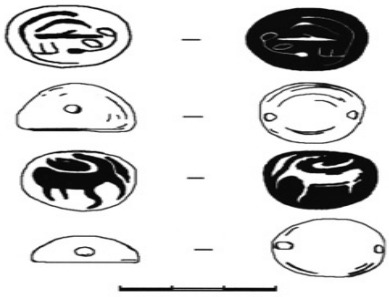


Fig. 14. Clay seals from Böyük Kəsik (Museyibli, 2007:16)
Fig. 15. Clay seals from Böyük Kəsik (Нариманов и др. 2007, стр, 62)

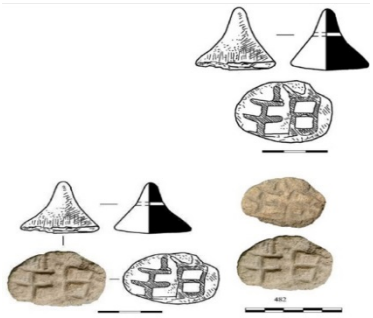


Fig. 16. Rhombus-shaped seals from Orchosani

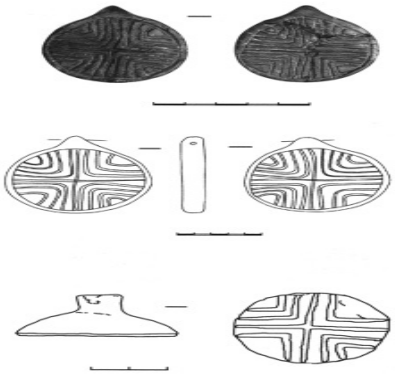
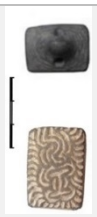
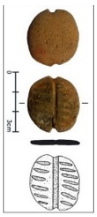


Fig. 17. Stump-shaped seals from Kaghchaghbiur trading area (Gambashidze et al., 2010: 284 & 439; Shanshashvili & Sherazadhshvili, 2013: 2)

Table x. Sites containing seals and impression seals (administrative documents) from northwest Iran

| No. | Site name | Seal sample | Impression seal sample | Geographical coordinates | Area ($m^2$) | Site height (m) | Elevation from sea level (m.a.s.l) | Overlooking one of the natural resources | Cultural period | Geographical coordinates | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Sohachay Tepe |  |  | 3919097 4822784 | 156 | - | 1650 | Sohachay | Chalcolithic and Paleolithic | Zanjan | Rahimi Sarkhani et al. (2016: 56) |
| **2** | Kulyeri |  |  | 3615385 4924358 | - | 12 | 1704 | A mountainous area-Yengechay River | Chalcolithic and Neolithic | Abhar | Khosravi et al. (2009: 40) |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3** | Tepe Chakhmaqluq |  | - | | 2500 | - | 2002 | A mountainous and uneven area | Chalcolithic and Neolithic | Abhar | Khosravi et al. (2012: 144) |
| **4** | Tepe Chay |  | - | 4254789 499552 | Less than 10,000 | 1 | 1181 | An intermountain Plain | Chalcolithic, Neolithic, and Paleolithic | Khoy | Gervand et al. (2022: 141-167) |
| 5 | Tepe Falaj |  | - | 36° 11′ 38.7″N 49° 2′ 43.0″ E | 12 × 1002 | 6 | 1497 | A mountainous and uneven area | Chalcolithic, Neolithic, Iron Ages, and Islamic era | Khoramdareh | Khosravi et al. (2009: 41) |

## 5.Conclusion

The current investigation discloses documentation concerning management, oversight, and regulation within the Chalcolithic communities of northwestern Iran. Notably, these documents are predominantly sourced from architectural spaces, charred pit deposits, burnt refuse areas, and kitchen zones. These discoveries serve as foundational evidence in reconstructing the management, social dynamics, economic structures, and potentially political systems during the Chalcolithic era.

The administrative management evident in prehistoric societies signifies the intricate social supervision exerted by a group identified as social elites over another group, termed as followers or internal control. These administrative artifacts encompass seals, seal impressions, and various types of tallying instruments, which have been sparsely acquired and examined within the northwestern region of Iran. The administrative records originating from Tepe Chay, Chakhmaqluq, Kulyeri Tepe, Soha Chay Tepe, Tepe Falaj, Tepe Qeshlaq, and Tepe Kelnan offer an opportunity to explore expansive trade networks, economic pursuits, societal intricacies, and cultural exchanges with neighboring regions within the northwestern Iranian plateau.

Seals and seal impressions engraved on clay tablets stand as some of the most invaluable remnants from prehistoric and historical societies on the Iranian plateau. A systematic analysis and examination of these artifacts afford archaeologists and art historians the means to scrutinize the material and spiritual dimensions of ancient cultures, symbols of authority, and societal hierarchies. Furthermore, these artifacts signify ownership and the transfer of commodities over prolonged periods. The scrutiny of these materials is paramount in elucidating administrative cultures, local and foreign commodities, as well as trade activities, be they local or across vast distances.

In the surrounding regions where administrative documents have been retrieved, notable sites encompass Tepe Khaleseh in Zanjan, the ancient Alu site in Qazvin, Tepe Zagheh

in Qazvin, and Tapeh Qeshlaq in Bijar within the central Iranian plateau. Additionally, sites such as Böyük Kəsik in the Republic of Azerbaijan, representing the Chalcolithic era (the earliest instance in the South Caucasus region), and the Orchusani in Georgia within the South Caucasus, are noteworthy. These seals exhibit circular, semi-circular, and oval shapes, featuring perforations designed to accommodate threads for suspension, and are crafted from fired clay, displaying depictions of animal and geometric motifs.

During the Chalcolithic periods in northwestern Iran, archaeological findings point to the presence of administrative documentation within this geographic area. These discovered documents, encompassing seals, seal impressions, and tokens, reflect the application of administrative management/internal control techniques, indicating the emergence of heightened societal intricacies and the facilitation of industrial specialization, particularly in metal manufacturing. This documentation suggests an improved means of communication among the region's inhabitants. The proximity between the mountainous and lowland areas represents short-distance interactions. In contrast, the connectivity with the central Iranian plateau, the South Caucasus, and even Mesopotamia denotes long-distance associations. The discovery of seals, seal impressions, tokens, and the utilization of administrative management/internal control techniques underscores the progression of societal complexity and the establishment of industrial specialization, particularly in metal production. This advancement has fostered enhanced communication between the highlands and lowlands in a localized context, while also fostering connections with the central plateau of Iran, the South Caucasus, and even Mesopotamia, signifying long-distance interactions.

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# بررسی و مطالعه باستان‌شناختی مدارک مدیریتی جوامع دوره مس و سنگ شمال‌غرب ایران

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## چکیده

بررسی و مطالعه مدارک مدیریتی مانند سایر داده‌های باستان‌شناختی، همواره در مطالعات باستان‌شناسی و جامعه‌شناسی دارای اهمیت بوده است. چنین پژوهش‌هایی می‌تواند در بازسازی نظام مدیریتی، اجتماعی، اقتصادی و حتی سیاسی مورد توجه قرار گیرد. در واقع مدیریت اداری در جوامع پیش از تاریخ نشان‌دهنده پیچیدگی‌های اجتماعی و نظارتِ گروهی از افراد جامعه (به‌عنوان سرگروه/رهبر) به گروهی دیگر (به‌عنوان زیرگروه/پیرو) است که از آن به‌عنوان کنترل داخلی نیز نام می‌برند. از مدارک مدیریتی می‌توان به مهرها، اثر مهرها و انواع اشیا شمارشی اشاره کرد. این‌گونه داده‌های فرهنگی به‌ندرت از منطقه شمال‌غرب ایران به دست آمده و مورد مطالعه قرار گرفته‌اند. هدف از نگارش پیش‌رو، معرفی، بررسی و مطالعه داده‌های مدیریتی دوره مس‌وسنگ منطقه شمال‌غرب ایران است که با روش توصیفی – تحلیلی انجام یافته است. در رابطه با مدارک و شواهد مدیریتی دوران پیش از تاریخ شمال‌غرب ایران سؤالات زیادی هنوز بدون پاسخ مانده است پرسش‌هایی نظیر اینکه آیا شواهدی از مدارک و داده‌های مدیریتی از جوامع دوره مس‌وسنگ شمال‌غرب ایران وجود دارد؟ و اینکه بر اساس این داده‌ها چگونه می‌توان بحث مالکیت و مدیریت در پیش از تاریخ پایانی شمال‌غرب مورد تجزیه و تحلیل و ارزیابی قرار داد؟ پاسخ به این مجهولات می‌تواند افق روشن و پیش زمینه‌ی مناسبی برای مطالعات این نوع موضوع در شمال‌غرب ایران را فراهم آورد. پژوهش حاضر بر اساس داده‌های مدیریتی به دست آمده از محوطه‌های تپه چای خوی، چخماق لوق، تپه کول بِری (تپه کاروانسرا)، سها چای تپه و غیره سعی بر آن دارد تا به ارزیابی شواهد مدیریتی در شمال‌غرب ایران بپردازد. بر اساس مواد فرهنگی برجای مانده و نتایج پژوهش‌های به‌دست‌آمده، می‌توان پدیده‌هایی مانند تجارت دور بُرد، فعالیت‌های اقتصادی، پیچیدگی‌های اجتماعی و برهمکنش‌های فرهنگی با مناطق همجوار را در شمال‌غرب ایران مورد بررسی قرار داد.

**واژه‌های کلیدی:** شمال‌غرب ایران، مدارک مدیریتی، دوره مس‌وسنگ، فعالیت‌های اقتصادی – تجاری، مناطق همجوار.

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# Preliminary Study and Introduction of Recovered Armaments from Parthian Catacombs at Vestemin, Kiasar, Sari, Considering 2015, 2017, and 2018 Excavation Seasons

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**Abstract**

The contractor of the gas line transition from Damghan to Neka destroyed and recovered two tombs in 2014. The site is located 80 km south of Sari. Archaeological excavations led to discovering two historical cemeteries, settlements, and an Islamic castle and cemetery. Architectural remains and objects indicate historical catacomb burials. There are questions about the site including the architectural structure of the catacombs, burial method and dating. Systematic survey and excavation and subsequent comparison of data, with burial method, suggest a vast Parthian settlement in the site. Vestemin is the first Parthian site in Mazandaran. What distinguishes the site from the other Parthian cemeteries is the family catacombs. The Vestemin catacombs consist of three parts, including 1) the rectangular space or the corridor, 2) threshold or entrance between the rectangular space and the catacomb chamber, 3) the catacomb chamber. Armaments including swords, daggers, arrowheads, trefoil arrowheads, and armor were among the findings of the cemetery. Varieties of the objects and using armaments as gifts, had nothing to the deceased's gender. Investigating the types of armaments reveal how the cavalries applied them, because armaments such as swords, daggers, and arrowheads, are light weapons that Agile Parthian cavalries used against the romans' heavy weapons, as their classic enemy.

**Keywords**: armament, Sari, Vestemin, Parthian, archaeology .

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## 1. Introduction

The contractor activities on transitional gas lines from Damghan to Neka revealed and partially destroyed the remains of two catacombs at Vestemin village, 80 Km south of Sari. The local MCHTO office was immediately informed which was followed by a preliminary investigation and the prevention of the development project. The preliminary investigation and recognition of anomalistic burials in Mazandaran, an excavation program proposed, accepted, and financed, which began after mapping and drawing 10*10 networks. Three seasons of excavations led to the finding of two historical cemeteries, a settlement, castle and an Islamic cemetery. Several questions were proposed about the site, including understanding the architectural structure of the cemeteries, recognizing burial method, and dating. Survey and comparison of data, and burial style, confirmed a Parthian vast settlement in the region. Vestemin site is the first Parthian site that was archaeologically excavated in Mazandaran. Family catacombs distinguishes the site from the other contemporary sites. The catacombs consist of 1) a rectangular space or corridor, 2) threshold or entrance between two rectangular space and the catacomb chamber, and 3) the catacomb chamber. The present paper uniquely explains the recovered armaments from the site. Armaments such as swords, daggers, arrowheads, trefoil arrows and armors with the other objects were burial gifts. Historical sources present very little information about the Parthian period, including Mazandaran during the Parthian era, in comparison to the other periods. Following the Parthian foundation at northeastern Iran, Arashk and Tirdad, then Artaban I conquered Hirkania and Mazandaran, respectively (Colledge 2001: 23), whereas the historical sources only referred to the kings' invasions to the southern strip of Caspian Sea. Again, historical sources talk of the people of Mazandaran during Pharaates I. In his first days, Mards or Amards were displeased of their neighbor's, Parthian movements and probably raised and rioted. On the other hand, Hirkania opposed and rioted against Parthians (Pirnia 2010: 1828). Tapooris, who lived between these two people, allied with the rioters. Therefore, Pharaates quelled the uprisings by leading his troops to the territories of Mards. Passing through the land of Tapoors, he went to the Mards' land. Probably, he defeated the Hirkanis and the Tapooris before the Mards, because he had to pass through their lands to reach Mards'. He fought hardly to Mards and finally dominated them. Then he ordered his troops to move from Tapooris to the Mards lands. From then on, sources rarely point to Mards in Mazandaran, hereby known as Tapooris.

Historical sources remain silent about the people of the south of the Caspian Sea, after Pharaates I, 176-174 BC, until Vologases I. However, during the reign of Vologases I another group of people from eastern Mazandaran, the Hirkanis, rioted in the region. Expeditions to the eastern regions of Mazandaran, Hirkani, was among the considerable actions of Vologases I. There was an uprising at 58 A.D. at Hirkania that Tacitus says in his annals, it was the reason that the Romans Proceeded to Rome during the reign of Vologases I. The Hirkani people rioted against Vologases and claimed independence, then sent representatives to Neron's court and ask for an alliance against Vologases. The event was in 58 AD, the year that Gorgan, as one of the oldest regions of the Parthian territory, departed from the country. Probably, the Romans could not effectively help the Hirkani rioters, due to the long distances. Therefore, the Hirkani ambassadors returned from Rome quite quickly, passed Euphrates and met Korbolo next to Militen (Parviz 2011: 136). The Hirkani uprising, continued from 58 to 75 AD, when the central Parthian government succeeded to suppress the riot (Haqiqat 2000: 162).

There is no information regarding the Parthian presence from Vologases' reign until the early Sassanid period, however, enlightening information was revealed when Gashnasf Shah, the king of Farashvadgar and Tabaristan, Exchanged letters to Tansar, minister of Ardashir Babakan.

However, historical sources are silent about Mazandaran during the Parthian period, archaeological findings including sites, cemeteries, and castles across Mazandaran, explain the Parthian presence in the region. One of the valuable Parthian sites is located at Vestemin village at the so called Latte Sar region of Sari, which is now known as Vestemin site. The site is considerable because of its approximation to the Parthian capital, Sad Darvazeh, and the Silk Road. It is 46 Km (air distance) from Sad Darvazeh, on the other hand, it is on the old road that connected the Parthian capital to Sari, capital of the Farashvadgar Province, and 80 Km far from Sari.

Following the gas line project from Qusheh Damghan to the Neka Power Plant, the pipe line directly passed through the site and damaged parts of the castle and the Eastern Cemetery, at the same time, road construction heavy machinery destroyed several catacombs in the Western Cemetery. Fortunately, Soortijie and his colleagues surveyed and documented the site, which led to the prevention of the Gas Company development activity. Then, during the summer and fall of 1394, 1396 and 2018 Sharifi excavated the site, of which the present paper's studies recovered armaments from 2015, 2017, and 2018 seasons.

## 2.History of research

Even though, Parthians governed for a long time, approximately 500 years, one should acknowledge there is little information for such a long period. Historical and non-historical sources of Parthian period are rare, compared to the other earlier and later periods, which was followed by a lack of scholar trends. Apparently, there is scarce information about the Parthian culture and civilization, let alone the Parthian armaments.

Scholars including Poor Davood (2003), Hekmat (1971), Narman Sharp (2005), Schippman (2005), Zia Poor (1964), Kaveh Farrokh (2008), and Nayyer Noori (1966) have written chapters about ancient Iranian armaments, however, they are not specialized and there are no detailed references to Parthian armaments.

## 3.Methodology

The authors enjoyed bibliography and field work to introduce and understand armaments. The studied material evidence discovered after several seasons of field work. The evidences prepared the following collection of historical sources about the history of Parthians, historical events and reports of wars, documentation of armaments such as swords, daggers, arrows, arrowheads, spears, armors, and shields, which were measured using instrumentation and calipers, photography, digital scan, and drawings. Finally, the extracted information was prepared by Excel software, as a table of abundant armament findings from Vestemin.

## 4- Location and geography of "Latt-i-Sar", Vestemin

Vestemin site located 9 Km southeast of Kia Sar, is the center of Chahrdangeh district, of the Sari environs. The Site is named after the village that is located 3 Km away. The main name of the Parthian site is "Latt-i-Sar", which was changed to the name of the village, which it is located in.

The village is located in a mountainous region, it is limited in the east to Terkam village, in the north it reaches the KiaSar road to the Cement Factory, from the south it

is surrounded by the Sari-Semnan road, and finally, regional forests in the western frontiers of the region. Latt-i-Sar, is located in a mountainous region, and includes a Settlement, an Eastern Cemetery, a Western Cemetery, and the Castle.

The site, is on a gentle slope of the mountain, that stretches east-westwardly, it starts from the east and ends after 300 m at a valley in the west. Furthermore, there is a shallow valley at the south of the site, which was created due the so called Latt-i-Sar spring and in the north the Parthian site reaches to a deeper valley where another spring is located, which is known as Babr Cheshmeh [the tiger spring]. The Site is at an altitude of 2010 m, 053 35’ 149” longitude, and 36 14’ 317” latitude (map 1, fig. 1).


**Map 1. The location of Vestemin of Let -Sar in Mazandaran**

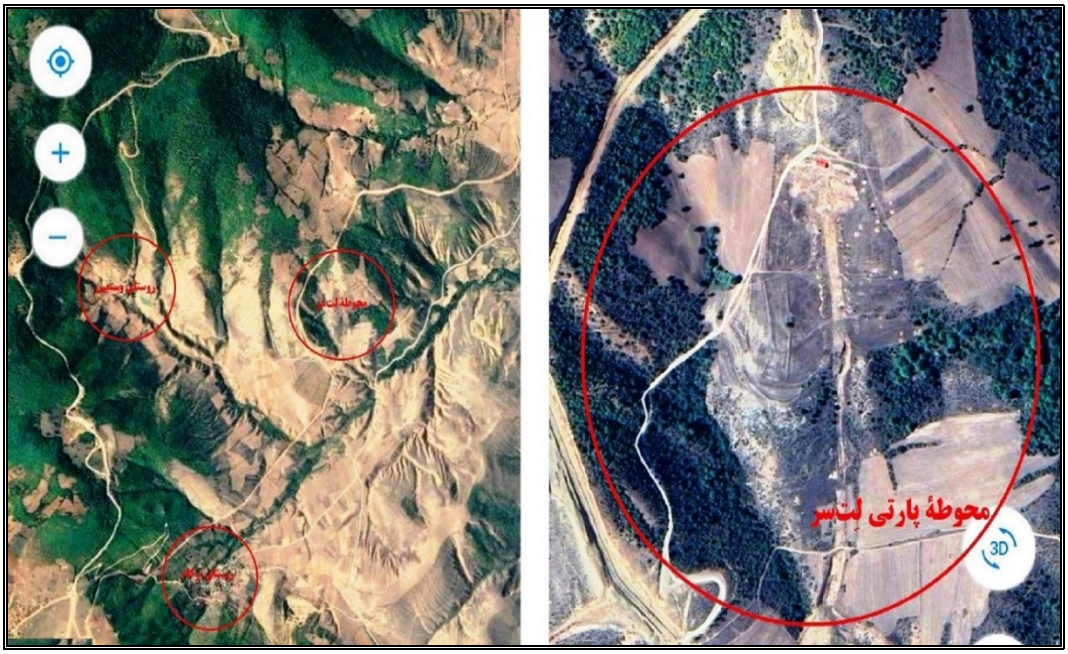



**Figure 1. The location of Vestemin of Let-Sar.**

## 5.Stylistics of Parthian armaments

Swords, daggers, bows and arrows, quivers, spears, axes and battle axes, javelins, clubs, slings, armors, shields, and helmets were included in the Iranian ancient armaments. Swords were very useful in ancient Iranian warfare. In other words, they were "… the main armaments of the battlefield…." (Hekmat 1971: 191), when swords were specialized to the cavalries. The weapons were long, wide and double bladed, which were tied on the waist using a leather band passing through the sheath (Zia Pur 1964: 294-5). Every belt passed through a "P" form joint, that had a changeable curve that let the soldiers draw the sword as quick as possible (Farrokh 2008: 21). Parthian swords were normallysmaller and thinner than later Sassanian swords; Sassanids increased the lengths of the swords to 110 cm with a 5-8 cm width (Farrokh 2008: 20).

Parthians were accustomed to horse riding and archery since early childhood, and were popular as *Pahlavan/ Pahlav/ Parthua* , which is a term used even today (Shapur Shahbazi 1986: 489). Bows and arrows were the long range offensive weapons that were used, not only in game hunting, but also, in battlefields. The weapons were engraved in a Tang-i-Sarvak relief with a chivalry (Mohammadifar 2008: 219). The contemporary arrows were made of wood, similar to bows, which were called "…Tigr and in Avest Tiqr…" (Purdavood 1967: 32). The Parthian's arrows were made so that they could shoot quickly and thoroughly to penetrate the armors of the roman legionnaires (Debevoise 1983:86). The arrowheads were made of iron, then they were poisoned. For more lethality against enemies, sometimes, they were made of trefoil.

**Quiver:** it was used as a holster for arrows by the archers. The word for quiver in Avest is "akan", in Pahlavi "kantir", and in Persian "Tarkesh" (Purdavood 1967: 41). The form of the quiver is engraved in the Tang-i-Sarvak relief, which is with the cavalry on the right side of the horse (Mohammadifar 2008: 219). Quivers are clearly visible in Firuz Abad reliefs of Ardashir I and his son Shapur I, two of the earlier Sassanid kings.

**Spear:** Iranians used the weapon since ancient times. The Avestan and ancient Persian word for spear is "Arashti" and it is "Nichak" in Pahlavi, which was changed to "Nizak" in Arabic (Purdavood 2003: 471). Darius I was proud of his spear throwing, and his ability to use the weapon on horse and on foot (Sharp 1988: 47). It should be noted that a short spear is called a javelin, with an approximate 1 m length.

**Armor:** It is war clothing, made of leather or woven of metal rings or plates, that has a long history in Iran. Parts of an armor, with scale-like plates that were woven on leather, were recovered in the 1996 excavation season in Zivieh, Kurdistan. Parthians wore scaled armor in comparison to Sassanians who wore chain armors (Shipmann 2005: 114). The cavalry weren't the only ones who wore armor, but their horses also used armors that were called "Bargostovan" (Nirnoori 1966: 174). There is an armored horse with scaled armor in the Tang-i-Sarvak relief (Mohammadifar 2008: 219). A Parthian cavalry man (Cataphract) is engraved in the Dura-Europos reliefs (fig. 2).

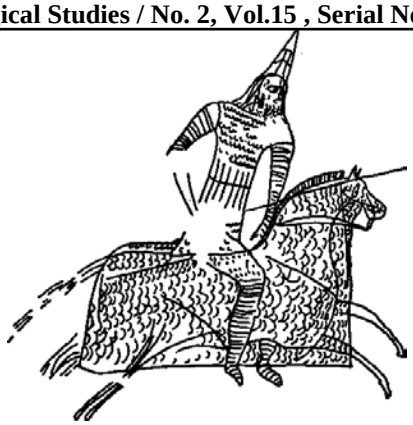


**Figure 2. Parthian Heavy cavalry painted on the walls of Dura-Europos.**

**Shield:** it is a portable armament of a soldier that was used to prevent hits from swords and spears from enemies (Amid 2002: the following words). The weight and width of shields vary throughout the history of Iran; they were made occasionally of light and thin wood and covered by leather, while some had copper and gold ornaments (Hekmat 1971: 194).

## 6.The Architecture of the Burials of Vestemin

Vestemin site has two eastern and western cemeteries, whereas only one burial was excavated through the 2015 season, while the main excavation activities were in the Western Cemetery. The western cemetery of Vestemin has a unique architecture of catacombs, which rarely appeared in the Parthian cultural range; therefore, the present paper involves a summary about the cemetery, before any discussion regarding the recovered armament from the cemetery.

### 6-1. The Architecture of Catacombs

The catacombs consist of three parts, including 1) rectangular space (corridor), 2) the threshold-like entrance, and 3) catacomb. On Average, the rectangular spaces have a 1.6 m length that varies from 1.4 to 1.8 m. The chambers have a variable width between 60 cm to 80 cm. Considering the west-east land slope, the spaces vary from 1.8-3 m in depth. The other architectural section is a connecting structure between the rectangular chamber and the catacomb, in a threshold form. Following the digging of the rectangular space, the structure continued at the western side, with an arched hole, 50 cm high and 45 cm wide, at the beginning of the catacomb. The threshold space was applied at the entrance of the catacomb, and was closed by stone and mud after the burial in the catacomb.

The main part of the catacomb structure is the catacomb itself, which usually is at the western side of the rectangular space. The catacombs, with variable sizes, usually appear as a domical earth, with circular or oval sections that varies from 1 to 3 meters, however, the fall of walls and clay-lime domes make figuring the dimensions of the structures ambiguous. Several intact and unfallen catacombs indicate a height of 110-150 cm (fig. 3).

There are rectangular, square, or circular pits, with various dimensions, at the threshold or center of most of the catacombs. However, their function is unknown. Except two of the pits that contained daggers, most of the pits were empty, without any cultural or human data. There were bones, vessels or other objects in some of the pits, which appeared during later penetration into burials, under natural factors such as earthquakes or water. In one case, there is a narrow canal on, with a gentle slope, on the

floor and toward the pit. The application of the pits as an altar or as a drain for the deceased's leaks, demands more similar findings. As it was a family burial site, for some of the new burials, earlier bones and objects were moved to the rectangular chamber, due to the lack of space for the new deceased (The most amount of new burials discovered in a catacomb were 5).

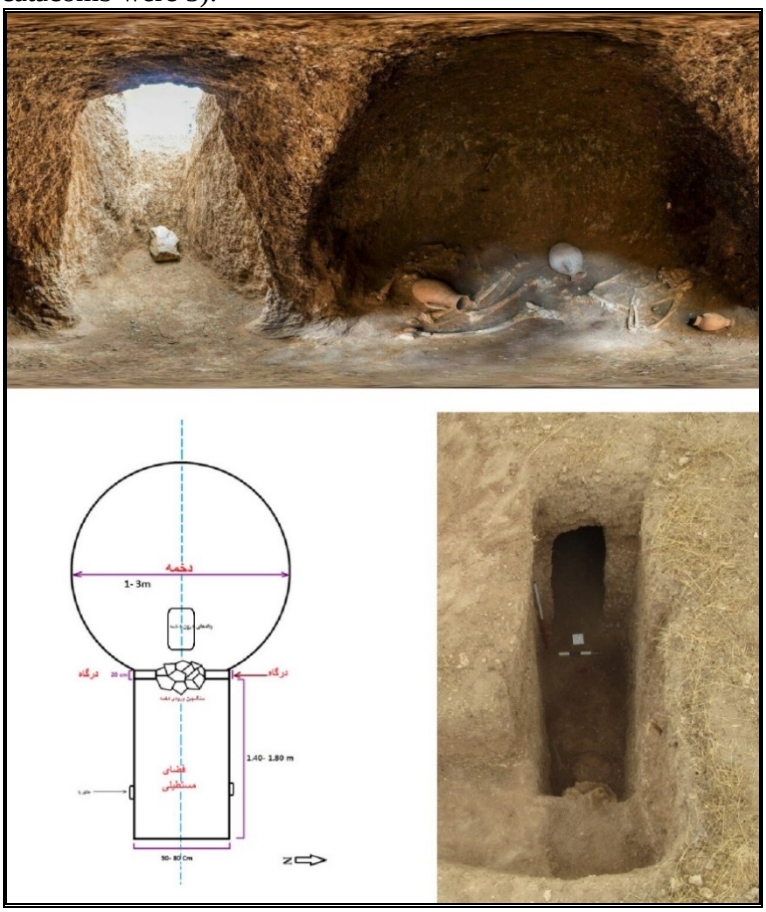



**Figure 3. The example of Catacomb of Let –Sar site**

## 7.The Armaments of Vestemin

Armaments generally directly follow every government martial strategy and method, which changed and developed through times. After Alexander, his descendants, Seleucids, enjoyed earlier strategies of Achamenid chivalries. Later, the Parthian chivalries changed martial tactics and technics that led to dominance on Greeks. The Parthian chivalries, very similar to ancient Northern Scythes and Masagets, could apply their martial technics against Greek foot soldiers [infantries] and defeated them. They used armor and helmet and used another armor for their horses, however, bows and arrows were their main weaponry (Farrokh 2008: 9). Furthermore, Parthian chivalries, the most efficient Parthian force, enjoyed sword, dagger and other light weaponries, because Parthians knew they could not rely efficiently on their foot soldiers against experienced Roman legionnaires that were of the best heavy weapon foot soldiers of the world in hand to hand combats. However, comparing to Parthian chivalries who had nomadic lifestyle and agility, Roman legionnaires were weaker and not so effective and useful in battlefields (Ibid 10).

According to the Parthian war technics, the recovered armaments from the burials of Vestemin can be categorized. Some 66 burials were excavated in the excavations of the Vestemin cemetery, which led to the recovery of armaments such as swords, daggers, arrowheads, trefoil arrowheads, and armors from 42 burials. The most abundant armament was trefoil arrowheads, while shields and armors were the rarest.

**7-1. Sword**

It was very applicable in ancient Iranian wars; in other words, it was: "… the main armament of the battlefield…" from the Achamenid to the Sassanian eras (Hekmat 1971: 191). Swords were recovered from 6 burials from the Western Cemetery, except 1 case that was unearthed from the Eastern Cemetery. Five swords were recovered next to male bodies, and one sword next to a female body, whereas another woman and a child, probably 3 years old, were buried as well; The swords were 74-92 cm. the swords were made of iron and had wooden sheaths, considering the remains of wood on the blades. Table 1 presents the dimensions of the swords. All 6 swords were straight and uncurved, even at their blade points. The swords have integrated blades and hilts, whereas cross guards [quillon] were in between and makes a cruciform of the swords. The hilts, due to the fact that they were covered with woods, were no longer than 16 cm. There is a round pommel at the end of the grip that was probably used to keep the wooden handle, which prevents it from coming out of the metal part of the hilt.

The five swords that were unearthed from the Western Cemetery, the catacombs, are typologically similar (fig. 4), while the sword that was recovered from the single burial of the Eastern Cemetery differs from the other swords. It is 92 cm long and 6 cm wide at the center of the blade, with an integrated hilt and uncurved blade (fig. 5).

Differences between the hilt of the swords are of the most important differences between this sword and the other ones that were recovered from the Vestemin cemeteries, because it does not have a cross-guard. The end of the hilt curved towards the blade and created a space for the handle. Furthermore, there are two appendices at both sides of the sword that were probably used to fasten the wooden sheath to a belt.

Another interesting point is the location of the swords in the burials. In the catacombs of the Western Cemetery, the swords were laid or stood next to the deceased, while the sword of the Eastern Cemetery is under the neck of the skeleton. The graves and burial objects, including the swords, were hardly disturbed, following the development activities of machineries before the systematic excavations. It should be noted that any explanation of the Eastern Cemetery relies on future excavations and unearthing more burials. Figs. 6 and 7 reveal the locations of the swords in the western catacombs and Eastern Cemetery.

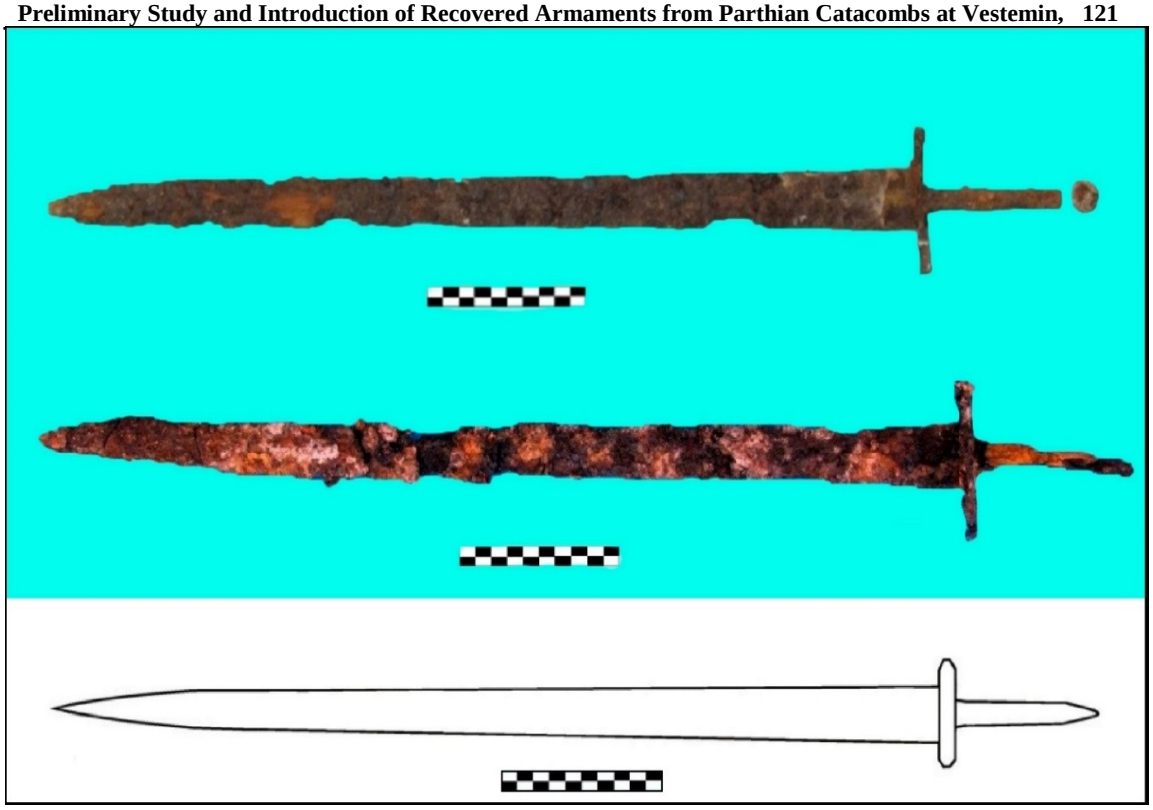


**Figure 4. The example of a claymore in the western cemetery**

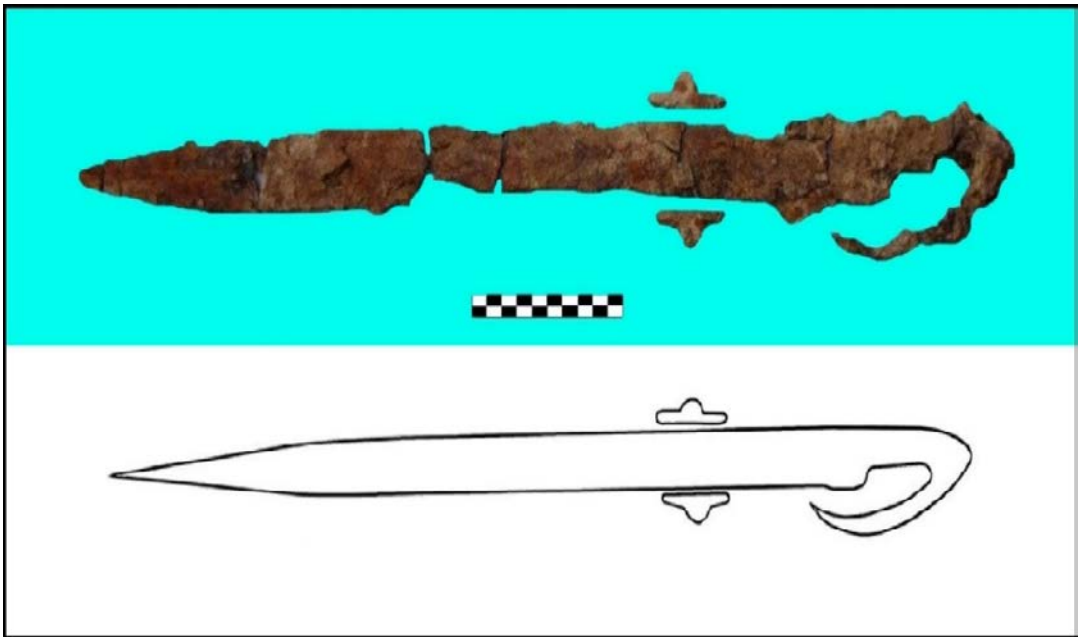


**Figure 5. The example of a claymore in the eastern cemetery**

**Figure 6- The claymore in the western catacomb.**


**Figure 7- The claymore located on the neck of the corpse in the eastern cemetery.**

**Table 2: Identification of the claymores of Vestemin cemetery.**

| NO | Handle length (cm) | Blade length (cm) | Blade center width (cm) | Hand protection size (cm) | Blade diameter (mm) | Total size of swords |
|---|---|---|---|---|---|---|
| 1 | 7.5 | 63 | 3.5 | 10 × 2 × 1.3 | 5 | 74 |
| 2 | 10.5 | 68 | 3.7 | 10 × 1.5 ×1.2 | 4 | 80 |
| 3 | 10 | 78.5 | 4 | 10 ×2 ×1.3 | 5 | 90 |
| 4 | 6.4 | 67 | 3.3 | ×1.5 ×0.6 10 | 4 | 74 |
| 5 | 16 | 76 | 6 | - | 5 | 92 |
| 6 | 13 | 70 | 4 | 10.5×1.8×1 | 4 | 83 |

## 7-2. Daggers

34 daggers were recovered, all made of iron, from 25 burials of the total 66 excavated ones. They are all made from iron and unearthed from the western catacombs. There was no dagger from the eastern cemetery. There were two recovered daggers from every one of the 7 excavated burials. Fourteen daggers were next to females and 16 daggers next to males, while in two cases, daggers were at the corridor or the rectangular space. It appears that the location of the daggers in burials was unisex, for both male and female burials. The daggers were sometimes sometimes standing, laid back on a wall, or laid on the floor next to the deceased.

The daggers consist of a hilt, separating point [cross-guard?], and a blade very similar to the recovered swords from the western cemetery of Vestemin. There was only part of an iron sheath, while in most of the cases there is remains of a wooden sheath on the blade. However, the diameter of the sheaths remains unknown, because only remains of wooden sheaths were found. The daggers vary in dimensions, however, there is not much typological difference. The daggers can be classified in three groups: 1) long daggers between 30 to 40 cm length, 2) middle daggers between 20 to 30 cm, and, 3) short daggers that are lower than 20 cm long. The shortest dagger is 16 cm and the lowest width is 2 cm. Table 2 presents dimensions of all recovered daggers from the Western Cemetery of Vestemin. Fig. 8 presents samples and drawings of recovered daggers from Vestemin.

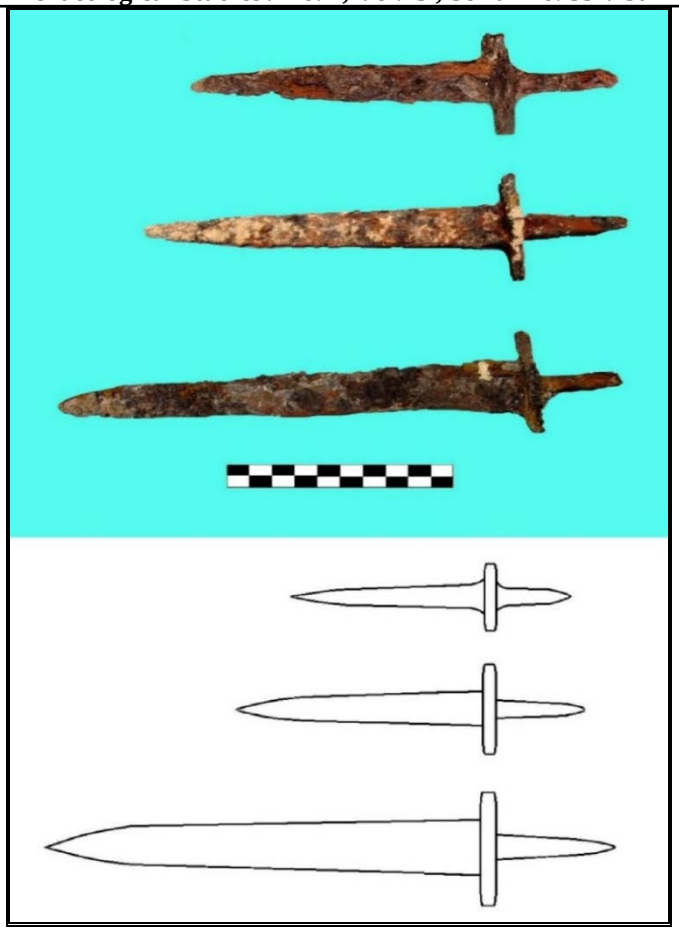


**Figure 8- The daggers discovered in catacombs.**

**Table 2: Identification of the daggers of Vestemin Cemetery**

| No | length (cm) | width (cm) | | NO | length (cm) | width (cm) |
|---|---|---|---|---|---|---|
| 1 | 32 | 4 | | 18 | 27 | 2.8 |
| 2 | 21 | 2.5 | | 19 | 38 | 3.8 |
| 3 | 28 | 2.8 | | 20 | 26 | 3.3 |
| 4 | 25 | 4.5 | | 21 | 35 | 4 |
| 5 | 16 | 4 | | 22 | 40 | 4 |
| 6 | 19 | 2.2 | | 23 | 34 | 3.8 |
| 7 | 35 | 3 | | 24 | 33 | 4 |
| 8 | 28 | 2.6 | | 25 | 33 | 4.5 |
| 9 | 18 | 3 | | 26 | 34 | 4 |
| 10 | 31 | 4 | | 27 | 30 | 4 |
| 11 | 31 | 4 | | 28 | 27 | 4 |
| 12 | 39 | 3.8 | | 29 | 30 | 3.5 |
| 13 | 32 | 3.3 | | 30 | 25 | 4 |
| 14 | 36.5 | 3.3 | | 31 | 30 | 3.2 |
| 15 | 32 | 4.7 | | 32 | 29 | 3.3 |
| 16 | 25 | 2.9 | | 33 | 40 | 4 |
| 17 | 26 | 2 | | 34 | 34 | 3.8 |

### 7.3- Arrowheads

After trefoil arrowheads and daggers, simple arrowheads were amongst the most abundant among the recovered armaments from the western cemetery of Vestemin. They consist of blade and shaft parts, where wood residue remained on the few samples, which indicates that the producers shoved the shaft in a wooden handle. Totally, 16 arrowheads were recovered from the catacombs that dimensionally vary from 3.4 to 18 cm, however, erosion hides the exact dimensions of findings. The arrowheads, which are made of iron, are formally rhomboid or cedarn. The arrowheads were unearthed from the catacombs, in some cases from the rectangular space. Considering the distribution of bone findings, they cannot be sexually assigned to a given burial. On the other hand, they are from 13 burials of the total 66 excavated ones. One should consider that the arrowheads are broken, and 16 arrowheads out of the total 18 were broken and fragmented. However, debris was not so effective on the fragmentation of the arrowheads, an intentional breakage can be the probable suggestion, however that needs more excavations to be proven. Fig. 9 presents samples of the unearthed arrowheads and fig. 3 presents the dimensions of the findings.

**Figure 9- The remains of rhomboid points**

**Table 3: index of arrowheads from the cemetery of Vestemin**

| NO | length (cm) | width (cm) | | NO | length (cm) | width (cm) |
|---|---|---|---|---|---|---|
| 1 | 18 | 6.5 | | 9 | 11.5 | 1.8 |
| 2 | 11 | 2.6 | | 10 | 11.5 | 2 |
| 3 | 7.4 | 1.6 | | 11 | 10 | 2.1 |
| 4 | 7.2 | 2 | | 12 | 10.3 | 2.1 |
| 5 | 7 | 2 | | 13 | 3.4 | 1.3 |
| 6 | 8.3 | 1.8 | | 14 | 6.6 | 1.5 |
| 7 | 6.4 | 1.8 | | 15 | 7 | 1.5 |
| 8 | 10.3 | 1.4 | | 16 | 13 | 2.2 |

## 7.4- Trefoil Arrowheads

The most abundant armaments from the catacombs of Vestemin were trefoil arrowheads, which consists of 158 from the total 214 findings. The arrowheads are not longer than 5.5 cm, with a width of 1.1. The number of arrowheads range from 1 to 19 in the burials that were next to both males and females, and in some cases, they appear on the catacomb's floor. The arrowheads are a trefoil blade, with sharp and narrow points, and a shaft that has wooden remains. It should be noted that arrowheads are made of iron, which was badly damaged following the oxidation. Fig. 10 presents a few arrowhead findings.

**Figure 10- The trefoil arrow head**

## 7-5. Armor

The only recovered armor from Vestemin is from the eastern cemetery that is from a young soldier's burial. It is made of iron plates, which is normally narrow strips on textile; there were recovered textile fragments from the burial (fig. 11).

Considering the variations of the recovered armaments from the eastern and western catacombs, one can suggest that both burials were from two different phases of the Parthian era, because the sword findings from the Eastern Cemetery differ to the same findings from the Western Cemetery, where no findings of armaments were reported of. Probably, martial strategies and/or burial customs varied through different periods, to be expected though, more excavations are required.

**Figure 11- The mail discovered from the eastern cemetery**

## 7.6- Shield

It was only recovered from the western cemetery and catacombs. It is made of iron. It was located next to a dagger, under the feet of a corpse at the western corner of the catacomb. Formally, it is concave with the remains of textile on the inner surface. The inner diameter is 15.1 cm and it is 0.5 cm thick. It has an appendix that probably worked as a handle (fig. 12).

**Figure 12- The iron shield**

## 7.7- Relevant non-Combat Tools:

In addition to armaments, some other tools were also recovered, which were relevant to armaments, including sharpener stones (fig. 13), baldric buckles and/or a belt to fasten sheaths or quivers, from the eastern and western cemeteries (fig. 14). Probably, the belts and baldrics were made of leather, because of the fragmented leather findings.

**Figure 13- The Whetstone**

**Figure 14- The buckles discovered at the catacombs**

**Chart 1: distribution of recovered armaments from Vestemin**

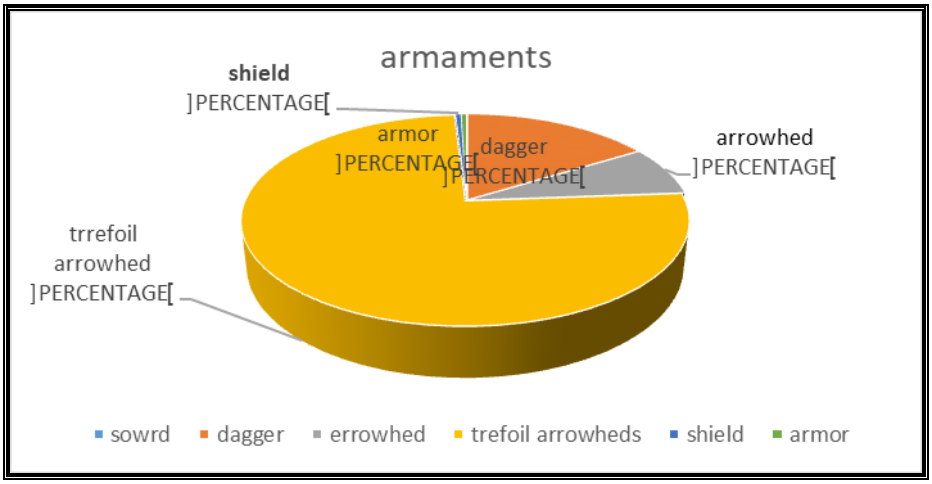
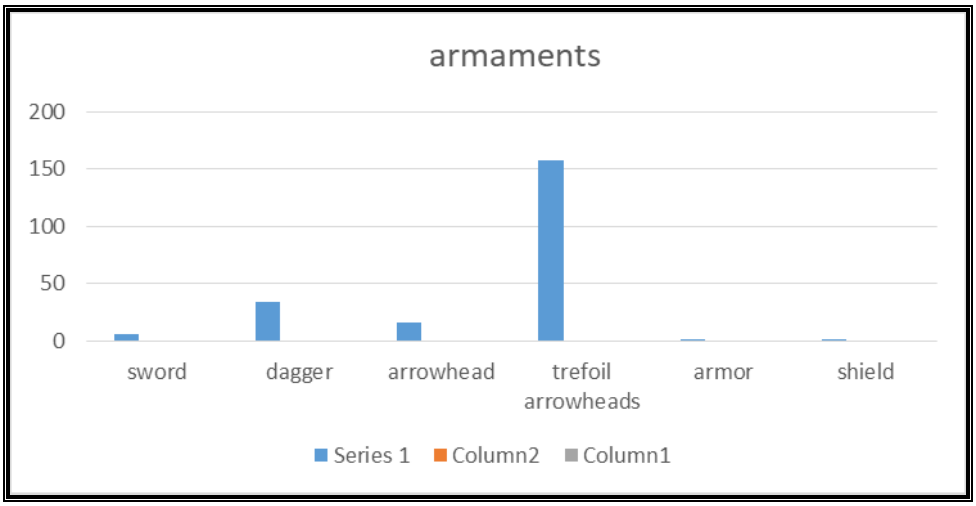



**Chart 2: distribution of recovered armaments from Vestemin**




## 8.Conclusion

Considering the recovered armaments from Vestemin, one can observe the irrelevance of sexuality in burial rites, because there was a sword in a female burial, in one case, and 14 daggers were recovered from the other female burials, a trend that could be seen for arrowheads and trefoil arrowheads as well. The Unearthed armaments included swords, daggers, shields, and arrowheads that were cavalry weaponries, the fact that these as well as light weapons, with several burial of horses were found at the western cemetery, reinforces the suspicion that the catacombs were for Parthian cavalries or/and their families, or at least the deceased were under martial culture influences. On the other hand, regarding the findings, one can confirm the significance of cavalries during the Parthian period. Furthermore, considering the difference of the burials in both the Eastern and Western cemeteries at Vestemin, with the variations of armaments, the other suggestion is that they were followed by two different Parthian phases that differed in their martial strategies. Secondly, the region was highly significant for its short distance to the Parthian 2nd capital, being located in the road from the capital city to Sari (relying on archaeological evidences), and it being a mint.

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# مطالعهٔ مقدماتی و معرفی جنگ‌افزارهای مکشوفه از گورستان اشکانی وِستِمین کیاسرِ ساری، بر اساس کاوش‌های سال ۱۳۹۴ ، ۱۳۹۶و۱۳۹۷

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## چکیده

در سال ۱۳۹۳ شمسی شرکت پیمانکار مجری خط انتقال گاز دامغان- نکا، بقایای دو گوردخمه را در روستای وِستِمین تخریب و نمایان ساخت. این محوطه در۸۰ کیلومتری جنوب شهر ساری قرار دارد. فعالیت‌های باستان‌شناسی منجر به شناسایی دو گورستان تاریخی، محوطه استقراری، قلعه و گورستان اسلامی شد. بقایای معماری و اشیاء، مبین وجود قبوری به شکل گوردخمه از دوره تاریخی بوده است. سوالاتی که در خصوص این محوطه طرح گردید، آگاهی یافتن از ساختار معماری گورها، شناخت شیوه تدفین و تاریخ‌گذاری آن‌ها بوده است؟ کاوش علمی و بررسی میدانی و نیز مقایسه داده‌ها و شیوه تدفین وجود استقراری وسیع از دوره اشکانی را در این محوطه مسجل نمود. محوطهٔ وِستِمین نخستین محوطه اشکانی در مازندران است که مورد کاوش باستان-شناختی قرار گرفته است. آنچه که گورستان این محوطه را از دیگر گورستان‌های اشکانی متمایز می‌نماید، وجود گوردخمه‌های خانوادگی است. گوردخمه‌های گورستان وستمین دارای سه بخش شامل: ۱- فضای مستطیلی شکل یا راهرو ۲ - ورودی یا درگاه بین فضای مستطیل شکل و اتاق دخمه ۳- اتاق دخمه است. جنگ‌افزارهایی مانند شمشیر، خنجر، سرتیر، سرپیکان‌های سه‌پر و زره از جمله آثار یافت‌شده از این گورستان است. در کنار اشیاء متنوع، استفاده از جنگ‌افزارها به عنوان هدیه، جنسیت متوفی مطرح نبوده است. با بررسی نوع جنگ‌افزارها می‌توان به کاربرد آن‌ها برای سواره‌نظام اشکانی پی برد، چراکه تسلیحاتی مانند شمشیر، خنجر، سرتیر و سرپیکان جزء تسلیحات سبک محسوب می‌شده و برای سواره نظام چابک اشکانی در برابر رومیان سنگین‌اسلحه به عنوان دشمن سنتی اجتناب‌ناپذیر بوده است.

**واژه‌های کلیدی:** جنگ‌افزار، ساری، وِستِمین، اشکانی، باستان شناسی.

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# Preliminary Study and Introduction of Recovered Armaments from Parthian Catacombs at Vestemin, Kiasar, Sari, Considering 2015, 2017, and 2018 Excavation Seasons

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**Abstract**

The contractor of the gas line transition from Damghan to Neka destroyed and recovered two tombs in 2014. The site is located 80 km south of Sari. Archaeological excavations led to discovering two historical cemeteries, settlements, and an Islamic castle and cemetery. Architectural remains and objects indicate historical catacomb burials. There are questions about the site including the architectural structure of the catacombs, burial method and dating. Systematic survey and excavation and subsequent comparison of data, with burial method, suggest a vast Parthian settlement in the site. Vestemin is the first Parthian site in Mazandaran. What distinguishes the site from the other Parthian cemeteries is the family catacombs. The Vestemin catacombs consist of three parts, including 1) the rectangular space or the corridor, 2) threshold or entrance between the rectangular space and the catacomb chamber, 3) the catacomb chamber. Armaments including swords, daggers, arrowheads, trefoil arrowheads, and armor were among the findings of the cemetery. Varieties of the objects and using armaments as gifts, had nothing to the deceased's gender. Investigating the types of armaments reveal how the cavalries applied them, because armaments such as swords, daggers, and arrowheads, are light weapons that Agile Parthian cavalries used against the romans' heavy weapons, as their classic enemy.

**Keywords**: armament, Sari, Vestemin, Parthian, archaeology .

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## 1. Introduction

The contractor activities on transitional gas lines from Damghan to Neka revealed and partially destroyed the remains of two catacombs at Vestemin village, 80 Km south of Sari. The local MCHTO office was immediately informed which was followed by a preliminary investigation and the prevention of the development project. The preliminary investigation and recognition of anomalistic burials in Mazandaran, an excavation program proposed, accepted, and financed, which began after mapping and drawing 10*10 networks. Three seasons of excavations led to the finding of two historical cemeteries, a settlement, castle and an Islamic cemetery. Several questions were proposed about the site, including understanding the architectural structure of the cemeteries, recognizing burial method, and dating. Survey and comparison of data, and burial style, confirmed a Parthian vast settlement in the region. Vestemin site is the first Parthian site that was archaeologically excavated in Mazandaran. Family catacombs distinguishes the site from the other contemporary sites. The catacombs consist of 1) a rectangular space or corridor, 2) threshold or entrance between two rectangular space and the catacomb chamber, and 3) the catacomb chamber. The present paper uniquely explains the recovered armaments from the site. Armaments such as swords, daggers, arrowheads, trefoil arrows and armors with the other objects were burial gifts. Historical sources present very little information about the Parthian period, including Mazandaran during the Parthian era, in comparison to the other periods. Following the Parthian foundation at northeastern Iran, Arashk and Tirdad, then Artaban I conquered Hirkania and Mazandaran, respectively (Colledge 2001: 23), whereas the historical sources only referred to the kings' invasions to the southern strip of Caspian Sea. Again, historical sources talk of the people of Mazandaran during Pharaates I. In his first days, Mards or Amards were displeased of their neighbor's, Parthian movements and probably raised and rioted. On the other hand, Hirkania opposed and rioted against Parthians (Pirnia 2010: 1828). Tapooris, who lived between these two people, allied with the rioters. Therefore, Pharaates quelled the uprisings by leading his troops to the territories of Mards. Passing through the land of Tapoors, he went to the Mards' land. Probably, he defeated the Hirkanis and the Tapooris before the Mards, because he had to pass through their lands to reach Mards'. He fought hardly to Mards and finally dominated them. Then he ordered his troops to move from Tapooris to the Mards lands. From then on, sources rarely point to Mards in Mazandaran, hereby known as Tapooris.

Historical sources remain silent about the people of the south of the Caspian Sea, after Pharaates I, 176-174 BC, until Vologases I. However, during the reign of Vologases I another group of people from eastern Mazandaran, the Hirkanis, rioted in the region. Expeditions to the eastern regions of Mazandaran, Hirkani, was among the considerable actions of Vologases I. There was an uprising at 58 A.D. at Hirkania that Tacitus says in his annals, it was the reason that the Romans Proceeded to Rome during the reign of Vologases I. The Hirkani people rioted against Vologases and claimed independence, then sent representatives to Neron's court and ask for an alliance against Vologases. The event was in 58 AD, the year that Gorgan, as one of the oldest regions of the Parthian territory, departed from the country. Probably, the Romans could not effectively help the Hirkani rioters, due to the long distances. Therefore, the Hirkani ambassadors returned from Rome quite quickly, passed Euphrates and met Korbolo next to Militen (Parviz 2011: 136). The Hirkani uprising, continued from 58 to 75 AD, when the central Parthian government succeeded to suppress the riot (Haqiqat 2000: 162).

There is no information regarding the Parthian presence from Vologases' reign until the early Sassanid period, however, enlightening information was revealed when Gashnasf Shah, the king of Farashvadgar and Tabaristan, Exchanged letters to Tansar, minister of Ardashir Babakan.

However, historical sources are silent about Mazandaran during the Parthian period, archaeological findings including sites, cemeteries, and castles across Mazandaran, explain the Parthian presence in the region. One of the valuable Parthian sites is located at Vestemin village at the so called Latte Sar region of Sari, which is now known as Vestemin site. The site is considerable because of its approximation to the Parthian capital, Sad Darvazeh, and the Silk Road. It is 46 Km (air distance) from Sad Darvazeh, on the other hand, it is on the old road that connected the Parthian capital to Sari, capital of the Farashvadgar Province, and 80 Km far from Sari.

Following the gas line project from Qusheh Damghan to the Neka Power Plant, the pipe line directly passed through the site and damaged parts of the castle and the Eastern Cemetery, at the same time, road construction heavy machinery destroyed several catacombs in the Western Cemetery. Fortunately, Soortijie and his colleagues surveyed and documented the site, which led to the prevention of the Gas Company development activity. Then, during the summer and fall of 1394, 1396 and 2018 Sharifi excavated the site, of which the present paper's studies recovered armaments from 2015, 2017, and 2018 seasons.

## 2.History of research

Even though, Parthians governed for a long time, approximately 500 years, one should acknowledge there is little information for such a long period. Historical and non-historical sources of Parthian period are rare, compared to the other earlier and later periods, which was followed by a lack of scholar trends. Apparently, there is scarce information about the Parthian culture and civilization, let alone the Parthian armaments.

Scholars including Poor Davood (2003), Hekmat (1971), Narman Sharp (2005), Schippman (2005), Zia Poor (1964), Kaveh Farrokh (2008), and Nayyer Noori (1966) have written chapters about ancient Iranian armaments, however, they are not specialized and there are no detailed references to Parthian armaments.

## 3.Methodology

The authors enjoyed bibliography and field work to introduce and understand armaments. The studied material evidence discovered after several seasons of field work. The evidences prepared the following collection of historical sources about the history of Parthians, historical events and reports of wars, documentation of armaments such as swords, daggers, arrows, arrowheads, spears, armors, and shields, which were measured using instrumentation and calipers, photography, digital scan, and drawings. Finally, the extracted information was prepared by Excel software, as a table of abundant armament findings from Vestemin.

## 4- Location and geography of "Latt-i-Sar", Vestemin

Vestemin site located 9 Km southeast of Kia Sar, is the center of Chahrdangeh district, of the Sari environs. The Site is named after the village that is located 3 Km away. The main name of the Parthian site is "Latt-i-Sar", which was changed to the name of the village, which it is located in.

The village is located in a mountainous region, it is limited in the east to Terkam village, in the north it reaches the KiaSar road to the Cement Factory, from the south it

is surrounded by the Sari-Semnan road, and finally, regional forests in the western frontiers of the region. Latt-i-Sar, is located in a mountainous region, and includes a Settlement, an Eastern Cemetery, a Western Cemetery, and the Castle.

The site, is on a gentle slope of the mountain, that stretches east-westwardly, it starts from the east and ends after 300 m at a valley in the west. Furthermore, there is a shallow valley at the south of the site, which was created due the so called Latt-i-Sar spring and in the north the Parthian site reaches to a deeper valley where another spring is located, which is known as Babr Cheshmeh [the tiger spring]. The Site is at an altitude of 2010 m, 053 35’ 149” longitude, and 36 14’ 317” latitude (map 1, fig. 1).


**Map 1. The location of Vestemin of Let -Sar in Mazandaran**

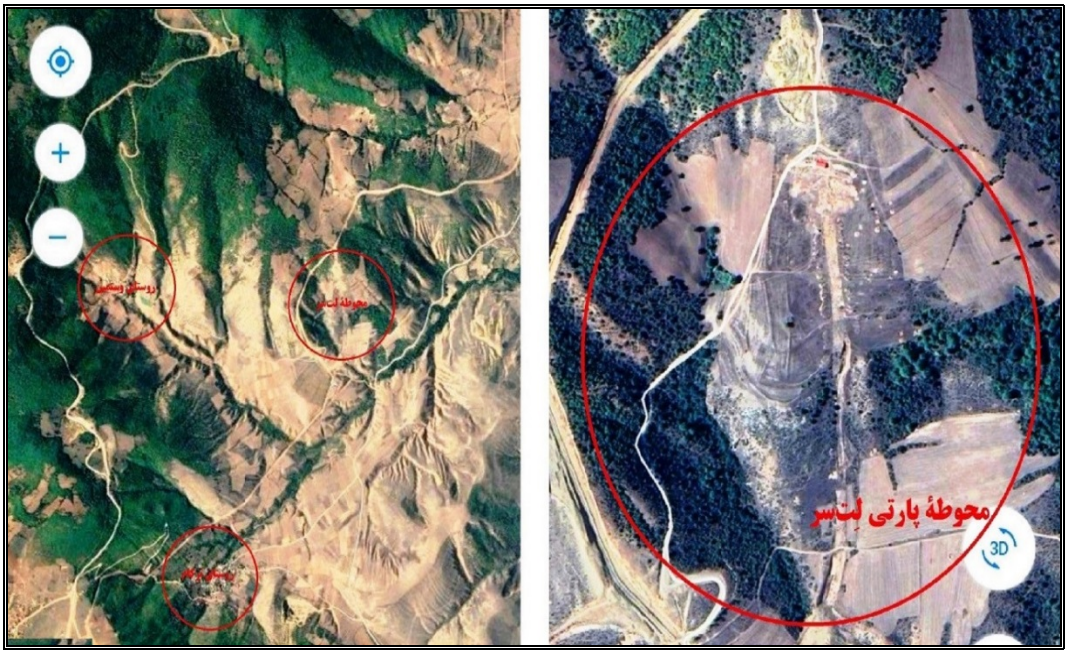



**Figure 1. The location of Vestemin of Let-Sar.**

## 5.Stylistics of Parthian armaments

Swords, daggers, bows and arrows, quivers, spears, axes and battle axes, javelins, clubs, slings, armors, shields, and helmets were included in the Iranian ancient armaments. Swords were very useful in ancient Iranian warfare. In other words, they were "… the main armaments of the battlefield…." (Hekmat 1971: 191), when swords were specialized to the cavalries. The weapons were long, wide and double bladed, which were tied on the waist using a leather band passing through the sheath (Zia Pur 1964: 294-5). Every belt passed through a "P" form joint, that had a changeable curve that let the soldiers draw the sword as quick as possible (Farrokh 2008: 21). Parthian swords were normallysmaller and thinner than later Sassanian swords; Sassanids increased the lengths of the swords to 110 cm with a 5-8 cm width (Farrokh 2008: 20).

Parthians were accustomed to horse riding and archery since early childhood, and were popular as *Pahlavan/ Pahlav/ Parthua* , which is a term used even today (Shapur Shahbazi 1986: 489). Bows and arrows were the long range offensive weapons that were used, not only in game hunting, but also, in battlefields. The weapons were engraved in a Tang-i-Sarvak relief with a chivalry (Mohammadifar 2008: 219). The contemporary arrows were made of wood, similar to bows, which were called "…Tigr and in Avest Tiqr…" (Purdavood 1967: 32). The Parthian's arrows were made so that they could shoot quickly and thoroughly to penetrate the armors of the roman legionnaires (Debevoise 1983:86). The arrowheads were made of iron, then they were poisoned. For more lethality against enemies, sometimes, they were made of trefoil.

**Quiver:** it was used as a holster for arrows by the archers. The word for quiver in Avest is "akan", in Pahlavi "kantir", and in Persian "Tarkesh" (Purdavood 1967: 41). The form of the quiver is engraved in the Tang-i-Sarvak relief, which is with the cavalry on the right side of the horse (Mohammadifar 2008: 219). Quivers are clearly visible in Firuz Abad reliefs of Ardashir I and his son Shapur I, two of the earlier Sassanid kings.

**Spear:** Iranians used the weapon since ancient times. The Avestan and ancient Persian word for spear is "Arashti" and it is "Nichak" in Pahlavi, which was changed to "Nizak" in Arabic (Purdavood 2003: 471). Darius I was proud of his spear throwing, and his ability to use the weapon on horse and on foot (Sharp 1988: 47). It should be noted that a short spear is called a javelin, with an approximate 1 m length.

**Armor:** It is war clothing, made of leather or woven of metal rings or plates, that has a long history in Iran. Parts of an armor, with scale-like plates that were woven on leather, were recovered in the 1996 excavation season in Zivieh, Kurdistan. Parthians wore scaled armor in comparison to Sassanians who wore chain armors (Shipmann 2005: 114). The cavalry weren't the only ones who wore armor, but their horses also used armors that were called "Bargostovan" (Nirnoori 1966: 174). There is an armored horse with scaled armor in the Tang-i-Sarvak relief (Mohammadifar 2008: 219). A Parthian cavalry man (Cataphract) is engraved in the Dura-Europos reliefs (fig. 2).

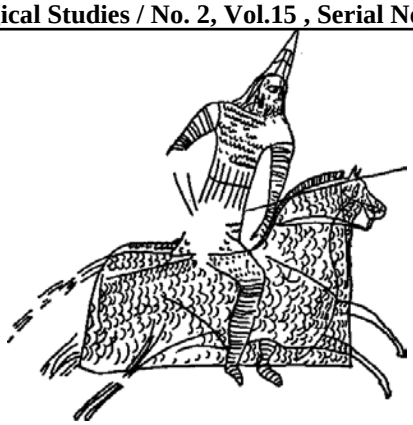


**Figure 2. Parthian Heavy cavalry painted on the walls of Dura-Europos.**

**Shield:** it is a portable armament of a soldier that was used to prevent hits from swords and spears from enemies (Amid 2002: the following words). The weight and width of shields vary throughout the history of Iran; they were made occasionally of light and thin wood and covered by leather, while some had copper and gold ornaments (Hekmat 1971: 194).

## 6.The Architecture of the Burials of Vestemin

Vestemin site has two eastern and western cemeteries, whereas only one burial was excavated through the 2015 season, while the main excavation activities were in the Western Cemetery. The western cemetery of Vestemin has a unique architecture of catacombs, which rarely appeared in the Parthian cultural range; therefore, the present paper involves a summary about the cemetery, before any discussion regarding the recovered armament from the cemetery.

### 6-1. The Architecture of Catacombs

The catacombs consist of three parts, including 1) rectangular space (corridor), 2) the threshold-like entrance, and 3) catacomb. On Average, the rectangular spaces have a 1.6 m length that varies from 1.4 to 1.8 m. The chambers have a variable width between 60 cm to 80 cm. Considering the west-east land slope, the spaces vary from 1.8-3 m in depth. The other architectural section is a connecting structure between the rectangular chamber and the catacomb, in a threshold form. Following the digging of the rectangular space, the structure continued at the western side, with an arched hole, 50 cm high and 45 cm wide, at the beginning of the catacomb. The threshold space was applied at the entrance of the catacomb, and was closed by stone and mud after the burial in the catacomb.

The main part of the catacomb structure is the catacomb itself, which usually is at the western side of the rectangular space. The catacombs, with variable sizes, usually appear as a domical earth, with circular or oval sections that varies from 1 to 3 meters, however, the fall of walls and clay-lime domes make figuring the dimensions of the structures ambiguous. Several intact and unfallen catacombs indicate a height of 110-150 cm (fig. 3).

There are rectangular, square, or circular pits, with various dimensions, at the threshold or center of most of the catacombs. However, their function is unknown. Except two of the pits that contained daggers, most of the pits were empty, without any cultural or human data. There were bones, vessels or other objects in some of the pits, which appeared during later penetration into burials, under natural factors such as earthquakes or water. In one case, there is a narrow canal on, with a gentle slope, on the

floor and toward the pit. The application of the pits as an altar or as a drain for the deceased's leaks, demands more similar findings. As it was a family burial site, for some of the new burials, earlier bones and objects were moved to the rectangular chamber, due to the lack of space for the new deceased (The most amount of new burials discovered in a catacomb were 5).

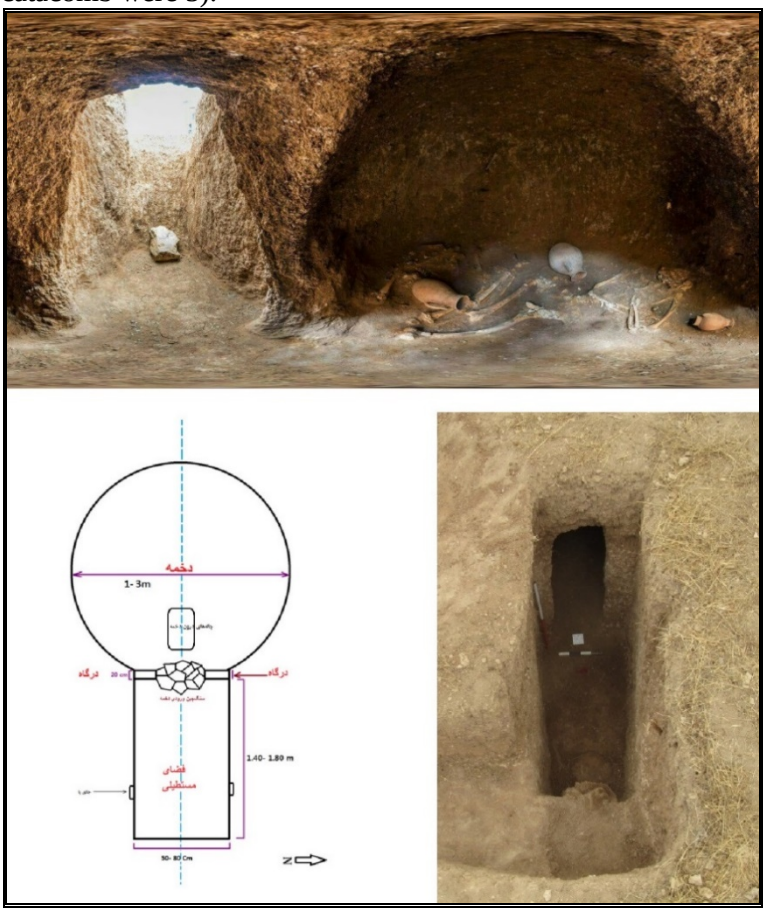



**Figure 3. The example of Catacomb of Let –Sar site**

## 7.The Armaments of Vestemin

Armaments generally directly follow every government martial strategy and method, which changed and developed through times. After Alexander, his descendants, Seleucids, enjoyed earlier strategies of Achamenid chivalries. Later, the Parthian chivalries changed martial tactics and technics that led to dominance on Greeks. The Parthian chivalries, very similar to ancient Northern Scythes and Masagets, could apply their martial technics against Greek foot soldiers [infantries] and defeated them. They used armor and helmet and used another armor for their horses, however, bows and arrows were their main weaponry (Farrokh 2008: 9). Furthermore, Parthian chivalries, the most efficient Parthian force, enjoyed sword, dagger and other light weaponries, because Parthians knew they could not rely efficiently on their foot soldiers against experienced Roman legionnaires that were of the best heavy weapon foot soldiers of the world in hand to hand combats. However, comparing to Parthian chivalries who had nomadic lifestyle and agility, Roman legionnaires were weaker and not so effective and useful in battlefields (Ibid 10).

According to the Parthian war technics, the recovered armaments from the burials of Vestemin can be categorized. Some 66 burials were excavated in the excavations of the Vestemin cemetery, which led to the recovery of armaments such as swords, daggers, arrowheads, trefoil arrowheads, and armors from 42 burials. The most abundant armament was trefoil arrowheads, while shields and armors were the rarest.

**7-1. Sword**

It was very applicable in ancient Iranian wars; in other words, it was: "… the main armament of the battlefield…" from the Achamenid to the Sassanian eras (Hekmat 1971: 191). Swords were recovered from 6 burials from the Western Cemetery, except 1 case that was unearthed from the Eastern Cemetery. Five swords were recovered next to male bodies, and one sword next to a female body, whereas another woman and a child, probably 3 years old, were buried as well; The swords were 74-92 cm. the swords were made of iron and had wooden sheaths, considering the remains of wood on the blades. Table 1 presents the dimensions of the swords. All 6 swords were straight and uncurved, even at their blade points. The swords have integrated blades and hilts, whereas cross guards [quillon] were in between and makes a cruciform of the swords. The hilts, due to the fact that they were covered with woods, were no longer than 16 cm. There is a round pommel at the end of the grip that was probably used to keep the wooden handle, which prevents it from coming out of the metal part of the hilt.

The five swords that were unearthed from the Western Cemetery, the catacombs, are typologically similar (fig. 4), while the sword that was recovered from the single burial of the Eastern Cemetery differs from the other swords. It is 92 cm long and 6 cm wide at the center of the blade, with an integrated hilt and uncurved blade (fig. 5).

Differences between the hilt of the swords are of the most important differences between this sword and the other ones that were recovered from the Vestemin cemeteries, because it does not have a cross-guard. The end of the hilt curved towards the blade and created a space for the handle. Furthermore, there are two appendices at both sides of the sword that were probably used to fasten the wooden sheath to a belt.

Another interesting point is the location of the swords in the burials. In the catacombs of the Western Cemetery, the swords were laid or stood next to the deceased, while the sword of the Eastern Cemetery is under the neck of the skeleton. The graves and burial objects, including the swords, were hardly disturbed, following the development activities of machineries before the systematic excavations. It should be noted that any explanation of the Eastern Cemetery relies on future excavations and unearthing more burials. Figs. 6 and 7 reveal the locations of the swords in the western catacombs and Eastern Cemetery.

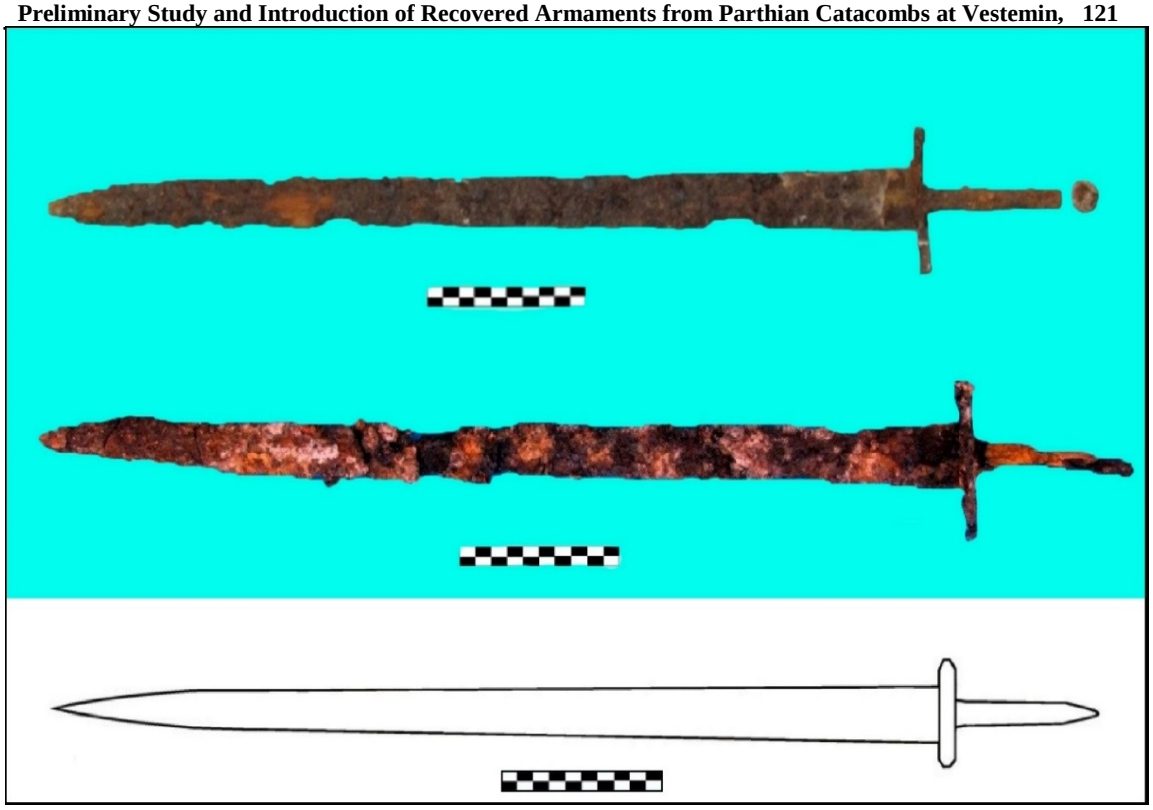


**Figure 4. The example of a claymore in the western cemetery**

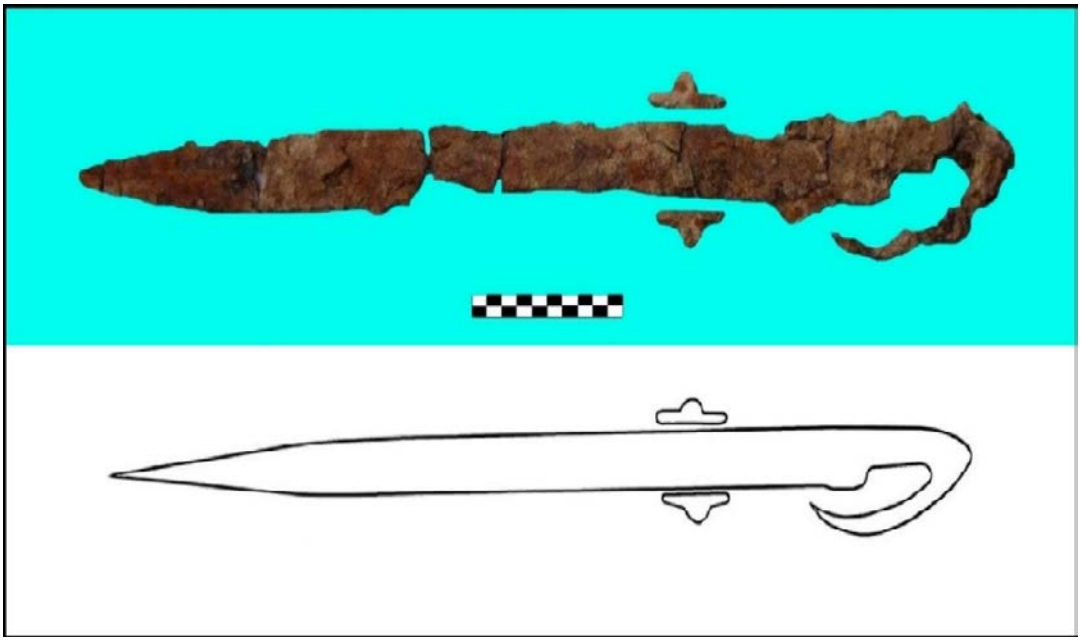


**Figure 5. The example of a claymore in the eastern cemetery**

**Figure 6- The claymore in the western catacomb.**


**Figure 7- The claymore located on the neck of the corpse in the eastern cemetery.**

**Table 2: Identification of the claymores of Vestemin cemetery.**

| NO | Handle length (cm) | Blade length (cm) | Blade center width (cm) | Hand protection size (cm) | Blade diameter (mm) | Total size of swords |
|---|---|---|---|---|---|---|
| 1 | 7.5 | 63 | 3.5 | 10 × 2 × 1.3 | 5 | 74 |
| 2 | 10.5 | 68 | 3.7 | 10 × 1.5 ×1.2 | 4 | 80 |
| 3 | 10 | 78.5 | 4 | 10 ×2 ×1.3 | 5 | 90 |
| 4 | 6.4 | 67 | 3.3 | ×1.5 ×0.6 10 | 4 | 74 |
| 5 | 16 | 76 | 6 | - | 5 | 92 |
| 6 | 13 | 70 | 4 | 10.5×1.8×1 | 4 | 83 |

## 7-2. Daggers

34 daggers were recovered, all made of iron, from 25 burials of the total 66 excavated ones. They are all made from iron and unearthed from the western catacombs. There was no dagger from the eastern cemetery. There were two recovered daggers from every one of the 7 excavated burials. Fourteen daggers were next to females and 16 daggers next to males, while in two cases, daggers were at the corridor or the rectangular space. It appears that the location of the daggers in burials was unisex, for both male and female burials. The daggers were sometimes sometimes standing, laid back on a wall, or laid on the floor next to the deceased.

The daggers consist of a hilt, separating point [cross-guard?], and a blade very similar to the recovered swords from the western cemetery of Vestemin. There was only part of an iron sheath, while in most of the cases there is remains of a wooden sheath on the blade. However, the diameter of the sheaths remains unknown, because only remains of wooden sheaths were found. The daggers vary in dimensions, however, there is not much typological difference. The daggers can be classified in three groups: 1) long daggers between 30 to 40 cm length, 2) middle daggers between 20 to 30 cm, and, 3) short daggers that are lower than 20 cm long. The shortest dagger is 16 cm and the lowest width is 2 cm. Table 2 presents dimensions of all recovered daggers from the Western Cemetery of Vestemin. Fig. 8 presents samples and drawings of recovered daggers from Vestemin.

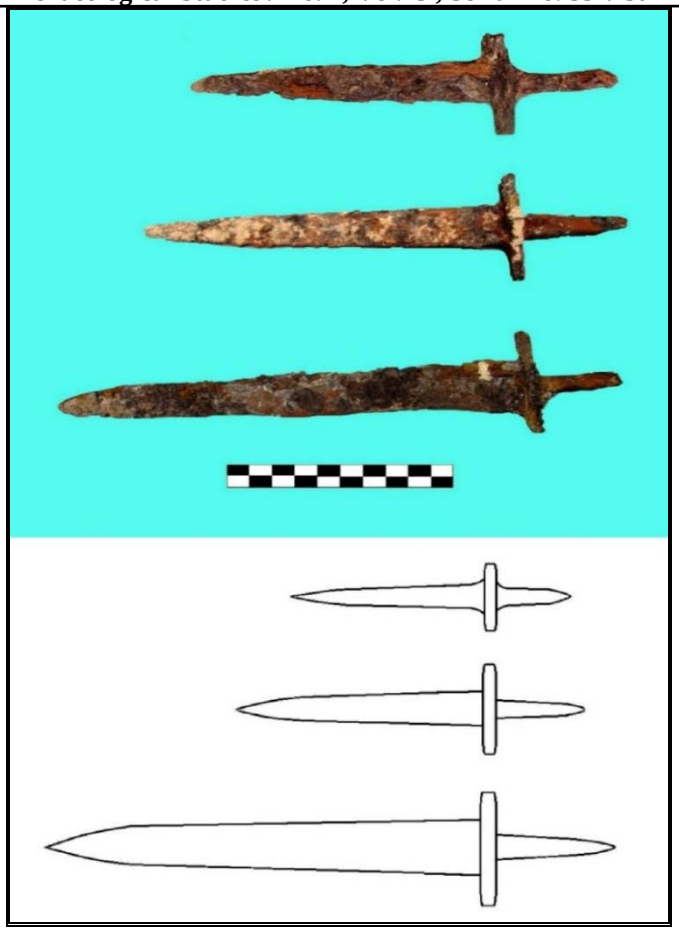


**Figure 8- The daggers discovered in catacombs.**

**Table 2: Identification of the daggers of Vestemin Cemetery**

| No | length (cm) | width (cm) | | NO | length (cm) | width (cm) |
|---|---|---|---|---|---|---|
| 1 | 32 | 4 | | 18 | 27 | 2.8 |
| 2 | 21 | 2.5 | | 19 | 38 | 3.8 |
| 3 | 28 | 2.8 | | 20 | 26 | 3.3 |
| 4 | 25 | 4.5 | | 21 | 35 | 4 |
| 5 | 16 | 4 | | 22 | 40 | 4 |
| 6 | 19 | 2.2 | | 23 | 34 | 3.8 |
| 7 | 35 | 3 | | 24 | 33 | 4 |
| 8 | 28 | 2.6 | | 25 | 33 | 4.5 |
| 9 | 18 | 3 | | 26 | 34 | 4 |
| 10 | 31 | 4 | | 27 | 30 | 4 |
| 11 | 31 | 4 | | 28 | 27 | 4 |
| 12 | 39 | 3.8 | | 29 | 30 | 3.5 |
| 13 | 32 | 3.3 | | 30 | 25 | 4 |
| 14 | 36.5 | 3.3 | | 31 | 30 | 3.2 |
| 15 | 32 | 4.7 | | 32 | 29 | 3.3 |
| 16 | 25 | 2.9 | | 33 | 40 | 4 |
| 17 | 26 | 2 | | 34 | 34 | 3.8 |

### 7.3- Arrowheads

After trefoil arrowheads and daggers, simple arrowheads were amongst the most abundant among the recovered armaments from the western cemetery of Vestemin. They consist of blade and shaft parts, where wood residue remained on the few samples, which indicates that the producers shoved the shaft in a wooden handle. Totally, 16 arrowheads were recovered from the catacombs that dimensionally vary from 3.4 to 18 cm, however, erosion hides the exact dimensions of findings. The arrowheads, which are made of iron, are formally rhomboid or cedarn. The arrowheads were unearthed from the catacombs, in some cases from the rectangular space. Considering the distribution of bone findings, they cannot be sexually assigned to a given burial. On the other hand, they are from 13 burials of the total 66 excavated ones. One should consider that the arrowheads are broken, and 16 arrowheads out of the total 18 were broken and fragmented. However, debris was not so effective on the fragmentation of the arrowheads, an intentional breakage can be the probable suggestion, however that needs more excavations to be proven. Fig. 9 presents samples of the unearthed arrowheads and fig. 3 presents the dimensions of the findings.

**Figure 9- The remains of rhomboid points**

**Table 3: index of arrowheads from the cemetery of Vestemin**

| NO | length (cm) | width (cm) | | NO | length (cm) | width (cm) |
|---|---|---|---|---|---|---|
| 1 | 18 | 6.5 | | 9 | 11.5 | 1.8 |
| 2 | 11 | 2.6 | | 10 | 11.5 | 2 |
| 3 | 7.4 | 1.6 | | 11 | 10 | 2.1 |
| 4 | 7.2 | 2 | | 12 | 10.3 | 2.1 |
| 5 | 7 | 2 | | 13 | 3.4 | 1.3 |
| 6 | 8.3 | 1.8 | | 14 | 6.6 | 1.5 |
| 7 | 6.4 | 1.8 | | 15 | 7 | 1.5 |
| 8 | 10.3 | 1.4 | | 16 | 13 | 2.2 |

## 7.4- Trefoil Arrowheads

The most abundant armaments from the catacombs of Vestemin were trefoil arrowheads, which consists of 158 from the total 214 findings. The arrowheads are not longer than 5.5 cm, with a width of 1.1. The number of arrowheads range from 1 to 19 in the burials that were next to both males and females, and in some cases, they appear on the catacomb's floor. The arrowheads are a trefoil blade, with sharp and narrow points, and a shaft that has wooden remains. It should be noted that arrowheads are made of iron, which was badly damaged following the oxidation. Fig. 10 presents a few arrowhead findings.

**Figure 10- The trefoil arrow head**

## 7-5. Armor

The only recovered armor from Vestemin is from the eastern cemetery that is from a young soldier's burial. It is made of iron plates, which is normally narrow strips on textile; there were recovered textile fragments from the burial (fig. 11).

Considering the variations of the recovered armaments from the eastern and western catacombs, one can suggest that both burials were from two different phases of the Parthian era, because the sword findings from the Eastern Cemetery differ to the same findings from the Western Cemetery, where no findings of armaments were reported of. Probably, martial strategies and/or burial customs varied through different periods, to be expected though, more excavations are required.

**Figure 11- The mail discovered from the eastern cemetery**

## 7.6- Shield

It was only recovered from the western cemetery and catacombs. It is made of iron. It was located next to a dagger, under the feet of a corpse at the western corner of the catacomb. Formally, it is concave with the remains of textile on the inner surface. The inner diameter is 15.1 cm and it is 0.5 cm thick. It has an appendix that probably worked as a handle (fig. 12).

**Figure 12- The iron shield**

## 7.7- Relevant non-Combat Tools:

In addition to armaments, some other tools were also recovered, which were relevant to armaments, including sharpener stones (fig. 13), baldric buckles and/or a belt to fasten sheaths or quivers, from the eastern and western cemeteries (fig. 14). Probably, the belts and baldrics were made of leather, because of the fragmented leather findings.

**Figure 13- The Whetstone**

**Figure 14- The buckles discovered at the catacombs**

**Chart 1: distribution of recovered armaments from Vestemin**

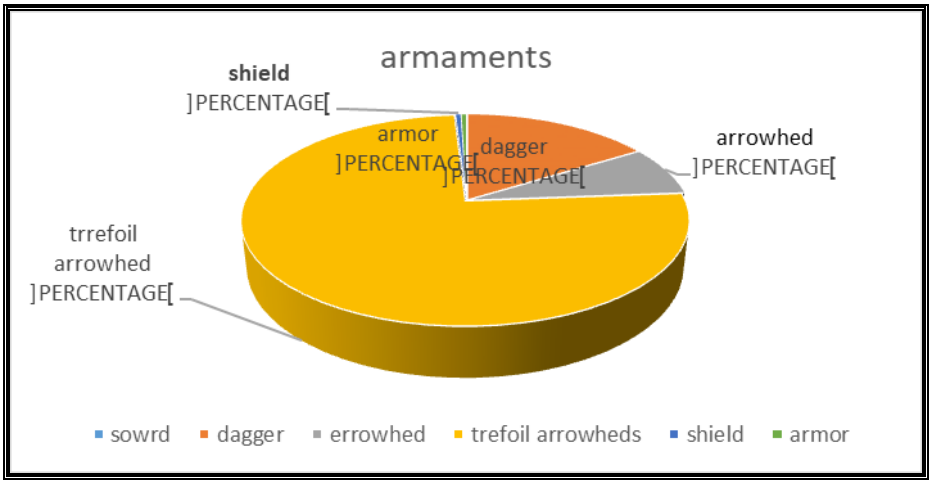
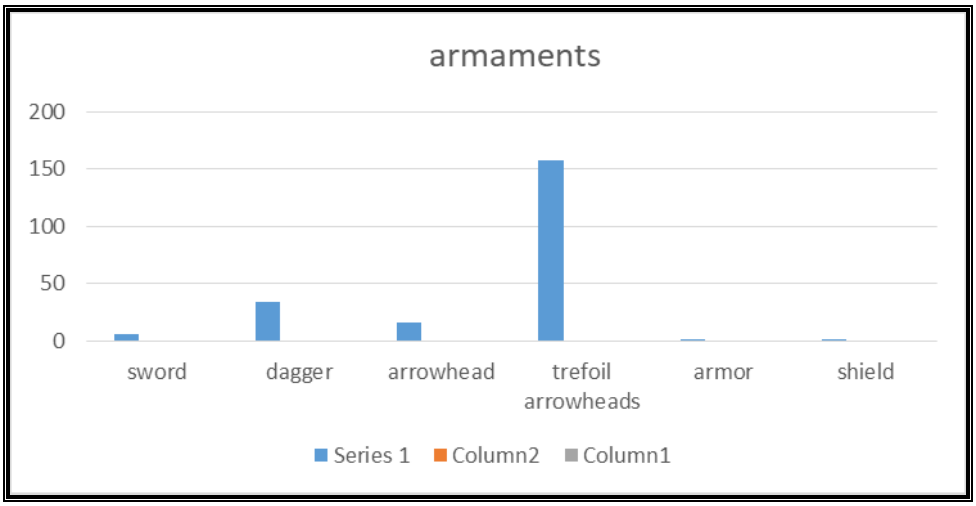



**Chart 2: distribution of recovered armaments from Vestemin**




## 8.Conclusion

Considering the recovered armaments from Vestemin, one can observe the irrelevance of sexuality in burial rites, because there was a sword in a female burial, in one case, and 14 daggers were recovered from the other female burials, a trend that could be seen for arrowheads and trefoil arrowheads as well. The Unearthed armaments included swords, daggers, shields, and arrowheads that were cavalry weaponries, the fact that these as well as light weapons, with several burial of horses were found at the western cemetery, reinforces the suspicion that the catacombs were for Parthian cavalries or/and their families, or at least the deceased were under martial culture influences. On the other hand, regarding the findings, one can confirm the significance of cavalries during the Parthian period. Furthermore, considering the difference of the burials in both the Eastern and Western cemeteries at Vestemin, with the variations of armaments, the other suggestion is that they were followed by two different Parthian phases that differed in their martial strategies. Secondly, the region was highly significant for its short distance to the Parthian 2nd capital, being located in the road from the capital city to Sari (relying on archaeological evidences), and it being a mint.

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# مطالعهٔ مقدماتی و معرفی جنگ‌افزارهای مکشوفه از گورستان اشکانی وِستِمین کیاسرِ ساری، بر اساس کاوش‌های سال ۱۳۹۴ ، ۱۳۹۶و۱۳۹۷

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## چکیده

در سال ۱۳۹۳ شمسی شرکت پیمانکار مجری خط انتقال گاز دامغان- نکا، بقایای دو گوردخمه را در روستای وِستِمین تخریب و نمایان ساخت. این محوطه در۸۰ کیلومتری جنوب شهر ساری قرار دارد. فعالیت‌های باستان‌شناسی منجر به شناسایی دو گورستان تاریخی، محوطه استقراری، قلعه و گورستان اسلامی شد. بقایای معماری و اشیاء، مبین وجود قبوری به شکل گوردخمه از دوره تاریخی بوده است. سوالاتی که در خصوص این محوطه طرح گردید، آگاهی یافتن از ساختار معماری گورها، شناخت شیوه تدفین و تاریخ‌گذاری آن‌ها بوده است؟ کاوش علمی و بررسی میدانی و نیز مقایسه داده‌ها و شیوه تدفین وجود استقراری وسیع از دوره اشکانی را در این محوطه مسجل نمود. محوطهٔ وِستِمین نخستین محوطه اشکانی در مازندران است که مورد کاوش باستان-شناختی قرار گرفته است. آنچه که گورستان این محوطه را از دیگر گورستان‌های اشکانی متمایز می‌نماید، وجود گوردخمه‌های خانوادگی است. گوردخمه‌های گورستان وستمین دارای سه بخش شامل: ۱- فضای مستطیلی شکل یا راهرو ۲ - ورودی یا درگاه بین فضای مستطیل شکل و اتاق دخمه ۳- اتاق دخمه است. جنگ‌افزارهایی مانند شمشیر، خنجر، سرتیر، سرپیکان‌های سه‌پر و زره از جمله آثار یافت‌شده از این گورستان است. در کنار اشیاء متنوع، استفاده از جنگ‌افزارها به عنوان هدیه، جنسیت متوفی مطرح نبوده است. با بررسی نوع جنگ‌افزارها می‌توان به کاربرد آن‌ها برای سواره‌نظام اشکانی پی برد، چراکه تسلیحاتی مانند شمشیر، خنجر، سرتیر و سرپیکان جزء تسلیحات سبک محسوب می‌شده و برای سواره نظام چابک اشکانی در برابر رومیان سنگین‌اسلحه به عنوان دشمن سنتی اجتناب‌ناپذیر بوده است.

**واژه‌های کلیدی:** جنگ‌افزار، ساری، وِستِمین، اشکانی، باستان شناسی.

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# From Apavortene to Abivard: Feasibility and Identification of the Early Parthian City of Dara in Northeastern Iran

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**Abstract**

According to classical texts, Dara stands out as a significant city from the early Parthian era, situated on the eastern fringes of the Parthian Empire. Classical sources have documented this region under various names such as Apavortene, Zapaortenon, Partauticena, and Apauarcticena. Since the latter half of the nineteenth century, Iranologists have engaged in speculation about the location of Dara, drawing insights from descriptions provided by Justin and Pliny, as well as references to its whereabouts in classical texts. This research endeavors to offer relative conjectures concerning the location of Dara and Shahr-Tepe, a potential site representing it, through an evaluation of archaeological data alongside classical and Islamic texts. To achieve the research objectives using a descriptive-analytical approach, the study employs the library research method and incorporates archaeological data. In alignment with classical texts, the research suggests that the province of Apavortene is situated in Eastern Iran, and there exists a likelihood that the Islamic-period Abivard is a transformed manifestation of this Parthian-period province. Aditionally, a comparative examination of Dara in classical texts with present-day Shahr-Tepe in Dargaz reveals congruence, aligning with the descriptions provided by Justin and Pliny. Shahr-Tepe, located on the opposite side of Hezar Masjed Mountains between Nisa and Abivard, exhibits a singular historical period. Surrounded by Hezar Masjed Mountains, the region boasts an abundance of rivers and springs, expansive meadows, and remnants of forests within Tandooreh National Park and Tivan region. These characteristics confirm the general depiction of Apavortene and Dara found in classical sources. Collectively, these findings suggest that Shahr-Tepe, covering an area of approximately 70 hectares, could indeed represent the prominent city of the early Parthian period.

**Keywords**: Dara, Shahr-Tepe, Parthian Period, Apavortene, Abivard.

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## 1. Introduction

One of the satrapies of Iran in the Achaemenid period (550-330 BCE) was the Parthava satrapy. During the Parthian period (247 BCE-224 CE), this satrapy was divided along with Hyrcania into the smaller provinces of Parthiyene, Osthaene, Apavortene, Hyrcania, Comisene and Choarene (Schippmann, 1980: 11). Apavortene was one of the provinces that was separated from the Achaemenid satrapy of Parthava. Located in Eastern Iran, it is recorded as Zapaortenon, Apavortene and Partauticena in the works of classical writers such as Justin (B.XLI, Ch. V), Pliny (Vol. II, Ch. 18 (16)), and Ptolemy (VI. 5.4). Isidore of Charaxalso locates Apauarcticena between Parthyena and Margiana in his book "the Parthian Stations" in more detail (Isid, 13).The simultaneous reference to Nisa, the central city of Parthyena, and Abivard in Islamic sources (Tabarī, 1964: 301; Narshakhi, 1984: 375; Maqdīsī, 1967: 321; *Bayhaqī*, 1989: 585; Yāqūt *al*-Hamawī, 1996: 333) may indicate the evolution of the word Apauarcticena to Abivard and the location of Apauarcticena in the vicinity of Abivard in the Islamic period. Justin (B.XLI, Ch. V) and Pliny (Pliny, Vol. II, Ch. 18 (16)) mention that Dara/ Dāreium is the central city of the province, and Isidore of Charax (Isid, 13), without naming Dara, registers the center of the province as the city of Apauarcticena. Dara was probably founded by Arsaces I (247-217 BCE), and its geographical location is widely debated (Weiskopf, 2011: 671-672). Since the second half of the nineteenth century, some Iranologists have speculated about the geographical location of this important city in the early Parthian period, by citing classical texts. One of the areas suggested by Iranologists for the possible location of Apavortene Province and its central city is Dargaz County (Etemad-al-Saltaneh, 1992: 350-351; Keall and Roaf, 2000: 1356; Rajabi, 2002: 65; Wiesehöfer, 2004: 409). Shahr-Tepe is located in the Chapeshlu District of Dargaz County and next to the old road from Dargaz to Quchan. With an area of 70 hectares, Shahr-Tepe is one of the largest Parthian sites in Northeastern Iran. The geographical positioning of Dargaz is consistent with the location of Apavortene as proposed by the writers of the classical period, especially Isidore of Charax. Justin's account of Dara is also compatible with Shahr-Tepe. In the present study, an attempt is made to evaluate the background of archaeological studies regarding Dara in the first place. In the next step, based on archaeological data, classical texts and literary sources of the Islamic period, logical speculations about the geographical location of the province of Apavortene and the city of Dara is provided. In order to evaluate the quality of Dara's identification with Shahr-Tepe, a comparative study of the history and geography of Dara with those of Dargaz and Shahr-Tepe is another goal of the present study.

## 2. Background

Early in the second half of the nineteenth century, when George Rawlinson speculated about its geographical location, some scholars sought to identify the location of Dara from the early Parthian period, based on archaeological studies and classical texts. Rawlinson, citing Justin, thinks that the city must have been located in the east of Iran and around Mashhad (Rawlinson, 1873: 53). Mohammad Hassan Khan Etemad-al-Saltaneh, one of the political figures of the Qājār court (1789-1925), considers Dargaz is to be the evolved form of Dara (Daragarz) and has located this city in the Dargaz County (Etemad-al-Saltaneh, 1992: 350-351). Later, Hassan Pirnia, one of the political figures of the late Qājār period, considered Abivard and Bāvard as the evolved form of Apavortene and Paart (Pāvart) and located it in Gorgan (Pirnia, 2012: 1822). Alfred Gutschmid also suggests that the area is in Abivard, referring to Dara's location in

Apavortene (Gutschmid, 1888: 34). Later, Wilhelm Tomaschek, referring to Kalāt in Islamic literary sources, which is described as an impregnable fortress situated on a steep cliff with many streams, located Dara from Dargaz to Kalāt (Tomaschek, 1900: 250). Shortly afterwards, Victor Chapot, by confusing the Parthian city with the one founded by Anastasius I (491-518CE), identifies the Parthian Dara with Nisibis (Chapot, 1907: 313-314). Edward Meyer, referring to the construction of Dara in a fertile plain and on a rocky texture, locatesit in Kalāt (Meyer, 1911: 870). Wilfred Schoff, in his commentary on "the Parthian Stations", described Dara as an alternative to the Greek city of Hecatompylos, and located it near Mashhad. Schoff believes that Artacana, mentioned by Ptolemy, is Dara indeed (Isid, Stathm; Schoff, 1914: 31). Sir Percy Sykes, arguing that there are not enough forests in Eastern Iran, assumes that Dara should not be located in the east. According to Sykes, due to the abundance of forests and water resources, Gorgan is more in line with the Apavortene mentioned in classical texts. Sykes considers Qaleh Māran, which he visited during his trip to Gorgān, is the ancient city of Dara (Sykes, 1915: 334). Ernst Hertzfeld later located Apavortene and its central city of Dara near Kalāt (Herzfeld, 1929/30: 109). William Woodthorpe Tarn, referring to the original homeland of the Parthians, situated Dara near Abivard (Tarn, 1932: 575).

Neilson C. Debevoise, while repeating the words of classical writers, suggests that the location of the city is in the mountains of Apaortenon (Debevoise, 1938: 15). Mikhail Evgenievich Masson also assumes that Dara is located in Abivard (Masson, 1950: 43). This area was later proposed as the site of Dara, by Richard Frye (Frye, 1962: 182) and Marie-Louise Chaumont (Chaumont, 1971: 199-201). Igor Khlopin, determining the approximate area of the Apavarktikene, located Dara in the down stream plains of the Lainsu and Archinyan rivers east of Kopet Dag (Khlopin, 1977: 148). Klaus Schippmann also positioned Dara near Dargaz, citing Isidore of Charax (Schippmann, 1980: 11-12). Mohammad Yousef Kiani, after surveying the Gorgan plain, pointed to the lack of pre-Islamic archaeological data in Qaleh Māran and identified Qara Shaikh Tepe with Dara due to the presence of Parthian bricks and pottery shards (Kiani, 1982: 47, Kiani, 1986: 108). David Bivar later sited Dara in the Kakhke near the Old Abivard (Bivar, 1983: 26). Josef Wiesehöfer has also suggested a place between Ashkabad and Merv (Wiesehöfer, 1996: 132) and in Dargaz (Wiesehöfer, 2004: 409). Abdolhossein Zarrinkoob, referring to the location of Apavortene in Abivard, has suggested Kalāt as the location of Dara (Zarrinkoob, 1999: 41). Edward Keall and Michael Roaf also assume that this significant city is located in Dargaz (Keall and Roaf, 2000: 1356). Parviz Rajabi evaluated the evolution of the word Darakert to Dargaz and positioned Dara in Dargaz (Rajabi, 2002: 65). Mohammad Rezaei, pointing out that Apavortene is sited between Dāmghān and Gorgān, considers Apavahana and Āhvānā as an evolved form of Apavortene, and by comparing the environmental conditions of Āhvānā to the reports of classical writers, has suggested this area as a possible place (Rajabi, 2002: 442-453). Richard Tada situates Dara between Ashgabat and Merv (Tada, 2008: 77). Mostafa Dehpahlavan also confirms Rezaei's opinion and considers Dara to be located in Āhvānā Valley (Dehpahlavan, 2010: 36-37). Marek J. Olbrycht believes that Dara, which is mentioned in classical texts, should be positioned somewhere between Kakhke and Dargaz (Olbrycht, 2014: 118).

## 3. Research problem

According to the classical texts, Dara is an important city of the early Parthian period in Iran. Although Justin, Pliny, Ptolemy, and Isidore of Charax mentioned this city or its position, Dara's actual location is still widely debated by scholars. The diversity of the

proposed areas, from Dāmghān to Gorgān and Khorāsān, shows the difficulty of research on Dara and emphasizes the importance of research on this prominent city. Archaeological survey of Dargaz County and archeological data discovered from Shahr-Tepe, resulted in re-evaluation of the classical and Islamic texts and the comparison of these literary evidence with the geography of Dargaz and the archeological data. As a result, we can now have reasonable assumptions about the location of Shahr-Tepe.

## 4. From Apavortene to Abivard

The Achaemenid satrapy of Parthava is the ground for a significant part of the political, social and cultural events of the early Parthian Empire. The exact extent of this satrapy in the Achaemenid, Seleucid (312-63 BCE) and Parthian periods is not clear. Schippmann, citing Achaemenid inscriptions and classical texts, assumes that this satrapy covered most of present- day Khorāsān and Hyrcania (Schippmann, 1980: 10). After a cycle of disintegration and unification of Parthava and Hyrcania in the Achaemenid and Seleucid periods, this satrapy along with Hyrcania was divided into smaller provinces in the Parthian period, including Parthiyene, Osthaene, Apavortene, Hyrcania, Comisene and Choarene (Schippmann, 1980: 11).

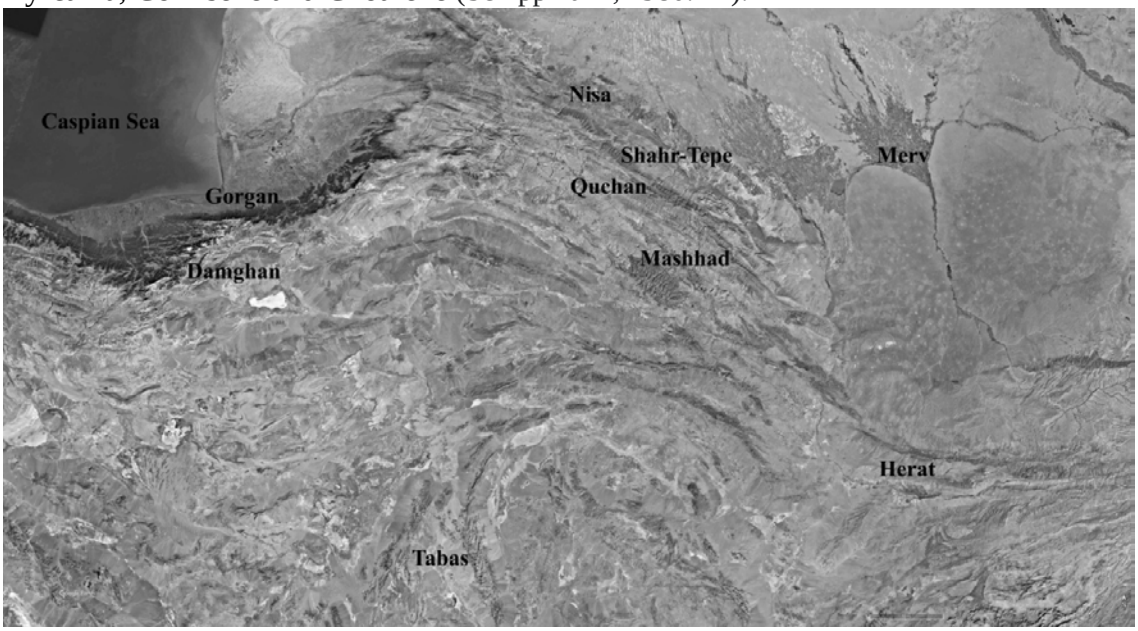

Figure 1. The position of Shahr-Tepe in relation to Nisa and Merv in the Northeastern Iran (Google Earth).

In the works of classical writers, Apavortene and its geographical location are mentioned. Justin (3rd century CE), in his "Epitome of Pompeius Trogus's Philippic Histories" (1st century BCE), while referring to Dara, mentions that this city islocated in the mountain of Zapaortenon (Justin, B.XLI, Ch. V). Pliny also spelled this region as Apavortene and considers it to be east of the Caspian Sea (Pliny, Vol. II, Ch. 18 (16)). Ptolemy also describes the geographical area of Parthia, from the north to Hyrcania and the Cronus Mountains, from the south to Kermān and Tabas, from the east to Aria (Herāt) and the Masdoranus Mountains, and from the west to the Medes. He goes on to call this region Partauticena and adds: "The part of Parthia which joins Hyrcinia is called Comisena, below which is Parthyena; next is Chorana and Partauticena, after this is Tabicenanear Carmania, then Sobide." (Ptolemy, VI. 5.4). Isidore of Charax, who

traveled to Iran, registered this region as Apauarcticena, and located it between Parthyena and Margiana (Isid, 13) (Figure 1).

Johann Gustav Cuno, equated Zapaortenon mentioned by Justin, Apavortene as described by Pliny, and Apauarcticena in Isidor of Charax's. He translated Za as "beyond" and paortenon as "mountain", and as result, Zapaortenon as "beyond the mountain" (Cuno, 1871: 198-199). Most scholars who have conducted research on Apavortene have located this Parthian province in Eastern Iran (Rawlinson, 1873: 53), near Mashhad (Isid, Stathm; Schoff, 1914: 31), Abivard (Gutschmid, 1888: 34; Tomaschek, 1900: 250; Tarn, 1932: 575; Chaumont, 1971: 199-201; Khlopin, 1977: 148; Bivar, 1983: 26; Wiesehöfer, 1996: 132; Keall and Roaf, 2000: 1356), from Kakhke to Dargaz and Kalāt (Herzfeld, 1929/30: 109; Olbrycht, 2014: 118), and Southern Turkmenistan (Schippmann, 1980: 12). Some also assume that Apavortene must be sited in Gorgān (Sykes, 1915: 334; Kiani, 1982: 47) and between Gorgān and Dāmghān (Rezaei, 2004: 442-453; Dehpahlavan, 2010: 36-37).

Isidore of Charax, located the Apauarcticena in the vicinity of Parthyena and names Nisa as its center (Isid, 13). As the excavations of Russian archaeologists has revealed the exact location of Nisa, the simultaneous reference of Islamic texts to Abivard and Nisa can be considered as reminiscent of Isidore of Charax referring to Apauarcticena and Nesaya. In the texts of the Islamic period, Abivard and Nisa have been repeatedly recorded together and in the form of two adjacent regions, which shows their similar socio-political history. For instance, in his narrative of the Muslim conquest of these areas, *Tabarī* writes: "According to 'Al*ī*—Abu Hafs al-Azd*ī*—Idr*ī*s b. Hanzalah al-'Amm*ī*: Ibn 'Am*ī*r captured the innercity of Abrashahr by assault and conquered the placesaround it—Tus, Abiward, Nisa…" (Tabarī, 1964: 301). In the history of Bukhārā's description of the political situation at the time of the Samanids and the Abbasids, that story is related as: "… Gave Nisa and Abivard to him" (Narshakhi, 1984: 375). Maqd*ī*s*ī* also points out that: "Abivard is more amazing than Nisa with a thriving market…" (Maqd*ī*s*ī*, 1967: 321). In describing the contemporary events of Masʿud I of Ghazni's reign, *Bayhaqī* also mentioned Nisa and Abivard: "And Sultan Masʿud ordered that letters should be sent to Herāt, Pushang, Tus, Sarakhs, Nisa, Bāvard and Bādgh*ī*s…" (*Bayhaqī*, 1989: 40). Yāqūt *al*-Hamawī also writes about the geographical location of Abivard: "Bāvard… is a city in Khorāsān between Sarakhs and Nisa" (Yāqūt *al*-Hamawī, 1996: 333).

## 5. Dara in the classical sources

Pompeius Trogus's Philippic Histories (1st century BCE), is the most important source regarding Dara. Unfortunately, this book was lost in the ancient era and only a summary of it is recorded by Justin. According to Justin: "He founded a city also, called Dara,on Mount Zapaortenon, of which the situation is such, that no place can be more secure or more pleasant; for it is so encircled with steep rocks, that the strength of its position needs no defenders; and such is the fertility of the adjacent soil, that it is stored with its own produce. Such too is the plenty of springs and wood, that it is amply supplied with streams of water, and abounds with all the pleasures of the chace" (Justin, B.XLI, Ch. V). Pliny also briefly refers to this description: "Lying to the east of the Caspians is the Regioncalled Apavortene, in which is Dareium, aplace noted for its fertility" (Pliny, Vol. II, Ch. 18 (16)). No other classical writers mention this principal city of the early Parthian period, using the spelling of Dara and Dareium. It should be noted that the village of Thara, which Justin mentions while describing the apprehension of Darius III (Justin,

B.XI, Ch. XV), and some scholars rely on it to locate Dara from Dāmghān to Gorgān (Rezaei, 2005: 442-453; Dehpahlavan, 2010: 36-37), is different from the Parthian Dara. Furthermore, Justin has mentioned them in a different historical context with two distinct spellings.

This significant city seems to have been rarely recorded in classical texts with the two spellings, Dara and Dareium. Sykes assumes that the Parthian kings returned to Hecatompylos due to the lack of water in Dara, and until the first century CE this city was the capital of the Parthians (Sykes, 1915: 334). Regardless of the exact date of Dara's abandonment, the registration of the Parthian capital by Chinese sources as Ho-tu or Fan-tou, possibly Hekatompylos, indicates that the Parthian kings have used this city, at least at some points (Leslie and Gardiner, 1996: 34). Chaumont also believes that the lack of reference to Dara in "the Parthian Stations" of Isidore of Charaxis due to the declining significance of the city at this time (Chaumont, 1971: 200). Without ignoring the hypothesis of Dara's abandonment, Olbrycht thinks that the lack of reference to Dara could be due to the fact that the city was far from the route used by Isidore of Charax (Olbrycht, 2014: 118). Although, in his commentary on "the Parthian Stations", Schoff assumes that the Apauarcticena asreferred to by Isidore of Charax (Isid, 13) and the Artacana mentioned by Ptolemy (Ptolemy, VI. 5.4) were indeed the early Parthian Dara (Isid, Stathm; Schoff, 1914: 31).

**6. Shahr-Tepe, the Parthian Dara?**

Since the second half of the nineteenth century, some Iranologists have tried to speculate about the location of Dara, by citing archaeological studies and classical and Islamic texts. Most of these researchers have located Dara in Eastern Iran and Khorāsān Province. Some of the most important of the proposed places are: Near Mashhad (Rawlinson, 1873: 53; Isid, Stathm; Schoff, 1914: 31), Abivard (Chaumont, 1971: 199-201; Frye 1962: 182; Masson, 1950: 43; Tarn, 1932: 575; Gutschmid, 1888: 34), Dargaz to Kalāt (Tomaschek, 1900: 250), Kalāt (Meyer, 1911: 870; Herzfeld 1929/30: 109; Zarrinkoob, 1999: 41), the down stream plains of the Lainsu and Archinyan rivers east of Kopet Dag (Khlopin, 1977: 148), Kakhke (Bivar, 1983: 26), between Ashgabat and Merv (Tada, 2008: 77; Wiesehöfer, 1996: 132), from Kakhke to Dargaz (Olbrycht, 2014: 118), Dargaz (Schippmann, 1980: 11-12; Etemad-al-Saltaneh, 1992: 350-351; Keall and Roaf, 2000: 1356; Wiesehöfer, 2004: 409; Rajabi, 2002: 65), Gorgān (Pirnia, 2012: 1822), Qale Māran in Gorgān (Sykes, 1915: 334), Qara Shaikh Tepe in Gorgān (Kiani, 1982: 47) and *Ā*hvānā Valley between Dāmghān and Gorgān (Rezaei, 2004: 442-453; Dehpahlavan, 2010: 36-37).

Of the areas and sites that can potentially represent what is mentioned in classical texts, we can nominate Dargaz City and Shahr-Tepe area. Shahr-Tepe is located in the northwest of Chāpeshlu City in the Dargaz County. With an area of 70 hectares, this is one of the largest Parthian sites in Northeastern Iran. Archaeological excavation of this area was started in 2009 by Ali Hassanābādi. In order to determine the core area and propose the buffer zone, he dug 29 test-pits in the core area and the buffer zone of Shahr-Tepe. As a result, architectural remains, painted bricks and clay vessels of the early period were discovered (personal correspondence). Later, in 2016, Hassan Nami, while re-surveying Dargaz County, reviewed the core area and the buffer zone of the site.While conducting systematic survey of Shahr-Tepe, he dug 38 test-pits in the site. Thence, the remains of a ditch, fortifications, gate, citadel, Sharestān and industrial areas (with numerous pieces of waster, slag and deformed glass) were discovered. In addition, the remains of a clay barrel-drain was discovered at the lower section and the

eastern end of the site, indicating that the site had an urban sewer system. As a result of systematic survey of the site, the remains of painted bricks, stucco pieces, stone pillar base and pottery shards from the Parthian period were discovered (Nami, 2016: 28-53). Since the archaeological studies of the site have already been published in the form of several monographs, no more details will be covered here (Nami et al., 2018; Nami and Mousavinia, 2019; Mousavinia and Nami, 2019).

A comparative study of Dara in classical texts with Dargaz and Shahr-Tepe shows the compatibility of this site with the prominent city of the Parthian period. Archaeological data acquired from the survey and excavations of Shahr-Tepe show that this area was inhabited only during the Parthian period. Therefore, the foundation, flourishing and decline of this site occurred entirely in the Parthian period. On the other hand, the proximity of this site to Nisa and the discovery of data comparable to this site (such as painted bricks), shows that Shahr-Tepe reached its zenith in the early Parthian period. Although there is no evidence on the exact date of the abandonment of Shahr-Tepe in the Parthian period, the mere evacuation of the site in this period is reminiscent of Isidore of Charax'slack of reference to Dara in the first century CE. Sykes (1915: 334), Chaumont (1971: 200) and Olbrycht (2014: 118) have also hypothesized that Dara was abandoned during the Parthian period. Furthermore, the location of the site at the foot of the Hizār Masjid Mountains is reminiscent of Dara's position on Zapaortenon Mountain. If, as Cuno points out, Zapaorton means "across the mountain" (Cuno, 1871: 198-199), then it can be assumed that Dara is located on the other side of Hizār Masjid Mountain. On the other hand, the existence of this mountain range, which has limited Shahr-Tepe and Dargaz on all sides, is a reminder of its strong position and its enclosure with steep cliffs. In addition, there are rivers in the county of Dargaz that originate from the surrounding foothills and water the Dargaz Plain. This is also in line with Justin's statements about Dara. Interestingly, there are two waterways around Shahr-Tepe that run along the northern and southern sides of the site. These waterways start from Hizār Masjid Mountains at a distance of 10 km west of Shahr-Tepe and as they approach the site, they are divided into two branches, northern and southern. One branch passes through the northern margin and the other goes through the southern edge of Shahr-Tepe, and after crossing the site, the two branches join in the east of Shahr-Tepe and extend further to the east in the form of asingle branch. The craftsmen of Shahr-Tepe have used these waterways to fill the moat that exists beyond the walls. Considering the results of the surface survey of the site, the moat that surrounds Shahr-Tepe is very large and is on average 11 to 15 meters wide and 6 to 8 meters deep. The meadows of Dargaz Plain and the forests of *Tandūreh* National Park and Tīvān region also have the last remnants of hunting grounds and extensive forests in this county and are reminiscent of Justin's reference to the abundance of forests and the existence of hunting grounds around the city (Figure 2).

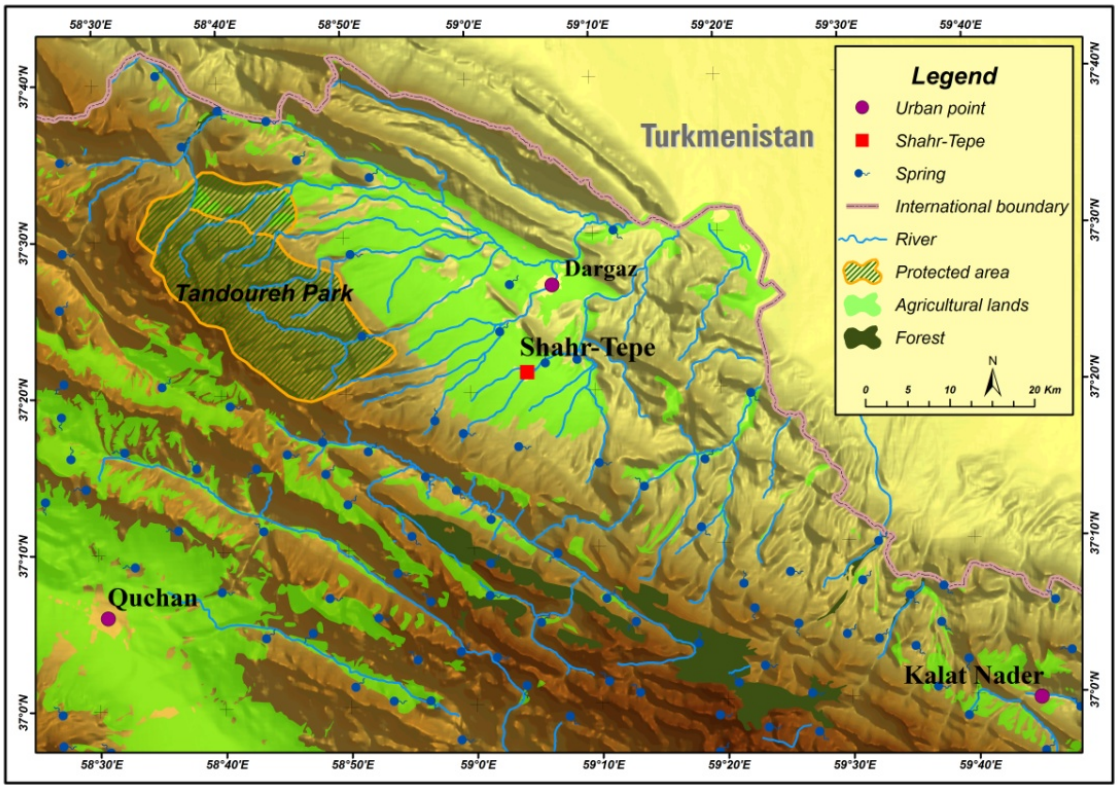


Figure 2. The position of Shahr-Tepe in relation to Geographical variables (Authors).

## 7. Evaluation

According to Justin and Pliny, Dara is located in the Zapaortenon Mountain (Justin, B.XLI, Ch. V) and the region of Apavortene (Pliny, Vol. II, Ch. 18 (16)). Although Ptolemy, while describing the region of Parthia, has generally located the position of Apavortene in Eastern Iran (Ptolemy, VI. 5.4), Isidore of Charax locates it more specifically between Nisa and Merv (Isid, 13). Some researchers, however, locate Apavortene in Gorgan without providing convincing evidence (Sykes, 1915: 334; Kiani, 1982: 47). Others, citing Justin, who mentions the village of Thara while narrating the imprisonment of Darius III of the Achaemenid dynasty (Justin, B.XI, Ch. XV), have equated“Dara”with “Thara”, thus locating Apavortene in the vicinity of Gorgān and Dāmghān.They consider the Āhvānā region, which is now located between Dāmghān and Gorgān, to be an evolving form of the Parthian Apavortene. By comparing the natural conditions of Dara with Justin and Pliny's statements about Āhvānā, they consider this region to be the Parthian Apavortene (Rezaei, 2005: 442-453; Dehpahlavan, 2010: 36-37).

The existence of the Greek city of Hecatompylos and its use by the Parthians when necessity arose, political instability of the western borders until the time of Farhād I (171-176 BCE), Arsaces I's attitude towards consolidation of power instead of invading Seleucid territories and enlarging the imperial domain are among other reasons for not situating Dara from Dāmghān to Gorgān. Justin's description of the city of Dara and the village of Thara in two different historical and geographical contexts and with two distinct spellings along with the proposed location of Apavortene in classical and Islamic texts also shows that this region and its central city of Dara, are not sited in the vicinity of Dāmghān and Gorgān, but they must be located in Northeastern Iran and the

borders of Iran and Turkmenistan.Due to the vastness of Shahr-Tepe and its distinct archaeological findings, this area was a significant city of the early Parthian period. The location of Shahr-Tepe on the other side of Hizār Masjid Mountains is reminiscent of Cuno's translation of the word Zapaortenon (Cuno, 1871: 198-199). Furthermore, the old road from Central Asia to Dargaz and Quchān passed along Shahr-Tepe until recent times, and this site is truly situated on the other side of the mountain from Quchān.The proximity of Nisa and Abivard in the Islamic texts is also a reminder of the vicinage of Parthyena with the center of Nisa and Apauarcticena with the centrality of Apauarcticena. In addition, the abandonment of the city during the Parthian period is remindful of Isidore of Charax'slack of reference to Dara during his possible voyage to Apauarcticena. The enclosure of Shahr-Tepe with Hizār Masjid Mountains, which made Dargaz look like an impregnable fortress, is also reminiscent of Dara's strong position and the rocks that surrounded it. Moreover, the abundance of springs and rivers that originate from Hizār Masjid Mountains, one of which has filled the huge moat of Shahr-Tepe, evokes the abundance of water in Dara. It is worthy of note that there are now paddy fields in parts of Dargaz that shows the richness of water resources in the distant past of this county. At the same time, the abundance of meadows and the environment of the Hizār Masjid Mountains, such as *Tandūreh* National Park and Tīvān region, can indicate the abundance of hunting grounds and forests during the Parthian period of Dargaz.

## 8. Conclusion

Dara is an important city of the early Parthian period. According to classical texts, the city is located in the province of Apavortene. Although Justin, Pliny, and Ptolemy have defined the approximate boundaries of this province, Isidore of Charax locates it more specifically between Parthyena and Margiana. The co-occurrence of Nisa and Abivard in the Islamic literary sources, while confirming the location of Apavortene, indicates that Dara (the central city of this province), must have been located in Abivard of the Islamic period. Shahr-Tepe is one of the most prominent Parthian sites in Northeastern Iran, which is situated on the other side of Hizār Masjid Mountains in Dargaz County. The discovery of clay vessels, painted bricks, stucco pieces, stone pillar bases and clay barrel-drain, along with the remains of a ditch, fortifications, gate, citadel, Sharestān and industrial areas shows that Shahr-Tepe is a prominent and pre-designed city from the first centuries of the Parthian Empire. Although there is no clear evidence on the date of the desolation of Shahr-Tepe, according to archaeological evidence this area was built in the Parthian period, reached its peak of prosperity and was eventually abandoned. This case is reminiscent of Isidore of Charax'slack of reference to Dara in his "Parthian Stations". Justin, quoting Trogus, gives a detailed description of Dara's position, which is consistent with the Shahr-Tepe's location. Shahr-Tepe is located in a strong position and is limited by the Hizār Masjid Mountains. There are rivers in Dargaz County that originate from the surrounding foothills. One of these rivers ran along Shahr-Tepe and filled the moat that surrounds the site.The meadows of the Dargaz Plain and the remnants of trees in the *Tandūreh* National Park and the Tīvān region are probably the last remnants of the hunting grounds and the immense forests around Shahr-Tepe that existed in the Parthian period. To put it concisely, the simultaneous evaluation of archaeological evidence and classical and Islamic texts shows that Shahr-Tepe is one of the most important Parthian cities in Dargaz County, which is historically and geographically consistent with Dara in the province of Apavortene. Extensive

archaeological excavations in Shahr-Tepe can evaluate this hypothesis and provide vital information on the first decades and centuries of the Parthian Empire.

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# از آپاورتنه تا ابیورد؛ امکان سنجی و شناسایی شهر اوایل دورهٔ اشکانی دارا در شمال شرق ایران

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## چکیده

با استناد به متون کلاسیک، دارا یکی از شهرهای مهم اوایل دورهٔ اشکانی است که در مرزهای شرقی شاهنشاهی اشکانی واقع شده است. متون کلاسیک این منطقه را با املاء آپاوُرتِنه، زاپائورتِنون، پارتاوتیکِنه و آپاوارکتیکنا ثبت کرده است. توصیف ژوستین و پلینی از شهر و اشارهٔ متون کلاسیک به موقعیت قرارگیری آن باعث گردید تا از نیمهٔ دوم سدهٔ نوزدهم میلادی برخی ایران‌شناسان راجع به مکان قرارگیری دارا گمانه زنی کنند. در این تحقیق تلاش می‌شود با ارزیابی داده‌های باستان‌شناسی، متون کلاسیک و متون نوشتاری دورهٔ اسلامی راجع به مکان قرارگیری دارا و محوطهٔ احتمالی معرف آن شهر تپه، گمانه‌هایی نسبی ارائه گردد. رویکرد این تحقیق توصیفی تحلیلی است و از داده‌های باستان‌شناسی و منابع کتابخانه‌ای برای دستیابی به اهداف تعیین‌شده استفاده گردیده است. تحقیق حاضر نشان می‌دهد بر اساس متون کلاسیک، ایالت آپاورتنه در شرق ایران قرار گرفته است و احتمالاً ابیورد دورهٔ اسلامی شکل تحول یافتهٔ این ایالت دورهٔ اشکانی است. از سوی دیگر، بررسی مقایسه‌ای دارای متون کلاسیک با شهر تپهٔ درگز نشان می‌دهد این محوطه با توصیف ژوستین و پلینی از شهر دارا همخوانی دارد. قرارگیری شهر تپه در آن‌سوی رشته‌کوه هزار مسجد بین نسا و ابیورد، تک دوره‌ای بودن محوطه، محصور شدن شهر تپه با رشته‌کوه هزار مسجد، فراوانی رودخانه‌ها و چشمه‌ها، گستردگی چمنزارها و بقایای جنگل در پارک ملی تندوره و منطق تیوان، ضمن تأیید شرح متون کلاسیک راجع به آپاورتنه و دارا، نشان می‌دهد شهر تپه با قریب به ۷۰ هکتار وسعت، می‌تواند معرف شهر مهم اوایل دورهٔ اشکانی دارا باشد.

**واژه‌های کلیدی:** دارا، شهر تپه، دورهٔ اشکانی، آپاورتنه، ابیورد.

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# An Archaeological Analysis of the Existing Shell Vessels (Libation Shell) in the Archaeological Contexts of the Iranian Plateau in the Third to the First Millennium B.C.

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**Abstract**

Sea shells are natural-biological objects. They are embedded in geological layers in the form of fossils, but also, to find in archaeological deposits as a result of human activities. Archaeologists can use the provenance of shells in the functional analysis of ancient sites in terms of social archeology and prehistoric trading activities. Archeological excavations in several sites of the Iranian Plateau have shown that from the 3rd third millennium B.C. onwards, finds of sea shells (e.g. Lambis, Dentalium, etc.) rapidly increased. Such shells were for instance discovered from ritual cemetery contexts such as Shahdad, Tepe Hesar, Kale Nisar cemeteries or Bani Surma. These objects are mainly used as natural or polished shells. In some cases, they served as a raw material for making all kinds of beads, buttons, and other ornamental objects.. The main question is to understand the relationship between the use of seashells and archaeological context, and also, their role in Bronze Age ritual life. In this article, the descriptive, analytical method has been used in the biological recognition of all types of shells. This method is also used based on similar studies on this issue in Mesopotamia's archeology of the Sumerian-Akkadian period. The distribution of recognizable species shows that these objects are concentrated in the settlements from south to southeast of Iran in the coastal strip of the Persian Gulf, and from the Oman Sea to the Zagros intermountain valleys, as well as in the northwest and northeast of Iran. The biological origin can be placed in the northern shores of the Oman Sea to the Gulf of Kutch on the northern coast of the Indian Ocean. It seems that with the growth and development of urbanization in Southwest Asia and especially the development of sea trade, oysters have been traded as valuable goods and other prestige goods. The importance of the shell findings is more than the value of the shells themselves because they were used as sacred goods in religious affairs. Analysis of the fields where the shells were discovered is more related to cemeteries and temples as sacred spaces. Also, the significant presence of Lambis shells for the production of specific ritual bowls, placed together with bronze axes in graves, can be seen as the reflection of a patriarchic tradition in the social-political organization of the third and second millennia B.C. Despite many excavations and the discovery of many samples of these types of shells, no further going investigation on these specific objects was undertaken so far. This desideratum reveals more valuable findings in the archeology of the Iranian plateau. Therefore, one of this article's final goals is to focus more on analyzing the context of the discovery of seashells in future Excavation.

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## 1. Introduction

Shell vessels have been made of several large marine gastropods species that were rarely used as grave objects in many cemeteries excavated in Mesopotamia. These documents belong to the third and second millennium B.C. The closest source of these shells is several hundred km far away (all distances noted are as-the-crow-flies). However, there is no independent work or mention of the prevalence of these rare and exotic species in Iranian archaeological publications. The source of these shells is in the Persian Gulf to the Indian Ocean south of the Indus Valley. The existence of one ancient trade route between the southern centers of Mesopotamia (at Uruk) to the Indus Valley has been confirmed based on traded lapis lazuli, chlorite, agate, and marine resources (Edens, 1992: 123, Kenoyer, 2008: 19). However, there have been changes in this ancient trade route at different phases due to cultural changes (Alden 1982:622-28). Based on these findings, the first discussion in this paper is about trans-regional trade. Another discussion of the paper is the study and analysis of the primary burial contexts that yielded these objects. Therefore, it is necessary to do some research on the archaeology of the dead for an accurate interpretation of the present data.

The information from the graves is one way of determining the social position of the deceased (Darck 2003: 111). It can be said that death has never been a priority in the human mind. However, essential was the emphasis on life and eternity (Larsson 2015:11). Sometimes, the grave structures reflect the social classification. However, the gender roles in the burials cannot be reliably identified. Gifts placed in graves are a gift from the living to the dead, and these gifts are sometimes of no use to the living people (Larsson 2015:12. Parker, Pearson, 1991; Duday and Pearce: 2009). The rarity and emphasis on the semiotic relationship of "symbiosis" belong exclusively to these objects in the graves of middle-aged men. It is often found alongside other symbolic objects, such as bronze axes. In this regard, we can mention the royal tombs in Ur, which are interpreted based on the political and social power of the rank and class within society. Most likely, these objects may show the deceased's social position or property; perhaps, these are merely memorials to those who participated in the deceased's funeral (Darck 2003:1-31).

**Shell vessels: previous research and their sources**

Most shell vessels are derived from two gastropod species: *Lambis* and *Turbinella pyrum*.

### 1.1.1. *Lambis*

Lambis (the spider conch) is a large gastropod (Figure 1). Their shell's size measure up to 220 - 330 mm wide. Lambis is found in the Persian Gulf and the Red Sea. Lambis truncata sebae is undoubtedly found in the Red Sea, and L. truncuata may be as well (G. Walls, 1980: 60)

### 1.1.2. *Turbinella pyrum*

Turbinella (formerly called Xancus; the chank shell, [sacred] chank, or divine conch) is a large, heavy shell with a maximum length of 250 mm, width of 100 to 150 mm, and weight of about 800 g. (Abbott, 1991: 70) (Figure 2). Its exterior is perfectly smooth, making it very attractive for printing and engraving. Its geographic range is limited to the Indian Ocean. It was used as the leading shell resource at Mohenjo-Daro (Kenoye,1984: 51). Although commonly used in the Indus Valley, it is not found in Mesopotamian sites. The absence of Turbinella Persian Gulf is attributed to the difference in salinity and the abundance of silt sediments in many parts of the Gulf. It has always been believed that in the past, Turbinella was derived only from the Indian Ocean (Gensheimer 1984:67).

### 1.1.3. Pleuroploca trapezium

Pleuroploca (formerly Fasciolaria trapezium; the trapezium horse conch or striped fox conch) is a relatively large gastropod (length 150 to 200 mm, width 200 mm) with a set of short

tubercles on the shoulder of the body whorl (Abbott, 1991: 65) (Figure 3). The central columella has two or three distinctive ridges or folds. This species is found in the Red Sea and parts of the East African coast. It is also reported from the Gulf of Kutch (west coast of India) and the Makran coast (southeast Iran and southwest Pakistan). They live in rocky areas or coral reefs, not on sandy ocean bottoms. There is no archaeological evidence that it had ever lived in the Persian Gulf.

Trumpet Triton, a familiar name the Triton's trumpet or the giant Triton, is a massive sea snail, a marine gastropod mollusk in the Charoniidae, the tritons.[1] Reaching up to two feet (or 60 cm) in shell length, this is one of the giant mollusks on the coral reef. One slightly smaller (shell size 100–385 millimeters (3.9–15.2 in). Charonia species inhabit temperate and tropical waters worldwide. This species is found throughout the Indo-Pacific Oceans, the Red Sea included (Linnaeus, 1758)

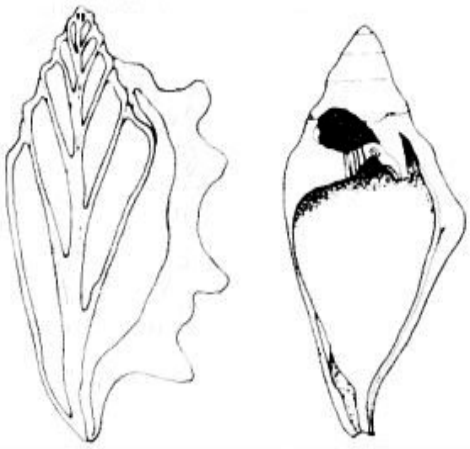

Figure 1. *Lambis* cross-section (left) and shell vessel (right) (Kenoyer 1983: fig. 3 and Gensheimer 1984: fig. 2:3).

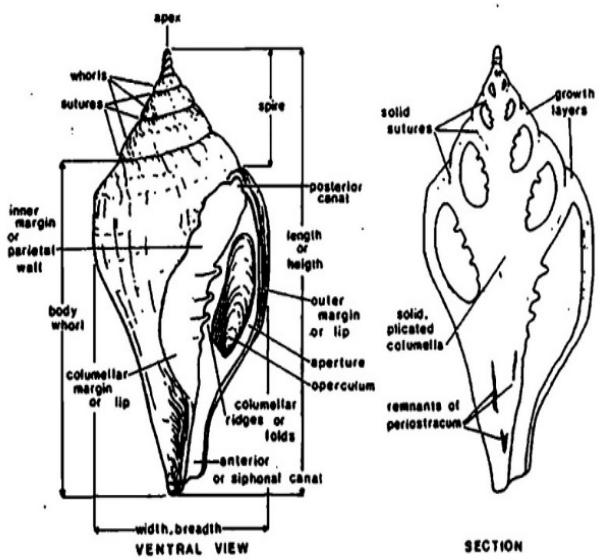


Figure 2. Exterior and cross-section of *Turbinella* (Kenoyer 1983: fig. 2 and Gensheimer 1984: fig. 2:2).

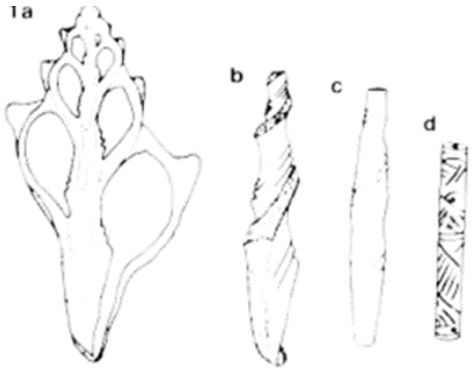


Figure 3. Cross-section (a), unworked columella (b), and worked Columellas (c-d) of *Pleuroploca* (Gensheimer 1984: fig. 2:1).

To create shell vessels, they first made a longitudinal cut at the surface of the shell and then removed much of the inner parts and part of the mouth and body. The external surface of Lambis is relatively flat in adulthood and more extensive than that of Turbinella. Nevertheless, the lower part of the shell is thorny. The morphology of this shell resembles a vessel or boat (Quenet 2018:16-17).

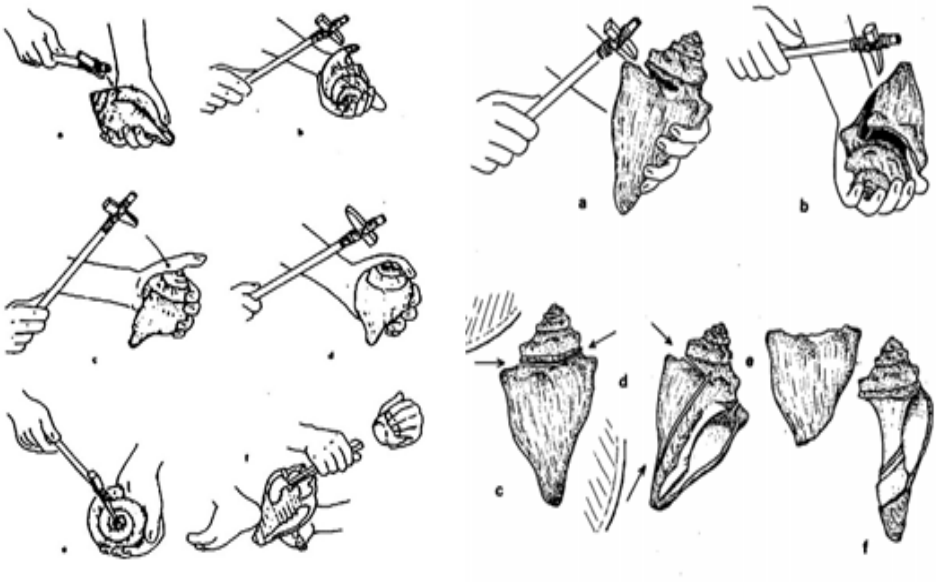


Figure 3. Making a shell vessel (Kenoyer 1983: fig. 9-8).

**1.2. Shell vessels in Iran**

Archaeological excavations in Iran have produced several shell vessels from cemeteries: Barde Zarda (Sharifi 2019), Kalle Nisar (Haernick and Overlaet 2006:60, 2008:58-59), Shahdad (Hakemi 1997, and Bani Surmeh (Vanden Bergh 1968). There is also one large gastropod found in Tepe Hissar (Schmidt 1937:232).


Map1. Iran and the site found shell vessels

### 1.2.1. Barde Zarda (West Azarbaijan province)

Barde Zarda is located about 15 km southwest of Piranshahr city in West Azerbaijan province and just behind the crown of Kani Sibe, about 1640 km from the Persian Gulf. For many years the remains of a cemetery from the third millennium B.C have been damaged due to the construction of the Kani Sibe Dam and the conversion of the area to farmland. In an area of nearly 1 hectare, signs of sedimentary bedrock and human bone remains are scattered.

For this reason, the archaeological team led by Mahnaz Sharifi excavated a trench right in the center of the destroyed cemetery. Excavations found a destroyed grave with a rock mass texture among a dense rock texture. Unfortunately, it was destroyed in its place due to the construction operations, so it was impossible to draw the architectural status and plan of the grave structure. However, among those deposits, the remains of at least one middle-aged male could be identified. Also, one of the worked shells, lambis trocenas was identified in the same tissue.

This vessel is 160 mm long and 80 mm wide, and its closest biological sources are on the northern shores of the Gulf of Koch in the Indian Ocean and the Sea of Oman. So far, many species have been reported in most groups of the third millennium to the first half of the millennium B.C. in Mesopotamia. During polishing, about one-third of the base shell is removed and then flattened by the edge of the shell throughout the oval circulation. It resembles the type o vessel that oysters are known as in the spiritual literature as Libation vessels. So far, the discovery of this rare species of shells has been reported exclusively in royal tombs or people of high social status. Unfortunately, the destruction makes it impossible to determine such a ratio in this context. However, using deductive reasoning, this grave can be considered one of the known types of graves. About 1640 km from the Persian Gulf. A destroyed tomb yielded a complete Lambis vessel and other objects (including a bronze axe). This vessel is 160 mm long and 80 mm wide (Sharifi 2019) (Figures 4–5).

Figures. 4 and 5 *Lambis* vessel from Barde Zarda, (sharifi,2019: 48)

### 1.2.2. The Kalle Nisar cemetery

The Kalle Nisar cemetery is located in western Iran (Elam province) near the border with Iraq and about 1290 km from the Persian Gulf. Less than 25 km from this cemetery, at least two other cemeteries were excavated (Bani Surmeh and Warkboud). All are pretty similar and date to the Middle Bronze Age. Kalle Nisar was excavated and studied in 1967–68 by a Belgian team directed by Louis Vanden Bergh. The graves here date from the MBA to 2000 B.C. In a grave (c13-38), a large Pleuroploca was found. Parts of its mouth and body were removed to make a vessel. Today, the distal (bottom) end is severely damaged (Haernick and Overlaet 2008:58-59) (Figure 6).

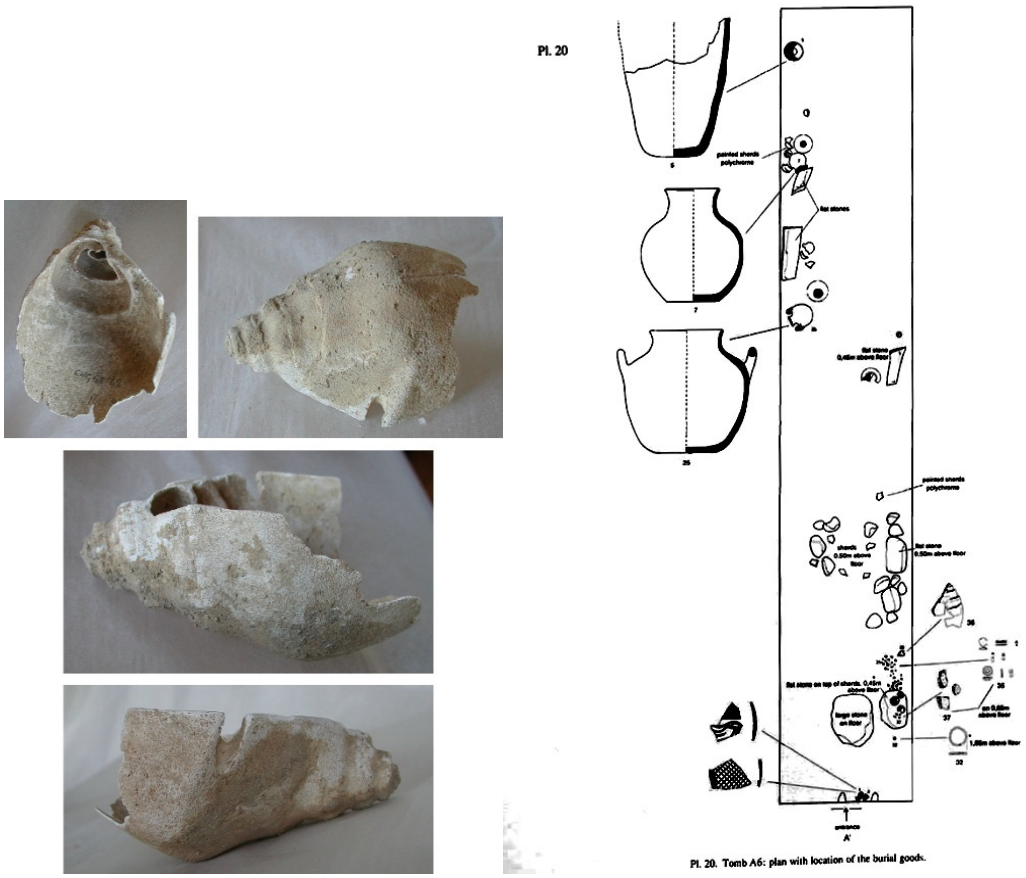


Figure 6. *Pleuroplaca* vessel from Kalle Nisar Grave c13-38
(Haernick and Overlaet 2008:pl. xxvii).

### 1.2.3. Bani Surmeh cemetery (Chawar region)

This cemetery is in western Iran (Elam province), about 1290 km from the Persian Gulf, and was excavated by Vanden Bergh's team. Grave A6-36 produced a large gastropod (Figure 7). The excavator compared it to shell vessels found in Iraq (Vanden Bergh 1968b:58). There are also reports of similar sherds in Lurestan (Haernick and Overlaet 2006:60).

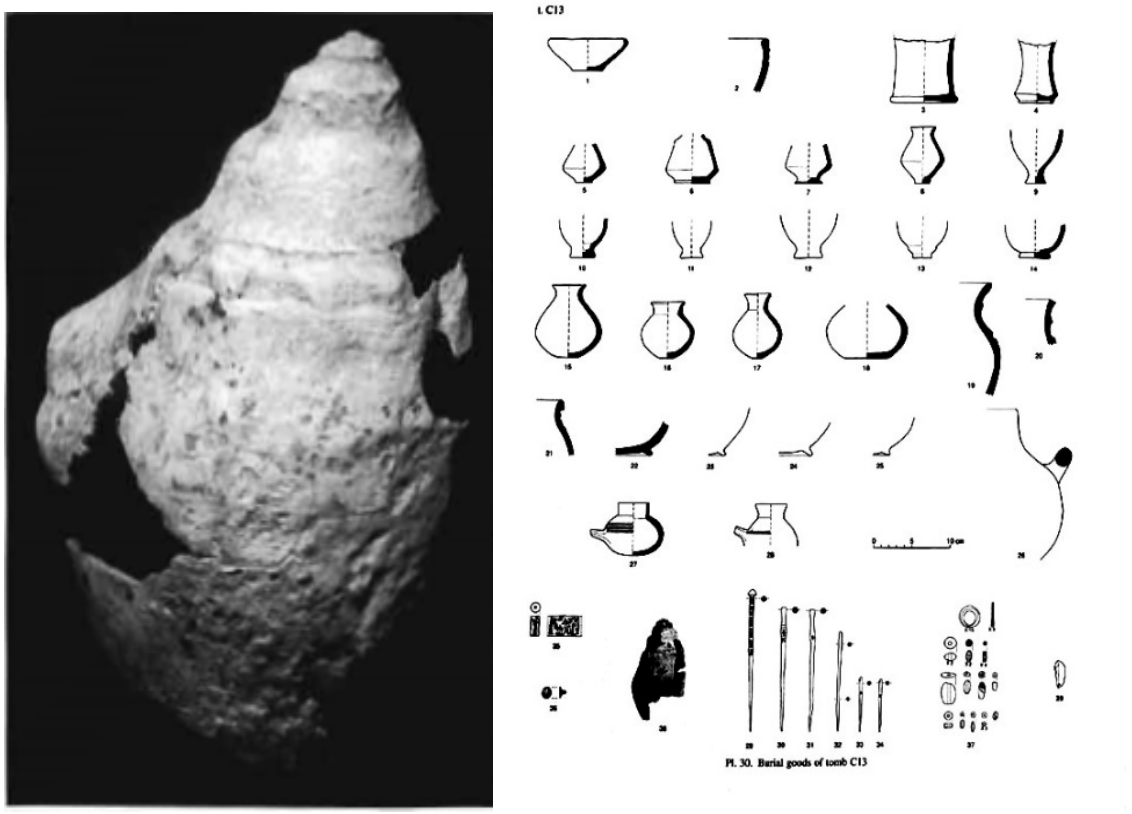


Figure 7. Shell from Bani Surmeh Grave A6-36 (Haernick and Overlaet 2006:60).

### 1.2.4. Shahdad cemetery (southwest of Put Plain)

Shahdad is in the center of the Iranian plateau, about 775 km from the Persian Gulf. One of the cemeteries at this site, called B cemetery or "Takab," is now wholly denuded due to severe wind erosion. In one of the shallow graves (at a depth of 150 mm), part of a human leg bone was found with other objects, including a Lambis vessel (Hakemi 1997:72-73) (Figure 8). The pottery and metal objects in the cemetery show links to western Iran (Susa), Mesopotamia, and sites and areas to the east such as Tepe Yahya, Shahr-i Sokhta, Baluchistan, and the Indus Valley. The alabaster and chlorite objects are comparable to those of Susa, Ur, and Uruk in the west and Kerman and Baluchistan in the east (Casanova, 2020, 302). The exciting thing about this shell is that it has been covered with plaster after processing.

Figure 8. *Lambis* vessel from Shahdad cemetery
(Authors. of the National Museum of Ancient Iran)

### 1.2.5. Tepe Hissar

Tepe Hissar in northern Iran, excavated in 1931–32, is almost 1400 km from the Persian Gulf. It probably produced a *Charonia Tritonis* (Triton or trumpet shell) with an open apex and a broken mouth from the Hissar III (second half of the third millennium and beginning of the second millennium B.C.; Bronze Age). It was published as "a large marine shell perforated for suspension" (Schmidt 1937:231-32, pl. LXX: H 1973). It could have been used as a vessel or a trumpet.

### 2. Shell vessels in Mesopotamia

In Mesopotamian archaeology, there is much more evidence in regards of using shells (Moorey 1994:128-29; Gensheimer 1984).

A significant number of shell vessels have been found in Mesopotamia, 1994:134), especially in the E.D., for example, at Ur (Figures 10–12), Kish, Tello, Abu Salabikh... A significant number of shells have been found in Mesopotamia (Aynard 1966, p. 29–30, Gensheimer 1984. p. 69; Moorey 1994, p. 134), especially in the early dynasty, for samples in Ur (Woolley 1934, p. 245, 248, pl. 137) Abu Slabikh (Martin, Moon & Postgate) Kish (Mackay 1925, p. 135. pl. III: 8; Moorey 1970, p. 105 sq.: Moorey 1978, p. 113), Farah (Martin 1988, pp. 59, 213), Chukha (Rumaidh 2000, p. 28, fig. 88) Site in Diyala (Delougaz 1967, p. 95–96, t. 89) and Hamrin (Ahmad al-Hattu: Eickhoff 1993, p. 77,167) and Marie (al-Hattu: Eickhoff 1993, p. 77,167). Examples of Lambis truncata species have been found in the Ur cemetery, decorated with carvings on the shell (Figure 15). One of the notable examples is the carved shell, the end shape of which is a duck's head (Fig. 16). (Gensheimer, 1984, woolly 1934, plate 102). A clear illustration of the primary type of changing structure of use is given by several categories of shell objects in 3rd-millennium Mesopotamia. Conch shells carved into lamps or cups are some of the little standards discovered in 3rd-millennium Mesopotamian destinations (see Aynard 1966).

These vessel shells are sometimes decorated with geometric patterns, painted, or just a splash and polish. In some cases, containers made of metal or stone were made in the shape of this shell container, which shows the importance of these shell containers. However, they appear to have a place for Lambis truncate sebae, Lambis lambis, and Turbinellacf. Pyrum (Gensheimer 1984:71; Kenoyer 1984:59; D. Reese, individual communication, 1986). Turbinella Pyrumoccurs as it extends along the coast of the Indian subcontinent north of the Indus Delta, while Lambis Ttruncatasebae and Lambis lambis have a wide distribution in the Indo-Pacific.

**3 Functionality and stylistic shell vessel - decorated**

A shell is a tool we can use to reconstruct aspects of the social and economic mechanisms of the past, such as the source of the shells, their final destination (trade routes) (Kenoyer, 2008: Edens,1992), how the shells are modified (technology) and how they are used (as exchange goods, funeral gifts, ornaments...) (Bar-Yosef Mayer 2011:186). According to Kenoyer, each region's shell artifact production has distinctive features. For instance, vessels were mainly manufactured from Turbinella in Mohenjo-Daro workshops (650 km from the Indian Ocean). Vessels were often manufactured of lambis in Mesopotamia. The carved motifs on the Indus vessels also differ significantly from those in the Mesopotamian. The huge columella and internal septa were painstakingly removed from the Indus vessels through the aperture, leaving the apex intact. The exterior of the hollow shell was then ground to eliminate the natural shell surface before being simply grooved (Kenoyer 1984: 57-59).

Some people think they were utilized as oil lamps. Although there is no proof of burning at the edges, it is possible to speculate that these were cups. Similarly, "In South India, unitized shells are used to give sick people their medicine or to milk-feed infants. Bengal produces more intricate, meticulously etched cups utilized all over South Asia for unique religious libations. The Indus containers were undoubtedly utilized in specific ritual functions because of their unique manufacture and shape, particularly suited to pouring some liquid. Therefore, Kenoyer labeled them "libation " (1984: 59-61) Vessels". However, care must be taken in using literature related to this species in Mesopotamia. Shells previously identified as Turbinella from Ur, Kish, and Tello (Hornell 1941: 23) have been recognized as Lambis. Pleuroploca was used almost exclusively in the Harappa and Mohenjo-Daro (Mallowan 1966:635).

Haerinck and Overlaet (2008:200) pointed out that Kalle Nisar and Bani Surmeh are similar to examples found in new Sumerian culture. However, in only one grave from each cemetery is a shell vessel discovered in, suggesting that one person would have had a higher rank than any other community member.

With the beginning of the third millennium B.C., special links between the coast and the sea emerged, which can be seen as a reflection of this belief and link to the grave goods in the Middle East (Méry and Charpentier 2009:22).

Based on the evidence, using marine shells as grave objects in the third millennium was essential. To the extent that objects were sometimes made of metal and stone to mimic the shape of shells, such as in Ur (see Appendix). Before the Ur Dynasty, some shells were found that were not only used to make vessels but were sometimes decorated with carving or engraving as well. For example, there is one instance where a piece of stone in the shape of a duck's head is attached to the bottom end (Zettler and Horne, eds. 1988:141-44).

Woolley suggested these shells were used for drinking or pouring liquid, similar to what Mackay (Marshal 1931:569) has described for shell vessels in the Indus Valley. Mackay has called a group of Lambis "U shell containers" because of their u-shaped cross-section. He pointed out, "In Sumer, smoothed shells are used as drinking cups or containers for purification" (Kenoyer 1984:59; Gensheimer 1984:70). The containers were initially interpreted as oil lamps. However, Woolley's views and Irene Winter referred to them as the "horns of freedom." He used it in events such as funerals and ritual ceremonies. However, his hypothesis was based mainly on Ur Third Dynasty cemetery finds. However, at least similar examples have been used centuries ago, found in many tombs and buildings where religious activities occurred at the end of the Jemdat Nasr period and the Second dynasties (Quenet 2018:17-20). Therefore, it can be concluded that at the beginning of the third millennium B.C., two species of large gastropods were used in Mesopotamia for a specific purpose (Quenet 2018:20-22). The shell vessels in Mesopotamia seem to be mainly found in elite burials

**4.1. Shell trade**

Various models of trading and exchange systems have been discussed for the prehistoric period (Lamberg-Karlovsky 1975; Clark 1968). Attempts were made to understand the value of "universal goods" in the prehistoric world, such as lapis lazuli, shells, metals, ceramics, and trade beads. While they were a trade and exchange commodity, they have attracted the attention of archaeologists. It is mentioned in discussions about early global trade communication (Friedman & Rowlands 1977; Graeber 2011; Brumfiel & Earle 1987; Marcus 2008; Prestholdt 2008; Stein 1998). Underscoring many of these discussions is the idea that 'exotic' early global commodities were objects of 'high value' that functioned as wealth and underscored power (Earle 2002; Friedman & Rowlands 1977; Harris 2017; Hayden 1998; Trubitt 2003). Larger cities appear to be directly related to regional networks and to have external trade connections. These cities, in turn, were associated with smaller towns and villages with intra-regional networks. At the local level, goods were distributed without reference to larger networks (Kenoyer 2008: 23). The Persian Gulf takes the commodities of the Inlet exchange included metals, materials, semiprecious stones, ivory, woods and reeds, cereals, all various vegetables and other condiments, oils, shells and conceivably pearls, and a little cluster of wrapped up items of wood, metal, or stone (cf. Pettinato 1972; Heimpel 1987). Many of these products may be classified as luxury goods whose use is more known in Mesopotamia. Where it carries the greatest load of ideological values, certain goods were used for clergy or people of high social class. On occasion, the intentions of holiness and specialist inserted in lapis lazuli are well known (Cassin 1968:114-119). It can be said that the raw and worked shells played an important economic or financial role in the region's economy. However, this industry has certainly been important. This issue has been confirmed by the distances from which the shells had to move (Kenoyer 2008: 23–25). The existence of shell artifacts in ancient places shows that shells were collected and made in Mohenjo Daro from other areas in the 3rd millennium B.C. These shells were found in the third millennium B.C. and exchanged with other regions through trade (Kenoyer 1983: 106-07).

Nevertheless, many of these models cannot be proven without written documentation from the Indus Valley. Based on the limited archaeological evidence from the Indus excavations. Shell industries existed at major Harappan sites such as Harappa, Lothal, Dolavira, etc., suggesting that internal trade networks were possible on the Indus

(Kenoyer 1989). Kenoyer pointed out that the trade in Asia and South Asia is based on family business relationships and that governments are not involved in this economic policy.

Furthermore, the long-term maintenance of such trade networks results from extensive kinship relationships and temporary contracts between producers and consumers. In the absence of strong state control, long-distance relationships would have been a form of insurance in trade relations (Kenoyer 2008:23). In Mesopotamia, Iran, and the Indus region, the role of various objects such as shells can be seen in a complex, socio-economic, and possibly socio-religious cultures in the 4th and early 3rd millennium B.C. (Kenoyer 1983:106-07). There is also evidence that people from the Indus Valley (e.g., Meluḫḫa) lived in Mesopotamia during the Akkadian period (ca. 2350–2200 B.C.) and became absorbed into the local population (Parpola *et al*. 1977). From the second half of the third millennium B.C. and then for several centuries to the second millennium B.C., Indus and Mesopotamian have been related to each other (Moorey 1994:132). Large gastropods were valuable objects in the third millennium B.C. (Moorey 1994:134). Kenoyer considers the presence of unique shells and beads and dark red agate specific to the Indus Valley as a particular trade item and exported from the Indus Valley to Mesopotamia and exported from the Indus Valley to Mesopotamia. It is considered a unique trade item and is exported from the Indus Valley to Mesopotamia. In the class society of Mesopotamia, only the elite could buy certain goods, such as vessels. The use of these shells was so crucial that gold and silver examples of these ships were made in the royal tombs of Ur because solid religious beliefs were hidden in them (Quenet 2018:25-27).

Several of the species used belong to the Indus coast. An exchange network for the movement of these shells is reconstructed through the connection between cities on known trade routes (see Map 2). According to the map, it can be seen that the closest place to trade shells on the Iranian plateau is Shahr-i Sokhta (Durante 1975, 1977, 1979). Which is then lead to Shahdad, Susa, behind the Luristan Mountains, and Barde Zarde. Based on the sites where *Lambis* has been found, it can be said that all of these sites were on the trade route in the third millennium B.C. The shells may have entered the Iranian plateau through two trade routes. Shells found in the western parts of Iran are likely to have entered the Zagros through Mesopotamian passages. Accordingly, it must be said that *Lambis* first entered Mesopotamia and then into the western parts of the Iranian plateau. Another discussion on shell vessels was their use in everyday life before being buried with the dead. Accordingly, two views have persisted. The first perspective was an oil lamp due to its shape and functional similarity.

In most cases, it was necessary to retain traces of the shell due to the fire's proximity to its pipe. However, the shell's calcium carbonate compounds are highly reactive to heat and will get burnt after a while, therefore, placing doubt on the general agreement that shell vessels are unlikely to have been used as lamps (Gensheimer 1984:69). Sometimes, the black color attributed to fire is considered to be the remains of a black cosmetic (common vermilion) as it is distinct from the effects of burning (see Mackay 1929:135).

Another use for these shell vessels is for pouring liquids, as Woolley noted (Woolley 1934a:283; cf. Mackay 1925: 18; Marshall 1931:569). What is clear is that raw shells were imported into Mesopotamia and produced locally using Sumerian-style decorations (Moorey 1994:134). The shell vessels from contemporary graves of the Iranian plateau are included in this classification.

## 5. Conclusion

Shells were a less accessible material to the inhabitants of the Iranian plateau in the third and second millennium B.C. Although, its importance in the cities of Mesopotamia has been widely regarded and significant. With the formation of the southern Mesopotamian cities and the classification of society, archaeological objects of a more dignified nature became more prominent. A strong connection between the southern shores of the Persian Gulf and the Indus can be documented in the Mature Harappan period and, to some extent, in the immediately post-Harappan period (Carter 2001; Laursen 2010). Regardless of its geographical location, Magan lost prominence in cuneiform sources after the Ur III period, when the trade between Mesopotamia and the cities to the southeast was directed through Dilmun (Potts 1990; Crawford 1998; Carter 2003). The imported materials are lapis lazuli, turquoise, copper, and shells. Based on the origin of these materials, the question of the existence of trade routes in the Uruk world, then eastwards to the end of Badakhshan in Afghanistan and the Indus Valley to the most eastern places such as Dilmun, Magan on the southern coast was raised. Because of their polished brilliance, scarcity, and spiritual and metaphysical dimensions, Marine shells originating in the sea are believed to have significance in the religious world, especially in people's views of life after death. Indeed, the contemporary cultures of the Sumerian dynasties in the Iranian plateau, especially in the western border regions of Iran or the places on the path of eastern trade routes, were influenced by the prevailing culture of Mesopotamia.

Hence, all ancient sites on the Iranian plateau where shell vessels are found are located on the western border connected to Mesopotamia or on the trade route. However, these vessel shells indicate the influence of Mesopotamian religion and religious thought on neighboring cultures such as Iran. Because in this period, we see many similarities between the culture of Iran and Mesopotamia. However, unfortunately, we are facing a lack of excavation data in Iran. All Iranian vessels were found in graves (except Hissar) and in cases where physical anthropological studies were performed in adult male graves. In at least three other cases, a bronze axe was found along with the oyster dish, showing its ritual, symbolic aspects, and social status. Based on the sites where Lambis has been found, it can be said that all of these sites were located on the third millennium B.C trade route. Note that shells may have entered the Iranian plateau through the two routes. Although the source of these shells is unique to the Indus region, shells obtained from the western parts of Iran are likely to have entered the Zagros region through Mesopotamian passages. On this basis, it must be said that the Lambis first entered Mesopotamia and then into the western parts of the Iranian plateau. The shell vessels are found only in particular graves in each cemetery. The status of the deceased's rank and class other than their male gender is unclear. Their elite status is similar to examples from the royal cemetery at Ur, where Woolley pointed to the critical presence of Lambis vessels.

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# تحلیل باستان‌شناسی رگ‌های صدفی موجود (پوسته لیباسیون) در زمینه‌های باستان‌شناسی فلات ایران در هزاره سوم تا اول پیش از میلاد

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## چکیده

صدف‌های دریایی اشیایی طبیعی-بیولوژیکی هستند. مدت‌ها در لایه‌های زمین‌شناسی به‌صورت فسیل‌ها و بعدها در لایه‌های باستانی در نتیجه فعالیت‌های انسانی کشف و قابل داده بودند. باستان شناسان می‌توانند از منشأ پوسته‌ها در تحلیل عملکردی مکان‌های باستانی استفاده کنند. باستان‌شناسی اجتماعی و تجارت قرار می‌گیرد. نتایج کاوش‌های باستان‌شناسی در فلات ایران نشان داده است که از حدود هزاره سوم پیش از میلاد به‌طور ناگهانی با صدف‌های دریایی زیادی از لامبیس، دنتالیوم و ... مواجه می‌شویم که این صدف‌ها از بافت‌های گورستان‌های آیینی مانند شوش، شهداد، ... تپه حصار، گورستان کله نثار، بنی سورما و ... این اشیاء عمدتاً به‌صورت صدف طبیعی یا صیقلی استفاده می‌شوند. در برخی موارد فقط به‌عنوان ماده اولیه برای ساخت انواع مهره‌ها، دکمه‌ها و سایر اشیا و زیورآلات زینتی استفاده می‌شود. سؤال اصلی درک و شناخت رابطه بین استفاده از صدف‌ها و زمینه‌های محل حفاری است. همچنین اهمیت برخی از این اشیاء در جوامع عصر مفرغ فلات ایران برای استفاده آیینی. در این مقاله از روش توصیفی، تحلیلی در شناسایی بیولوژیکی انواع پوسته استفاده شده است. روش قیاس نیز بر اساس مطالعات مشابه در این زمینه در باستان‌شناسی بین‌النهرین دوره سومری-اکدی استفاده شده است. پراکندگی گونه‌های قابل‌شناسایی نشان می‌دهد که این اشیاء در سکونتگاه‌های جنوب به جنوب‌شرق ایران در نوار ساحلی خلیج فارس، دریای عمان تا دره‌های زاگرس و شمال غرب و شمال شرق ایران متمرکز شده‌اند. منشأ بیولوژیکی این پوسته‌ها مربوط به سواحل شمالی دریای عمان تا خلیج کوچ در سواحل شمالی اقیانوس هند است. به نظر می‌رسد با رشد و توسعه شهرنشینی در آسیای جنوب غربی و به ویژه توسعه تجارت دریایی، صدف‌ها به‌عنوان کالاهای با ارزش مورد خرید و فروش قرار گرفته‌اند و سایر کالاهای معتبر اهمیت صدف را بیش از ارزش خود صدف می‌یابد زیرا متعلق به امور مذهبی است. به‌عنوان کالاهای مقدس تجزیه‌وتحلیل زمینه‌هایی که در آن صدف‌ها کشف‌شده است بیشتر مربوط به گورستان‌ها و معابد به‌عنوان فضاهای مقدس است. همچنین حضور چشمگیر پوسته بره به شکل کاسه موسوم به جام روحانی به همراه تبرهای برنزی در قبور مردان، بازتابی از شکل‌گیری سنت اجتماعی و سیاسی مبتنی بر مردسالاری در جوامع هزاره سوم و دوم است. قبل از میلاد مسیح. است. متأسفانه با وجود کاوش‌های فراوان و کشف نمونه‌های فراوان از این نوع پوسته‌ها، اقدام دیگری برای توصیف و معرفی آنها صورت نگرفته است. این خلأ اطلاعات شناختی، یافته‌های ارزشمندتری را در باستان‌شناسی فلات ایران نشان می‌دهد. بنابراین، یکی از اهداف نهایی مقاله تمرکز بیشتر بر تحلیل زمینه کشف صدف‌ها در حفاری آینده است.

**واژه‌های کلیدی:** رگ‌های صدفی، پیش از تاریخ ایران، بارده زردا، کله نثار، بنی سورمه، شداد، تپه حصار، لامبیس، توربینلا پیروم.

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# The Historical Approach to the Relative Chronology of Caravansarai of Alaki, Near Marand

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## Abstract

Due to the importance of Tabriz in various historical periods after the Mongol's invasion to the end of the Qajar period, as continuously being the capital city or the residence city of the prince, entrance to this city has been reflected in various reports. Most of the foreigners who entered Iran from European countries came from Caucasus Road to Tabriz and reported many buildings on their way. Moreover, this road was one of the most significant roadways for Caravans on the Silk Road, where various residential buildings have been constructed. Alaki caravansarai is one of the most important roadside accommodations in Northwest Iran, and so many reports about it and the quality of its façade decorations can be traced in the travelogues of foreigners who traveled to Iran. Its vastitude and elegant entrance gate nevertheless, this building has unfortunately been neglected and was about to be ruined in the 19th century and afterward. However, the beauty of its entrance gate has gained the attention of many people and has been reported in many sources. Based on the ornaments used, recent sources in the history of architecture have estimated its date to the 12th century and Ilkhanid Abū Saʿīd Bahādor Khan and the Timurid period. These sources based their estimation only on the type of ornaments used on its entrance gate and its probable that the existence of dated artworks of the Ilkhanid period nearby, such as the Mihrab of Marand's Jame Mosque, has influenced this speculation. This article aims to meticulously study this building in various travelogues, al-Wqafīyya al-Rashīdīyya, and other sources in the history of architecture and discusses the ornament types used and their history. The detailed study of the documents and sources indicated that this building could belong to the presidency period of Ḵʷāja Rašid-al-Din Fażl-Allāh, and based on his emphasis to establish this building, can be dated 1297-1309. The ornaments, moreover, indicate the transient period from brickwork to tilework which happened in the late 13th and early 14th centuries.

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## 1. Introduction

The recognition of the construction date of a building can certainly help a lot to study and realize its historical evolution and architectural styles. In the past, Marand city was one of the main entranceways for foreign travelers to Iran from the Caucasus path towards Tabriz. For this reason, besides inner-city caravansaries, other caravansaries were built in the suburbs of Marand City, including some very famous ones. Two names of Alaki Caravansarai and Airandibi Caravansarai have been sited on Jolfa to Marand Road, and Yam Caravansarai on the Marand to Tabriz Road was mentioned in historical sources. The latter example has been restored at present. Alaki caravansarai was located at 13th kilometer to the North of Marand in an area called Harzand. Gemelli Careri (1704: 116) and Madam Dieulafoy (1887: 37–38) have presented photos and descriptions of this caravansarai in their travelogues. Other historians and archeologists such as Wilber (1969: 176–177), Seyyed Marandi (2014: 212–215), Siroux M (1949: 57), Kleiss, W.(1972: 186–187) and Kiani and Kleiss (1983: 499) have also mentioned this caravansarai and have dated it based on its decorations. Unfortunately, the remains of the caravansarai were ruined in 1990th but parts of its foundation and decoration have been discovered in archeological excavations, whose findings have been published (Moradi & Omrani, 2014). Accordingly, this architectural monument consisted of a four-iwan plan with nine towers (Fig.13) and a magnificent entrance gate with impressive decorations. Until 1990, some architectural parts of its entrance gate remained (Seyyed-Marandi, 2014, p. 213) whose pictures have been published by architectural historians (Blair & Bloom, 1984; Siroux, 1949, p. pl. IV-3; Wilber, 1969, p. Pls.179-180). Moreover, Nemati Babaylou and Saidi Mehrabad (2020) studied the issue of the Endowment of this caravansarai and the related documents has been thoroughly.

One of the main points that can be achieved from the previously written documents is the date of the construction of this building. Some researchers have no clear idea about the exact date of this building and pertain it to the Ilkhanid era (Seyed Zanozi, 1979: 269–271). In the documents of Iran's National Heritage Registration Organization, this building is registered to the Safavid period without mentioning the exact date (East Azarbaijan Cultural Heritage, Handicrafts and Tourism Organization Website, 2005). Seyyed Marandi (2014: 213) believes it belonged to the reign of Abū Saʿīd Bahādor Khan, the last Ilkhanid king in Iran, (1316-1336). This assertion is done without providing certain evidence. It seems that the artworks of this period in Marand, especially the inscription date on the Mihrab of the Friday Mosque (1331) (Siroux, 1956) and the date given by Wilber (1969: 176–177) for caravansarai have influenced this assertion. The field studies of the decorations found in the archeological excavations of this caravansarai and its historical photos indicate that this monument could belong to date before Abū Saʿīd.

Therefore, the present article aims to explore the dating of this building. To this end, the analysis of written as well as visual documents and archaeological founds will be pursued. This caravansarai was one of the most magnificent buildings of its time in the region, further escalating the necessity for its recognition. The required data in this study have been collected through field and library methods and then presented via descriptive and analytic methods. Written documents were analyzed, and to determine the dating of the building, field studies, including area visits and photographic documentation of the fragments have been applied, and

the results have been compared with historical images. Finally, all the evidence has been analyzed towards attaining the research aim.

## 2. Research methodology

The required data in this study have been collected through field and library methods and then presented via descriptive and analytic methods. For this purpose, written documents were analyzed and, in order to determine the dating of the building, field studies including area visits and photo taking of the fragments have been applied and the results have been compared with historical pictures. Finally, all the evidences have been analyzed towards the attainment of answers to the research questions.

## 3. The geographical location of the Caravansarai

Regarding the name of Alaki, it can be certainly asserted that it is taken from an area by this name. Although no signs of this area cannot be found on maps nowadays, but, in the past, there was an area known as Alaki Plain which is attested and used by the local residents. Chardin (1811:316) mentions passing the Alacou area before Marand and asserts that people believe that Hulagu had built a city in this area which was later destroyed in Iran and Ottoman war. The name Alaku is also marked on the Empire of Iran's map (Fig. 1) which was drawn by Emanuel Bowen in 1747 (Bowen 1747).

Alaki caravansarai is located at 13th km to the North of Marand City (Moradi and Omrani 2014) in an area known as Harzandat. This area includes rustic parts of New Harzand and Old (Atiq) Harzand and their agricultural lands. By studying the historical documents, especially the endowments of the area in the Endowment Book of Rashidi1(al-Hamedani 1977:157), it cannot be certainly asserted that the lands of this caravansarai belong to the rustic areas of New Harzand or Atiq Harzand (Nemati Babaylou and Saidi Mehrabad 2020).

Seyyed Marandi (2014:212) has mentioned at least three caravansaries in the Harzand area towathe rds Darediz mountain pass without indicating their names, but in most sources, only Āyrāndibi and Alaki caravansaries are mentioned. Being abandoned, fast destruction in the modern period, and lack of sufficient archeological studies have caused problems in naming this caravansarai. One of these problems is using the name Āyrāndibi caravansarai instead of Alaki. But due to the fact that, in the past, caravansaries often took the name of the area where they located, and based on the comparative geographical specifications of Atiq Harzand and New Harzand villages and Āyrāndibi area (Fig. 2), the two caravansarais can be considered separately. According to Seyyed Marandi (2014:212), the Āyrāndibi caravansarai, whose foundation stones have only remained now, was located at 6 kilometers from the Alaki caravansarai.

1. This book was registered in Memory of the World Heritage in 2007.


Fig 1. A part of the map of the Empire of Iran, drawn by Emanuel Bowen(1747).

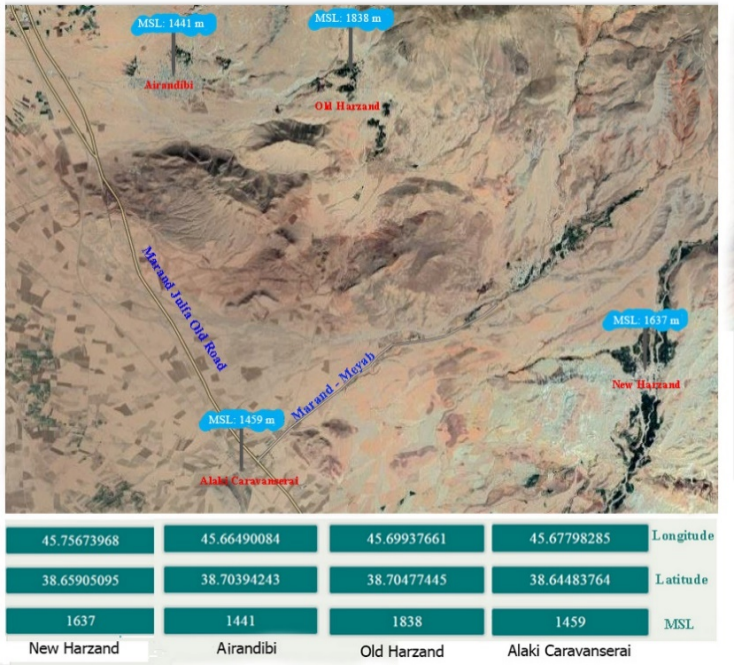


Fig 2. Geographical specification of the Caravansarai and its neighboring areas.

## 4. Document Review

### 4-1. Historical and archeological studies

In many sources, Alaki caravansarai has been explained as having great foundations, composed of black stone in two layers (Kleiss 1972:186–87; Siroux 1949:57; Wilber 1969:176). Kleiss has also mentioned the ruins of another building at 115 meters of this caravansarai with illustrations of the masons' signatures carved on its stones. Following their archaeological studies in Alaki, Moradi and Omrani(2014) have also reported the existence of such figures on the stones of its southern entrance gate. By comparing them to the similar samples in buildings in Darband, Pasargadae Persepolis, Kangavar, Shahr-e Ghor, and Farhād Tarāsh, all

of which belong to the Sasanid period, they have speculated that these bases could belong to a building from Sasanid period in this area which had been reused in order to expand Iran's trading paths. During Moradi and Omrani's excavation, the building mentioned by Kleiss had been totally destroyed, and it seems probable that the discovered stones by them belonged to the building mentioned by Kleiss, not Alaki.

Some archeologists and art historians have mentioned the Alaki caravansarai and given explanations about it which are followed, all of which could deem important in studying the Alaki caravansarai and its ornaments.

By studying the remains of the entrance gate of this caravansarai, Maxime Siroux believes that this caravansarai belongs to a time before the settlement of Mongolians and, by considering the date of such decorations in two buildings of Momineh Ḵātūn of Nakhchivan and Gonbad-e Kaboud of Maragheh, dates it to early 12th century, concurrent to the reign of Eldiguzids in Azerbaijan (Siroux 1949:57). Wilber has mentioned that, despite the caravansaries in Iran are generally pertained to Shah Abbas Safavid, the local residents in this area pertain this caravansarai and its remains to Hulāgu Khan. He has dated this caravansarai to around 1330-1335, concurrent to Sarcham Caravansarai (1332-1333). He also believes that the type of inlaid tiles used in the building had not been developed before 1310 and belongs to a time after this date (Wilber 1969:176–77). By studying this caravansarai in 1967, Wolfram Kleiss has introduced it by Āyrāndibi name and, in its description, based on the magnificent brickwork in its entrance gate, dated it to the Timurid period (Kleiss 1972:186–87). Though this theory has later been revised by Kiani and Kleiss's study (1983:499), as pertaining to the Ilkhanid period, following Wilber, local authors such as Seyyed Zonouzi (1979:269–71) and Seyyed Marandi (2014:212), date the construction of this building to the reign of Abū Saʿīd Bahādor Khan in the year 1331.

## 4-2. The travelogues

Many tourists from the 11th to 20th centuries have trotted the Caucasus to Tabriz (or the reverse) path[1], some of whom have mentioned the caravansaries on the way or explained their characteristics. For various reasons, such as organizing the notes after the travel, mistakes have occurred in the description of the location or the characteristics of these caravansaries in some travelogues. This has happened to two of the main caravansaries in the suburbs of Marand, namely Alaki, and Yām.[2] To understand which caravansarai has been mentioned in the travelogues, this point could be clarifying that the Alaki caravansarai is located at the North of Marand, on the old Marand-Jolfa road while, the Yām caravansarai is located at the South of Marand on the Marand-Tabriz Road (Fig. 3). Due to the fact that in some travelogues, the names of these caravansaries are not certainly dependable,

1. Nāṣir-i Khusrau (1045) , Ambrogio Contarini (1473-7), Jean-Baptiste Tavernier (1632-68), Evliya Çelebi (1640), Jean Chardin (1664-1677), Gemelli Careri (1693), Pierre Amédée Jaubert (1806), Auguste Bontems (1806-7), Gaspard Drouville (1812-13), Morris De Kotzebue (1817), Baron Feodorkov (1834-5), Mary Leonora Woulfe Sheil (1856), Heinrich Karl Brugsch (1860-1), Naser-al-Din Shah Qājār (1873), Jane Dieulafoy (1881), Williams Jackson (1903), Khalil Irāqi (1910), Mirza Sāleh Shirazi (1928), Fred Richards (1930), Etesām al Mulk (1932) and Haj Sayyāh (1937) have passed through Marand.

2 Yām Caravansary has been completely rehabilitated into a tourism site and renamed as Payām-e Marand Tourism Complex(Seyyed-Marandi 2014:205).

as a result, characteristics of the caravansaries at the suburbs of Marand were studied in the following travelogues: Gemelli Careri, Jean-Baptiste Tavernier, Auguste Bontemps, Morris De Kotzebue, Heinrich Karl Brugsch, Mirza Sāleh Shirazi, Jane Dieulafoy and Williams Jackson.


Fig 3. The geographical location of Alaki and Yām Caravansaries, respectively on the North and South of Marand.

In most travelogues, the name of caravansarai is not directly mentioned and its geographical location is only given. Among them, based on the geographical information, Bontem, Mirza Sāhel Shirazi, Dieulafoy and Jackson's travelogues have described Yām caravansarai and Alaki is accounted for in Brugsch's travelogues. Tavernier has talked about the existence of two caravansaries, such as the Alaki caravansarai, before Marand, and both caravansaries have been mentioned in Careri and De Kotzebue's travelogues.

The descriptions of the five travelogues correspond with the location of the Yām caravansarai but cannot be documented for Alaki. The description of Madam Dieulafoy and the design she has introduced for this place (Fig. 6) are completely compatible with Alaki caravansarai. This is confirmed by corresponding with the picture presented by Wilber (1969:176–77) (Fig. 5) and Siroux (1949:57) (Fig. 7), though its geographical location has been mistaken with Yām caravansarai. Siroux (1949:77) and Seyyed Marandi (2014:213) have also cited Dieulafoy's mistake in describing the location of Alaki caravansarai as Yām. Dieulafoy has also mentioned the repair of caravansarai in Safavid period, which, itself, has led to this mistake. In Bontems, De Kotzebue and Jackson's travelogues much information has not been provided about Alaki caravansarai and is limited to just mentioning the presence of a caravansarai. For this reason, the analysis of that information will not be much fruitful. As a result, it can be claimed that only in five travelogues, including Gemelli Careri, Jean-Baptiste Tavernier, Morris De Kotzebue, Heinrich Karl Brugsch, and Jane Dieulafoy, Alaki Caravansarai has been mentioned. Gemelli Careri wrote that after passing the Araxes River for 14 miles, they arrived at a small caravansarai in Dareduz (Darediz) valley and stayed there. The next day, after going another 15 miles on a rocky road and passing a frightening deep valley, they arrived at Alaki-Hulāgu caravansarai with a brick

tower entrance gate. A large brick caravansarai has been built which has a fountain in the middle of its yard with clear and refreshing water. The next day, having gone 10 more miles from Marand, they arrived at a beautiful caravansarai called Yāmchi which had sufficient capacity for so many travelers and four large brick towers had been built in its four corners (Gemelli-Careri 1704:11). In Gemelli Careri's text, the existence of three caravansaries of Darediz, Alaki and Yām has been mentioned and the difference between Alaki and Yām caravansaries has been explained by referring to the number of towers in Alaki caravansarai. This fact that can be evidently seen in their architecture. Jean-Baptiste Tavernier mentions the existence of a caravansarai on Jolfa to Marand road - near Marand - which is magnificently built with nicely cut stones (Tavernier 1676:49–50). Dieulafoy describes the caravansarai for which she provides a picture that corresponds with Alaki as today, the caravan stopped in the ruins of one of the 999 Shah Abbasi caravansaries. The building is rectangular and its walls are built with red strong stones and possesses defensive towers. A part of the entrance gate is destroyed and the remains have ceramics with beautiful blue tiles and red bricks. This caravansarai, like similar ones, was a shelter for bandits for a while (Dieulafoy, 1887:38). De Kotzebue has explained that, after passing Alamdar and Gerger[1]3 villages, they stayed in a caravansarai near a high impassable mountain, whose entrance gate had blue embossed decorations (Von Kotzebue 1819:121-2). He also mentions an old caravansarai after Marand and before Soufiane which corresponds with the geographical location of Yām caravansarai. Heinrich Karl Brugsch has mentioned the ruins of a caravansarai at the left side of the road after passing Harzan village which is called Abbāssijeh, meaning this caravansarai has been built by Shah Abbas. He then describes its features as having sufficient space for caravans, their cattle and loads. Their buildings are so strong that, even the royal castles of the time, are not comparable to them.

The foundations of this kind of buildings have been built with large blocks of stone and mortar. They possesses magnificent and interesting decorations on walls and tile inscriptions on their large entrance gate, their rooms, the stables and water wells, as well (Brugsch 1862:162–63).

## 4-3. Historical documents

Al-Wqafīyya al-Rashīdīyya which is hand-written by K̲ᵛāja Rašid-al-Din Fażl-Allāh Ṭabib Hamadāni and includes a complete description of Rab'-e Rashidi endowments is considered as one of the most prominent documents about Ilkhanid architecture studies (al-Hamedani 1977). The original copy of this book written by its author is kept in the Central Library of Tabriz. In the al-Wqafīyya al-Rashīdīyya in the third chapter, the second part, the twelfth section, named sustenance conditions, the name of Alaki caravansarai in Harzand region is mentioned and an allowance is set for its travelers (Fig.4). According to the varied writing forms of this caravansarai name in Persian, including Alaki (الکی), Alâki (الاکی) and Âlâki (آلاکی) in various sources and also referring to the name of New Harzand village in the text of the Endowment book and appointing the people of this village as trustees; it can be considered as corresponding with Alaki. It is important to note the explicit reference of K̲ᵛāja Rašid-al-Din to the construction

1. The present Hadi Shahr

of the caravansarai by his own order (al-Hamedani 1977:157), which indicates that the caravansarai had been built and was being used at the time of writing the Endowment book (1309-1318) (ibid, XXXI).There is an ancient judicial document belonging to the end of Rabi al-Thani month in the year 791 AH (1389) in the museum of the University of Tabriz, in the text of which the issue of Alâki lands in Harzan is mentioned. The issue under discussion is the resolution of the dispute between Ḵᵛāja Ḡīāṯ-Al-Dīn Moḥammad and the descendants of Sultan Pir Ayub and other peasants of Harzan village, over two of the six proportions of Alâki region, which as a result of this document, considers these two proportions to be specific to the subjects of the ancient village of Harzan (Nawabi 1953). The point that bears importance in this document is that one of the plaintiffs is Ḵᵛāja Ḡīāṯ-Al-Dīn Mohammad son of Ḵᵛāja Rašid-al-Din Mohammad Tabrizi that both are similar to Rašid-al-Din Fażl-Allāh and his son. But Ḡīāṯ-Al-Dīn, the son of Rašid-al-Din Fażl-Allāh Hamedani, was not alive on that date. On the other hand, Ḵᵛāja Rašid-al-Din has never been known as Tabrizi. Therefore, it seems that, on the mentioned date, due to the similarity of the names and based on the documents of Endowment book of Rashidi, the purchase and endowment of Alaki lands by Rashid al-Din has been abused. In general, this document, in which the name of Alâki is completely mentioned, and the claim of this person could confirm the belonging of the items mentioned in the al-Wqafīyya al-Rashīdīyya to Alaki caravansarai.

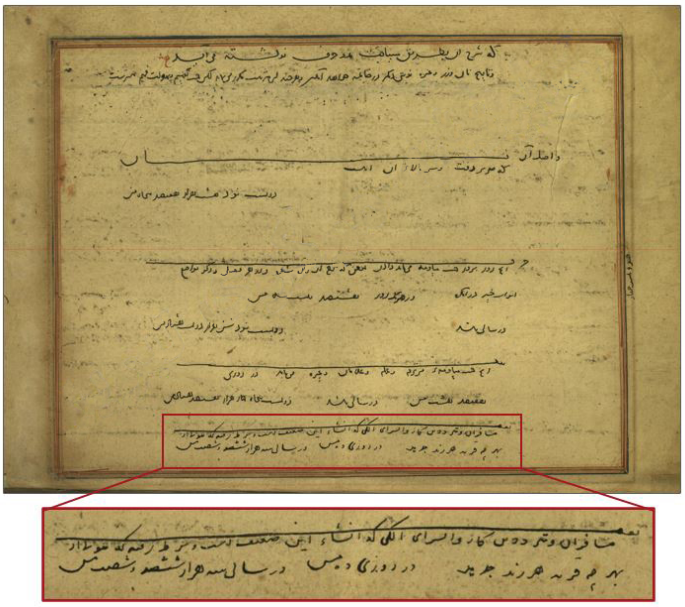

Fig 4. Part of Endowment book of Rashidi in which Alaki Caravansarai is mentioned (by permission obtained from Central Library of Tabriz).

## 4-4. Historical images

The oldest surviving image of the Alaki entrance gate is a gravure drawn by Dieulafoy in 1887. In this picture, the entrance gate is drawn from the southwest angle and the wall on the north side is relatively intact. After her, Maxime Siroux and André Godard took pictures of this caravansarai at an angle close to Dieulafoy’s drawings, which was published in Siroux 's 1949 report. Siroux’s photo indicates the destruction of the northern side of the eastern wall (entrance gate wall). Donald Wilber also recorded images of this caravansarai, which is

stored in the University of Michigan archives and was took 1939 (Wilber 1969:177). However, Wilber obtained most of her information on Ilkhanid architecture from 1942 to 1946 (Blessing 2015) and reported that the gateway was destroyed in those years. These images show a situation similar to the Siroux's photo. Until that time, the entrance arch of the caravansarai was intact. But the image taken by Wolfram Kleiss in 1967 shows the destruction of the northern base of the arch and the surrounding walls, and only the southern base is visible in the image (Kleiss 1972:TAFEL 53); A situation that can later be observed in the pictures of Sheila Blair in 1984. Seyyed Marandi also filmed this complex in the 1980s, the archive of which is not available. Blair's photos are the last available images of the caravansarai's entrance gate, showing only a small section of the south base of the entrance gate and part of the inscription.

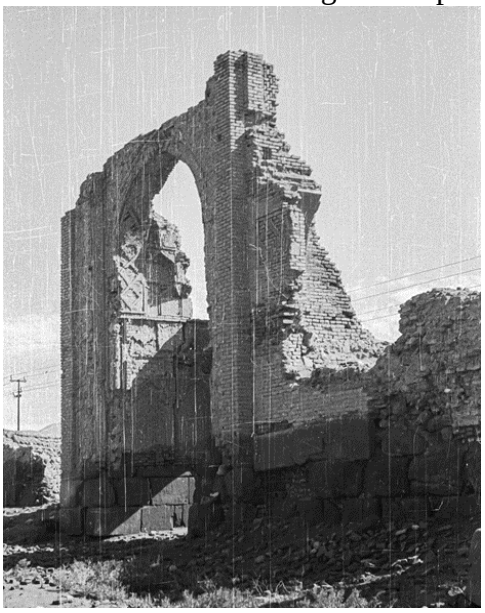

Fig 5. The images recorded by Wilber (by permission obtained from Michigan University).

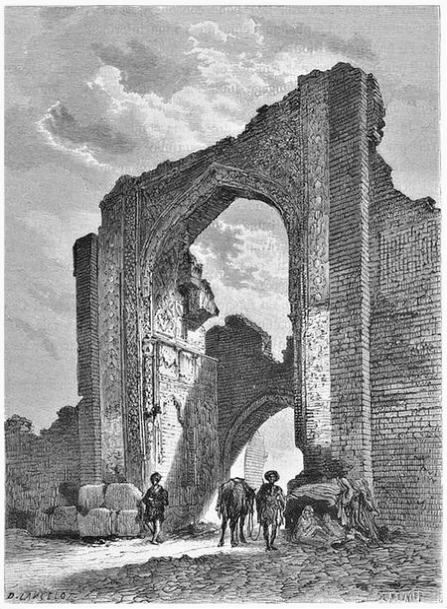

Fig 6. The engraving recorded by Madam Dieulafoy (Dieulafoy 1887).

Fig 7. The images recorded by Maxime Siroux (Siroux 1949:Pl.IV.3).

Fig 8. The images recorded by Wilber (by permission obtained from Michigan University).


Fig 9. the images recorded by Wolfram Kleiss in 1967 (Kleiss 1972:TAFEL 53).


Figs 10-12. the images recorded by Sheila Blair and Jonathan Bloom (1984) (by permission obtained from Blair and Bloom).

## 5. Architectural Remains

### 5-1. Architectural Characteristics

It is not possible to thoroughly study the architecture of the Alaki Caravansarai, due to the complete destruction of the building, the conversion of the caravansarai's lands into archeological sites and the rural construction carried out on parts of the building grounds, as well as the limited excavations done. Therefore, the data so far are presented based on studies of the history of architecture and archeology.Archaeological studies indicate that this caravansarai has generally a rectangular plan with nine towers and a magnificent entrance gate, though Wilber (1969:176) and Seyyed Marandi (2014:213) have reported ten towers. Archaeological excavations carried out have revealed the architectural remains of up to a quarter of the plan of this caravansarai, which shows a 50-by-60-meters rectangle shape with a brick body on a platform of huge black ashlar fine stones. The courtyard of the caravansarai is also rectangular in dimensions of 30 by 40 meters. Based on the documents, it can be stated that a period of expansion of space in the building has been done by removing a part of the rooms

facing the pond to increase the dimensions of the courtyard in later periods, and the walls of the building with defensive towers in the corners and the defensive semi cylindrical towers along all the sides of the building have been reinforced. On the four sides of the plan, accommodation rooms for caravans, and in the space behind them, stables and other service sections had been located, which are mentioned by Maxime Siroux, and Brugsch in the description of the caravansarai features. According to the plan, the caravansarai had four-Ayvān (iwāns) and a regular rectangular courtyard. One of the important points of the plan is the columns in the space behind the northern rooms and the two sides of the southern side, which have been used to build larger openings to cover the roof in these parts (Moradi and Omrani 2014). The development of two-Ayvāns plans of early twelfth century of Khorasan into four-Ayvāns plans of the Ilkhanid period in Tabriz School is one of the architectural turning points of the Ilkhanid period (Ajorloo 2010). The caravansaries before this building were generally closed on all sides to resist the weather conditions, and for this reason, the design of the Alaki caravansarai can be considered as one of the oldest caravansaries with a plan of four ayvāns in NW Iran (Moradi and Omrani 2014). The building is made of bricks with dimensions of 5 × 22 × 22 cm, on rubble stone. The entrance gate is built on a base of rectangular cubic ashlar fine stones and has a width of about 4.40 meters (Kleiss 1972:186–87). Use of a combination of brick and ashlar stone has been one of the architectural characteristics of northwestern Iran (Wilber 1969:177) Kleiss (1972:187) mentions the existence of a building located at 115 meters northwest of the caravansarai in the 1971 excavation activities, on the stones of which, there have been seen two types of stonemason marks. Moradi and Omrani(2014) have also reported similar marks on the stones of this caravansarai.

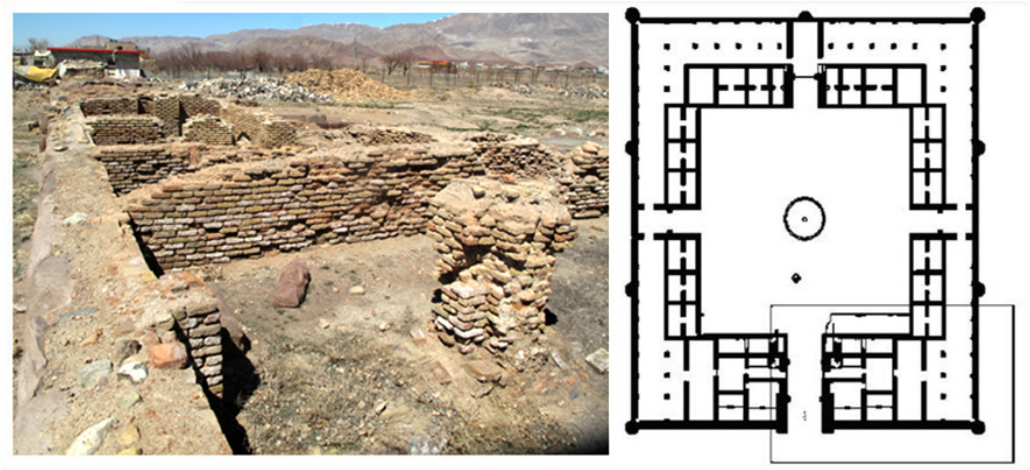

Fig 13. the excavated part of the caravansarai (Ali Nemati-Babaylou, 2022) and reconstructed plan based on the foundation work on its spatial ¼ (Moradi and Omrani 2014).

## 5-2. Decoration

The comparison of the images and historical descriptions with the remains obtained from archeological excavations (Fig. 14) indicates that the main architectural decorations of this caravansarai include brickwork and tileworking, and in most cases, a combination of them. Pieces with inlaid and glaze engraved (Loâb-Parân) tileworking techniques can also be seen among the discovered fragments, but the main decorations of the building are a combination of tiles and

bricks. Despite the differences in the color of the glaze and body in various fragments, it seems that the method of making them was the same, and the differences in the color of the glaze in some fragments can be due to the differences in the amount of metal oxides in the composition of glaze. It seems that non-glazed large pieces (bricks) are made with initial molding and final grinding, but tile pieces mainly indicate their being cut from larger pieces. Other decorations include entrance gate inscriptions, in which two different techniques have been used. The main facade of the caravansarai is facing west and the entrance includes Muqarnas decoration, tileworking, inscriptions and, using brick coffering (noghul) and brick partition wall (spar) in the internal parts (Moradi and Omrani 2014). Matching the archaeological discoveries with the historical images and the descriptions of the decorations by Wilber (1969:176–77) and Kleiss (1972:186–87) indicates the application of different types of decorations as follows:

**Inscription**

The study of Wilber's photos and description of the entrance gate shows that it had at least three inscriptions. The first inscription around the entrance arch is in the Kufic script, which is also mentioned in the travelogues and parts of it have been found in archaeological excavations. This inscription was made of unglazed ceramic on a blue tile background about 25 cm wide. Part of this inscription can be seen in the pictures taken by Sheila Blair and Jonathan Bloom in 1984. According to Khanykov and George Miles, this inscription was probably a Persian text or poem. Khanykov considers it similar to the Kufic inscription of Momineh Ḵātūn Mausoleum in Nakhchivan1 (Wilber 1969:176–77). The reading of this inscription is very important because there are few inscriptions in Persian before this date.

The second inscription was located inside the entrance gate and below muqarnas decoration above the inner arch of the entrance. Wilber reports that it is a type of white mosaic tile on a dark blue background, but his image of the only word left on it has similarities with stuccowork. This inscription was in Thuluth script or its subdivisions. These types of inscriptions in the tradition of Islamic architecture are generally construction inscriptions that include the year of establishment and the founder of the building. Wilber reports another inscription below this inscription on the hexagonal geometric decorations on the north and south walls inside the entrance, which is technically similar to the second inscription. Archaeological excavations have also discovered fragments of white inscription tiles on a dark blue background.

**Geometric decorations**

Apart from the combination of bricks and tiles in the exterior of the entrance gate, at least four geometric patterns can be seen in the decorations of this entrance gate. The first is the geometric pattern of the twelve-pointed star, which is used in the exterior view, and its apparatus (Ālat) is unglazed and in relief, and its interstice region (Loqat) is a turquoise glazed tile (Fig.14). The second is a

1. The text of the poem of Momineh Ḵātūn Mausoleum in Nakhchivan is as follows: We turned and the time is passed / we pass away but this remains as a memorial ( ما بگردیم بس بماند روزگار/ ما بمیریم این بماند یادگار) (Ajorloo 2020).

geometric pattern, next to the first one, and contains a five-pointed geometric pattern. The spandrel in the corner of the arch forms the third geometric pattern, which is only visible in Wilber's image and appears to be similar to the second pattern. The fourth pattern includes hexagon form and a six-pointed star, which is used on the inner sides of the entrance gate. In this pattern, the stars are with turquoise glaze and the hexagons are without glaze.

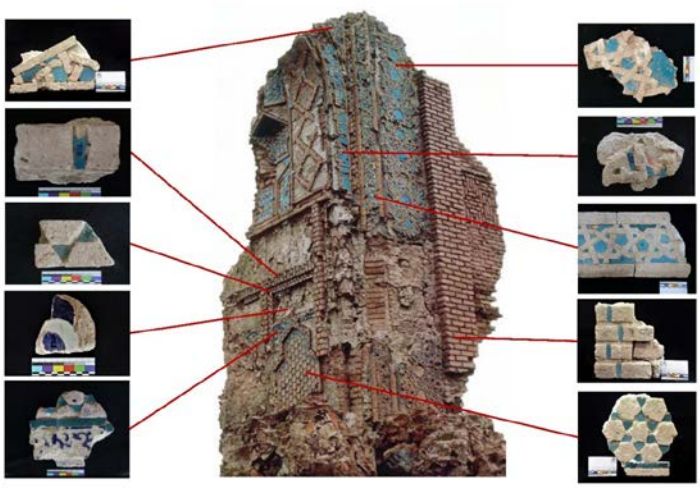

Fig 14. the comparison of the decoration discovered in archeological excavations with Blair and Bloom's photo.

## 6. Results and discussion

According to the evidence mentioned above, it can be generally concluded that the building of Alaki Caravansarai was probably intact until the end of the 17th century, and from these years until about 1880 CE / 1297 AH, most parts of it were damaged and destroyed (Table 1).

Table 1. The status of the building in various historical reports

| Source | Visiting year (CE) | Building status |
|---|---|---|
| Jean-Baptiste Tavernier | 1632-1668 | No evidence of destruction |
| Gemelli Careri | 1694 | Intact |
| Morris De Kotzebue | 1817 | Intact |
| Heinrich Karl Brugsch | 1860-1861 | Damaged and abandoned |
| Jane Dieulafoy | 1880-1881 | Only the entrance gate left |
| Maxime Siroux | 1940s | Only the entrance gate left |
| Donald Wilber | 1942-1946 | Only the entrance gate left |
| Wolfram Kleiss | 1967 | The south arch basis left |
| Sheila Blair and Jonathan Bloom | 1984 | The south arch basis left |

Based on most documents and the various datings proposed by historians, this building belongs to Ilkhanid era, but the theory of its belonging to the reign of Abū Saʿīd Bahādor Khan, the last Ilkhanid king, is not correct. According to the al-Wqafīyya al-Rashīdīyya and the direct reference by Ḵᵛāja Rašid-al-Din, the construction of this building was carried out by Ḵᵛāja Rašid-al-Din himself. Since the text of the endowment book was written in 1309 BC/ 709 AH (al-Hamedani 1977:30) and, additions were added to it before the time of Ḵᵛāja's assassination in 1318 BC/718 AH, with reference to the endowment book's emphasis on determining the tariff paid by the travelers, it seems that the caravansarai was complete at this time and was being used. Therefore, according to the time of Ḵᵛāja Rašid-al-Din's ministry, its date can be attributed to 697-709 AH / 1297-1309. In addition, the quality and method of construction chosen for the decorations also confirms that this building belongs to mid-Ilkhanid period, because the use of a combination of tiles and bricks in architecture was common in Seljuk and Anushtegin (Khwarazmian) dynasties, and gradually, was replaced by tile work in Ilkhanid period. So that, in late Ilkhanid and early Timurid periods, the art of inlaid tileworking became completely popular and replaced brickwork (Kiani, Karimi, and Quchani 1983:13–16). The various decorative methods used in this entrance gate do not exactly have the characteristics of the thirteenth or fourteenth century, but include a variety of decorative types of both. For example, the combination of bricks and tiles before that had been experienced in northwestern Iran in buildings such as the Kabood (Blue) Dome tomb tower of Maragheh (1195/592), Momineh Ḵātūn tomb tower in Nakhchivan (1185/581) and in some Seljuk buildings in Turkey such as İzzeddin Keykâvus tomb in Sivas (613/1216) (Nemati-Babaylou and Alimadadi 2020). The type of brickwork is also consistent with the artifacts discovered from the decorations of Gilāneh Kharābeh caravansarai in Nakhchivan. But a more advanced form of the combination of brick and tile in this period is observed in eastern Iran in Malek Zuzan Mosque (1213/610). On the other hand, inlaid tiles were not completely widespread in the seventh century and were limited to some buildings in Iran and Anatolia such as Malek Zuzan Mosque in Khāf, Karatāy and Sirchāli schools in Konya (1236/634). Therefore, in terms of decorative types, the mentioned date seems to be correct for the building because it shows the transition time from the combination of tiles and bricks and the prosperity of the inlaid tileworking. The gradual change in the decoration of the buildings from brickwork to tileworking is one of the points of transfer of Seljuk to Ilkhanid architecture (Ajorloo 2010), as a result of which, geometric tiles with a combination of bricks and tiles have been used to decorate the structural elements of the building at the entrance of Alaki Caravansarai. This caravansarai is one of the oldest buildings in the northwest of Iran, in which the technique of inlaid tiles and engraved tiles has been used to perform some part of the inscriptions and decorations. The engraved glaze technique can be seen in Iran from the twelfth to the fifteenth century, but, compare to other techniques, has been used less. This technique can also be seen in some 13th century Anatolian buildings such as İzzettin Keykāvus Tomb and the tomb in Boroujerdi school of Sivas. This technique has been used in Alaki in the spandrel of decorative brick coffering in the form of plant motifs and an example of it has been discovered in archeological excavations. The combination of plant and geometric designs and

motifs in this building can be considered as one of the first examples of combined decoration of buildings with tiles in Ilkhanid period (Moradi and Omrani 2014).

## 7. Conclusion

The Alaki Caravansarai can be considered as one of the most important roadside residential buildings in northwestern Iran, which is located exactly on the Silk Road and on the Tabriz-Caucasus-Europe terminus. In this regard, the site has special importance. The size of the building and the quality of the entrance gate, which is recorded in the reports of travelers, as well as by the studies and images of architectural historians, indicate its importance. The quality of the building decoration corresponds to the transition from brick to tile techniques, the combination of these two methods, and the beginning of the popularity of some tile techniques such as inlay. Accordingly, the building can be attributed to a time after the Mongol invasion. On the other hand, according to the text of the Endowment book and the writer's emphasis on the construction of this building by himself, the date of construction of the building can be considered as the time of his presidency until the initial writing of the Endowment book between the years 697 to 709 AH (1297-1309 CE).

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## Declaration of conflicting interests

This article does not contain any studies with human participants or animals performed by any of the authors. The authors have no financial or proprietary interests in any material discussed in this article.

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# رویکرد تاریخی به گاهشماری نسبی کاروانسرای الکی نزدیک مرند

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## چکیده

با توجه به اهمیت تبریز در دوره‌های مختلف تاریخی پس از حمله مغول تا پایان دوره قاجار، به‌عنوان پیوسته پایتخت یا محل اقامت شاهزاده، ورود به این شهر در گزارش‌های مختلفی منعکس شده است. بیشتر خارجی هایی که از کشورهای اروپایی وارد ایران شده بودند از جاده قفقاز به تبریز آمده بودند و از ساختمان های زیادی در مسیر خود خبر دادند. علاوه بر این، این جاده یکی از مهم‌ترین جاده‌های کاروانیان در جاده ابریشم بوده که در آن ساختمان‌های مسکونی مختلفی ساخته شده است. کاروانسرای الکی یکی از مهم‌ترین اقامتگاه‌های کنار جاده‌ای شمال غرب ایران است که در سفرنامه‌های خارجی‌هایی که به ایران سفر کرده‌اند، گزارش‌های فراوانی درباره آن و کیفیت تزئینات نمای آن یافت می‌شود. وسعت و دروازه ورودی شیک آن، متاسفانه این بنا مورد بی توجهی قرار گرفته و در قرن نوزدهم و پس از آن در شرف ویران شدن بود. اما زیبایی دروازه ورودی آن مورد توجه بسیاری از مردم قرار گرفته و در منابع بسیاری گزارش شده است. منابع متاخر تاریخ معماری بر اساس تزیینات به کار رفته قدمت آن را به قرن دوازدهم و ایلخانی ابوسعید بهادرخان و دوره تیموریان تخمین زده اند. این منابع تخمین خود را تنها بر اساس نوع تزیینات به کار رفته در دروازه ورودی آن انجام داده اند و احتمال می رود وجود آثار تاریخی دوره ایلخانی در نزدیکی آن، مانند محراب مسجد جامع مرند، بر این گمانه زنی تأثیر داشته باشد. هدف این مقاله بررسی دقیق این بنا در سفرنامه‌های مختلف الوقفیه الرشیدیه و دیگر منابع تاریخ معماری و بررسی انواع تزیینات و تاریخچه آنهاست. بررسی دقیق اسناد و منابع حاکی از آن است که این بنا می تواند متعلق به دوره صدارت رشیدالدین فضل الله باشد و با توجه به تاکید وی بر تأسیس این بنا، می توان به تاریخ ۱۳۰۹-۱۲۹۷ اشاره کرد. تزیینات همچنین نشان دهنده دوره گذرا از آجرکاری تا کاشی کاری است که در اواخر قرن ۱۳ و اوایل قرن ۱۴ اتفاق افتاده است.

**واژه‌های کلیدی:** کاروانسرای الکی، بقایای باستان شناسی، منابع تاریخی، الوقفیه الرشیدیه، دوره ایلخانی.

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# Revisit the Kura-Araxes: The Absolute and Relative Chronology of Qaleh Tepe and Ali Yourd Tepe, Zanjan Province, Iran

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**Abstract**

The communities of the Kura- Araxes cultural complex with their highly distinctive cultural and economic features represent the occupation of some parts of the Near East and Caucasia during the Bronze Age. Generally, the origin of this culture is sought in the Southern Caucasus. In Iran, the spread of this cultural tradition represents not only a rupture in the cultural development of the Mesopotamian traditions. Environmental changes linked to Rapid Climate Change (RCC) also forced the population to develop new economic strategies. Until about two decades ago, knowledge of the flourishing Kura Araxes occupation was limited to the north-west of the country and to some parts of the Central Zagros, but recent research in the zones south and north of the Alborz Mountain Range, on the northern edge of the Central Plateau allows by now to present a more detailed picture of the Kura Araxes occupation in both diachronic and synchronic perspective. Recent archaeological excavations in the two sites of Qaleh Tepe and Ali Yourd Tepe revealed some important new data from Kura-Araxes settlements in the corridor of the north Central Plateau and northwestern Iran. The two sites are located in the eastern Zanjan Province in the Abhar Rood Basin. This paper aims to update the chronology of the Kura-Araxes culture based on the radiocarbon dates from the two sites of Qaleh Tepe and Ali Yourd Tepe. The stratigraphy and radiocarbon dates of the two sites reveal the beginning of the Kura-Araxes culture in the region from c. 2900 BCE, followed by a quick extension into the northern Central Plateau, where it is represented by sites such as Shizar, Doranabad, Ostur, and Barlekin. Similarity and diversity characterize the Kura-Araxes cultural complex. However, based on the current data, the ceramic style represents a common feature, but also the architectural remains indicate a common cultural tradition during the first quarter of the third millennium BCE in the Central Zagros, northwestern Iran, and on the Central Plateau.

**Keywords**: Kura-Araxes Expansion, Kura-Araxes Chronology, Central Plateau of Iran, Qaleh Tepe, Ali Yourd Tepe.

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## 1.Introduction

Over a period of about two millennia, Chalcolithic communities in the Central Zagros and the northwestern and northern Central Plateau of Iran instigated and witnessed fundamental changes in the development of craft specialization, long-distance communication, movement of craft goods and people and the administration of trade goods. This innovative period ended towards the end of the fourth millennium BCE with the introduction of a new social, economic and settlement system known as the Transcaucasian or Kura Araxes world (Renette and Mohammadi Ghasrian 2020, Sagona 2018, Matthews and Fazeli Nashli 2022). Antonio Sagona characterized the Kura- Araxes archaeological culture in his excellent work as follows:

There is no evidence of rigid hierarchy or political centralization. Instead, we have communities whose decision-making processes were collective and based on horizontal kinship networks. Emerging from the fuzziness of the Late Chalcolithic around 3500 BC, these south Caucasian groups stamped the following millennium with an imprint entirely their own (Sagona 2018, p. 213).

The Kura-Araxes core region presented a new cultural world strongly differing from the traditional hierarchical organization of the neighboring cultures of Maikop and the Mesopotamian Uruk societies. Within the Central Zagros to the northern Central Plateau, there was a tendency towards a vertical hierarchical social organization from the fifth to the fourth millennium BCE. This system shifted to greater heterogeneity (Fazeli Nashli et al 2021, Fazeli Nashli and Matthews 2021) afterwards as represented in Arslan Tepe and Shengavit (Rothman, 2021, Palumbi 2019). Shengavit was a small polity center but a kinship network to exert some controls and the data does not support a high level of hierarchy.

Previously, knowledge of the extension of the Kura-Araxes occupation in Iran was limited to the northwestern and Central Zagros regions (Roaf 1990, 80). Over the last two decades, archaeological investigations revealed new evidence regarding the presence of this cultural tradition over a much wider area of the Iranian Plateau, including the eastern Central Zagros (Abedi et al. 2014; Khaksar et al. 2015; Sharifi 2021), the northern slopes of the Alborz Mountains, and the northern Central Plateau of Iran (Fahimi 2005; Mousavi et al. 2007; Fazeli Nashli et al. 2022, Fazeli Nashli and Abbasnezhad 2005; Piller 2012; Fazeli Nashli et al. 2013) (fig. 1). These new findings have instigated some discussion about various aspects of the Kura-Araxes extension in Iran and their social components, including potential routes of communication and dispersal and internal chronology. But the evidence of the Kura-Araxes extension in Iran is mostly obtained from small-size excavations or regional surveys, which do not provide enough details about the Kura-Araxes sequence in various regions. In addition, the absolute radiocarbon dates are not available at all sites.

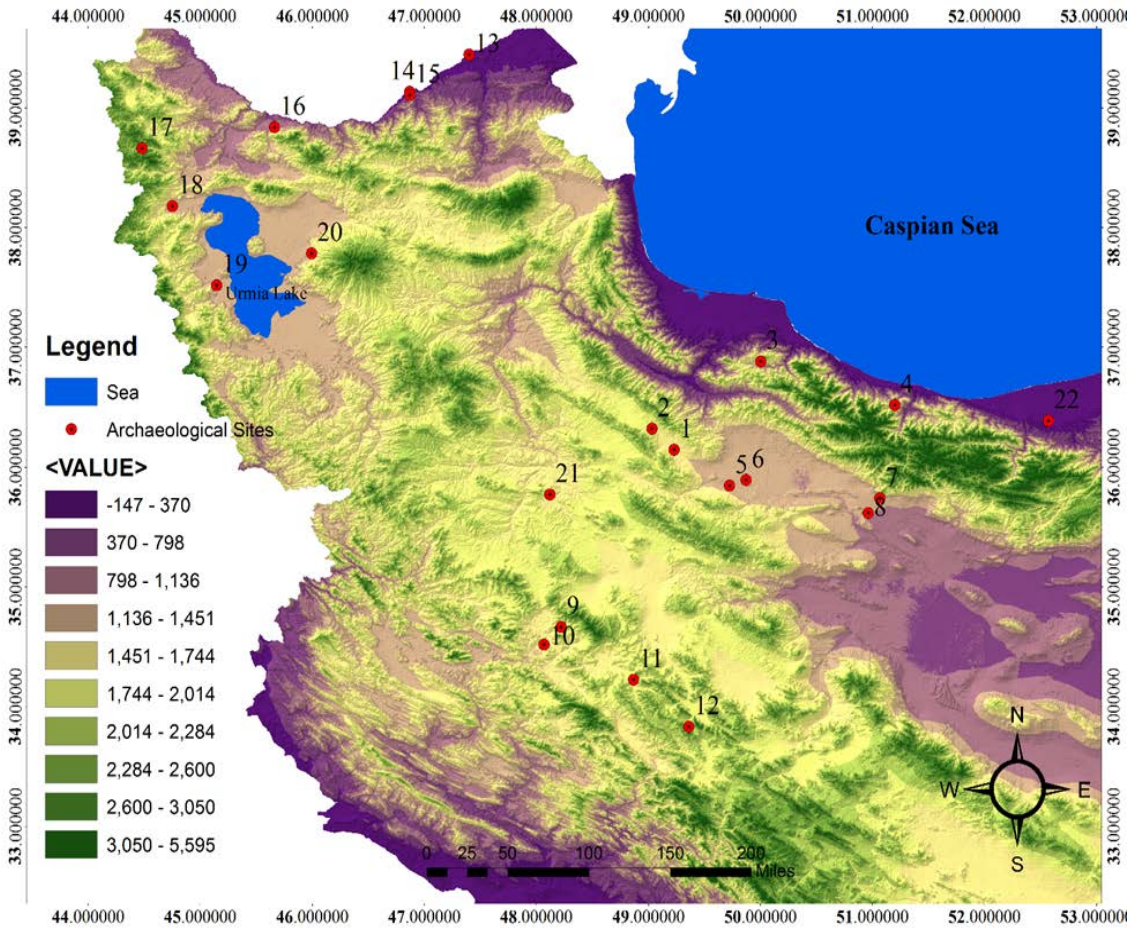


Fig. 1 Important Kura-Araxes sites in Iran: 1. Qaleh Tepe, 2. Ali Yourd Tepe, 3. Diarjan, 4. Tapeh Kelar, 5. Shizar, 6. Doranabad, 7. Tepe Ostur, 8. Barlekin, 9. Tepe Pissa, 10. Godin Tepe, 11. Tappeh Gourab, 12. Tapeh Qal'eh-ye-Sarsakhti, 13. Nadir Tepesi, 14. Kohne Pasgah Tepesi, 15. Kohne Tepesi, 16. Kul Tepe near Jolfa, 17. Kohne Shahar, 18. Haftavan Tepe, 19. Geoy Tepe, 20. Yanik Tepe, 21. Chal Tepe Pirtaj, 22. Ghal-e Ben (Map by H. Rostami)

The two sites of Qaleh Tepe and Ali Yourd Tepe in the borderlands between northwestern and central Iran provide important data for a relative dating of the Kura-Araxes occupation and these are corroborated by radiocarbon dates[1]. This evidence is presented in the following. Both settlements can be characterized as small villages with a combination of farming and animal husbandry, showing no sharp social differentiation within and between villages. Located approximately 30 km apart from each other, the two sites inhabit a narrow plain in the eastern part of Zanjan province. Like a topographical corridor, this plain connects the northwest of Iran to the Central Plateau and can be considered the most likely route for the Kura-Araxes dispersal into north-central Iran.

## 2.The site of Qaleh Tepe and its excavations

The archaeological site of Qaleh Tepe (Lat. 36.0847°; Long. 49.1343°; Elevation c. 1540 m asl.) is located on the eastern edge of the modern City of Abhar. Urban development, land leveling and construction have destroyed large swaths of the site. Today, only a

1. Radiocarbon dating was carried out within the framework of project "ChronIran", granted to Barbara Helwing and Hassan Fazeli Nashli by the Fritz Thyssen Foundation, Germany. Samples were analyzed at the AMS lab of the Curt Engelhorn Centre in Heidelberg.

small part of the site's center with an area of about 1,000 square meters remains intact (fig. 2). Nevertheless, Qaleh Tepe was one of the large mounds in the region. It is situated on a low natural terrace on the southern side of the Abhar Rood, the most important river in the region, which flows in a northwest-southeast direction in the eastern part of a long and narrow plain. The first archaeological excavation at Qaleh Tepe was carried out by A. Mirfattah in 1993 (Mirfattah, 1993). Another excavation was directed by M. Asgarian in 2001 (Asgarian, 2001), and the last excavation was conducted by A. S. Naghshineh in 2011 (Naghshineh, 2017) and is reported in the following. All these excavations were limited in size, but they nevertheless provided evidence for Islamic, historical, and prehistoric occupation. Among these finds, the Early Bronze Age deposits are most interesting and significant.

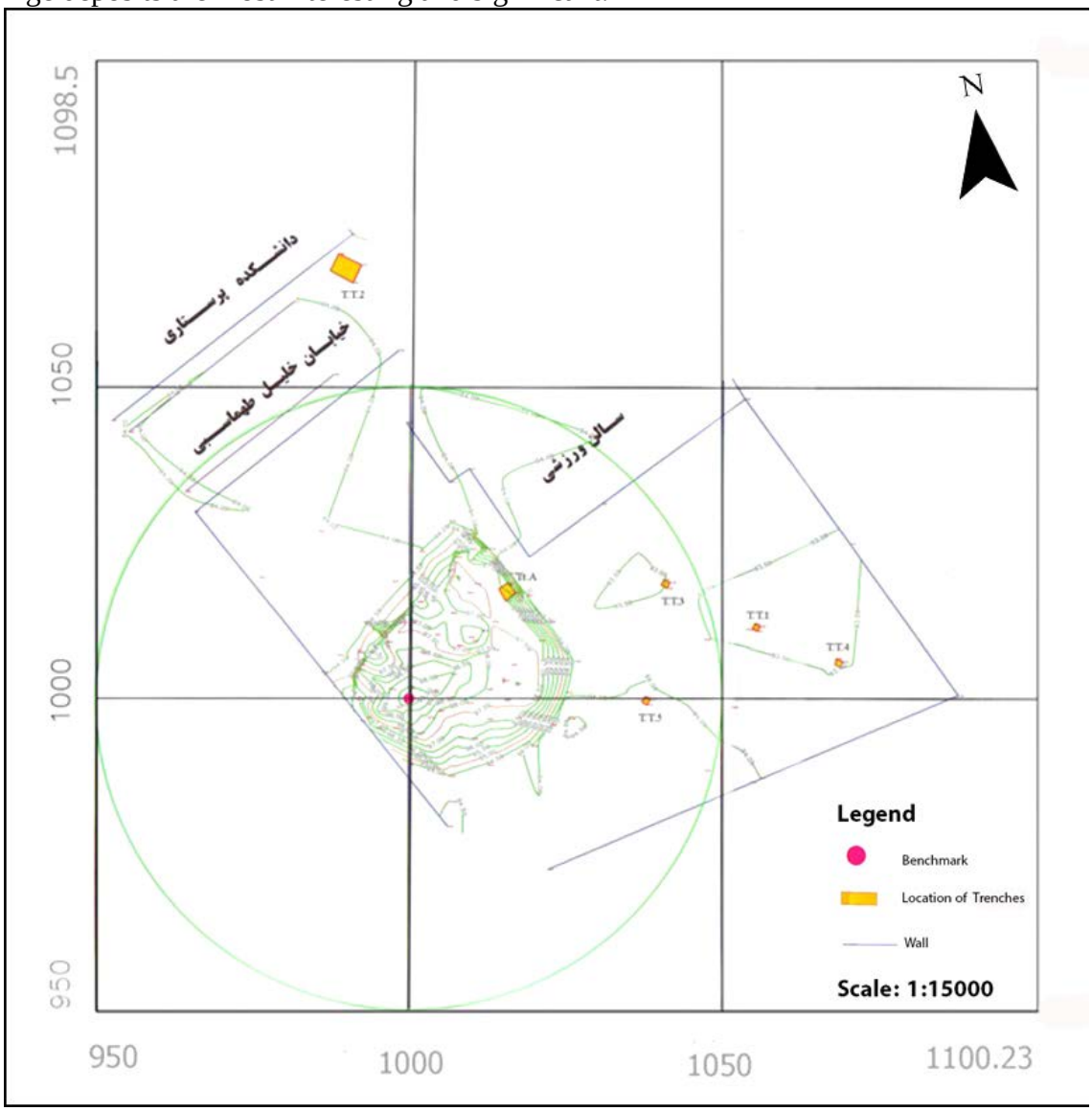


Fig. 2 Qaleh Tepe, Topographic map indicating the location of excavation trenches

In the 2011 excavation, a trench (trench A) in the center of the mound and five test trenches (TT. 1-5) in the leveled parts of the east and north were excavated (fig. 2). Trench A, with dimensions of 2x2 meters, was excavated for stratigraphic purpose on

the eastern part of the central part of the mound, which was formed by recent leveling activities in the site. The four test trenches 1, 3, 4, and 5, with dimensions of 1x1 meters, were opened in the leveled eastern part to reach the earliest occupation at the site and potentially Iron Age graves. Test Trench 2 was opened in the northern part of the site alongside a street built in this area. It was later enlarged to 3x4 meters to allow more insight into the Early Bronze Age remains.

In Trench A, 26 contexts (or stratigraphic units) were distinguished with a total depth of 322 cm (fig. 3). The upper contexts were disturbed and contained mixed material culture residues, mainly from historical and Islamic periods. The middle contexts were less disturbed and consisted of remains from the historical period, probably Parthian. The lowermost contexts were exposed only in the eastern part of the trench as a narrow strip on virgin soil. They belong to the first occupation phase during the Early Bronze Age. Occupation was limited to the eastern part of Trench A and did not extend to the higher western part of the site. Finds from the Islamic period were limited to indicator pottery sherds found in disturbed layers, and no considerable architectural evidence from this period was detected, due to the destruction of the upper levels of the site. Only some pottery sherds and fragments of two mud brick walls were found from the historical, likely Parthian period. The Early Bronze Age layers were undisturbed and contained in situ sherds characteristic of Kura-Araxes pottery, but no distinct architectural remains were found. No useable samples for radiocarbon dating were taken from this trench.

Four test trenches 1, 3, 4, and 5 were excavated in the widely disturbed and leveled eastern part of the site. Seemingly, the Qaleh Tepe area has been used as a graveyard during the Iron Age, and traces of these graves were seen during the leveling of the eastern part of the site (Naghshineh et al, 2013-2014). But the four trenches yielded no evidence for graves or a settlement from this period, and there were only disturbed layers with mixed cultural materials. Ultimately, the ancient remains and layers were destroyed in this part of the site. Therefore, no dating samples were retrieved from these trenches.

The presence of Kura-Araxes pottery sherds on the surface of the northern part of the site and the possibility of finding undisturbed Bronze Age remains in this area motivated the excavation of test trench 2. Initially, TT.2 was 1x1 meters in size, but was later extended to 3x4 meters since intact in situ remains were encountered. Due to leveling and the construction of a street in this part of the site, the upper layers have completely disappeared. However, undisturbed remains from the earliest occupation at Qaleh Tepe were found intact underneath the street level. In TT.2, 32 contexts were distinguished with a total depth of 150 cm (fig. 4). While the upper contexts were disturbed by the street construction, the lower contexts with a depth of about 110 cm were intact, which revealed the earliest phase of an Early Bronze Age settlement on virgin soil. Thus, the most important and detailed finds from the Early Bronze Age settlement of the site were found in TT.2.

## 3. Kura-Araxes settlement at Qaleh Tepe

Remains of an Early Bronze Age settlement were found in trench A and TT.2 at Qaleh Tepe, both located atop virgin soil. The settlement was situated on a low curve with a slow slope to the south, overlooking the Abhar Rood River in the north. Since remains of the settlement were found only in the eastern part of Trench A, the settlement seemingly did not extend to the center of the site and was limited to northern and

eastern parts. In addition, it seems that the occupation period of this small settlement was not long, because the Early Bronze Age layers in Trench A measured only about 70 cm in depth (fig. 3). In TT.2, the top layers have disappeared due to the street construction and therefore the final layers of this period cannot be identified, but it seems that the Bronze Age deposits in this area have not been very deep because of the feature and topography of the site. Therefore, the Early Bronze Age settlement at Qaleh Tepe must have been a small and short-lived settlement with an extension of around one hectare.

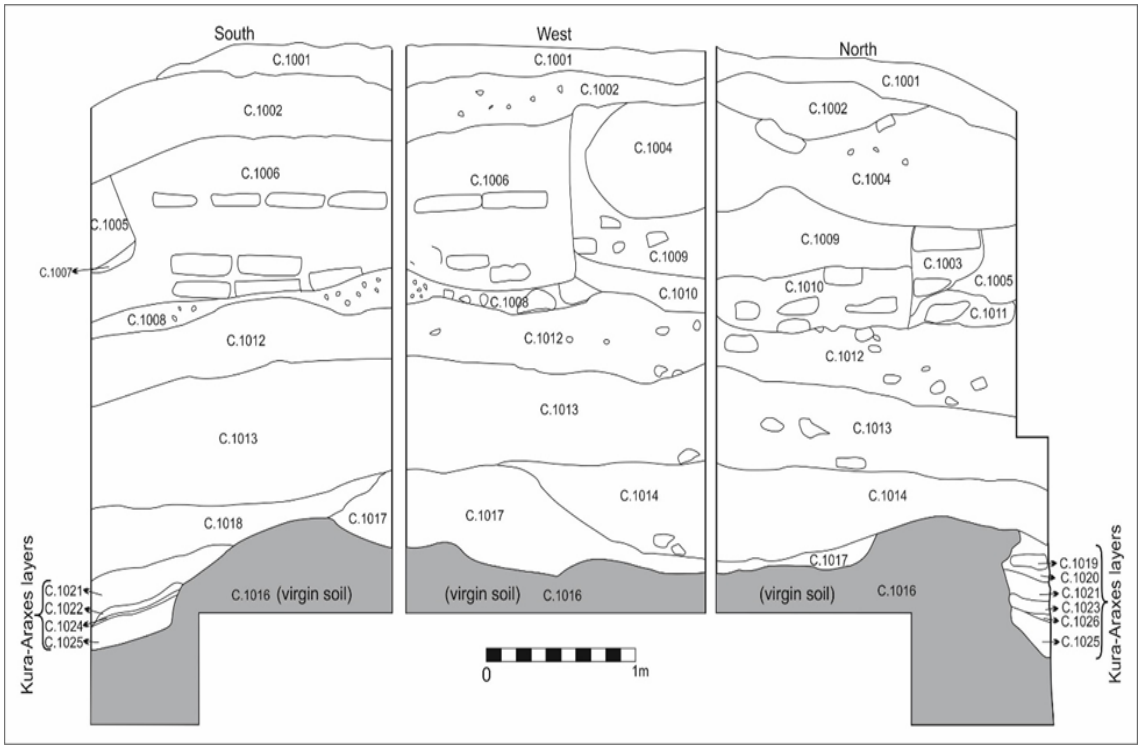


Fig. 3 Qaleh Tepe, stratigraphic sections of Trench A with Kura-Araxes layers exposed on the virgin soil

Significant settlement remains were discovered in TT.2 where the first building phase of a Kura-Araxes settlement was documented in the form of a part of a rectangular chamber (fig. 5). The walls of the chamber were built of mud and there were platforms of the same material along the walls. The surfaces of the walls, floor, and platforms were plastered with clay on which traces of black paint could be seen. This building is comparable with building 3 in Godin Period IV in the following aspects: the rectangular layout, the benches along walls, and the painting on the walls and benches (Young and Weiss, 1974: 208; Rothman 2011, 184, Fig. 5.43). Recovering fragments of two large jars on the floor suggests that the chamber was probably a storeroom. The building was filled with unmixed deposits consisting mainly of debris and layers composed of soil and ash. In addition to pottery sherds, various small objects characteristic of the Kura-Araxes cultural tradition were found, including three animal figurines, a horn knife handle, a bone awl, and three small disc beads.

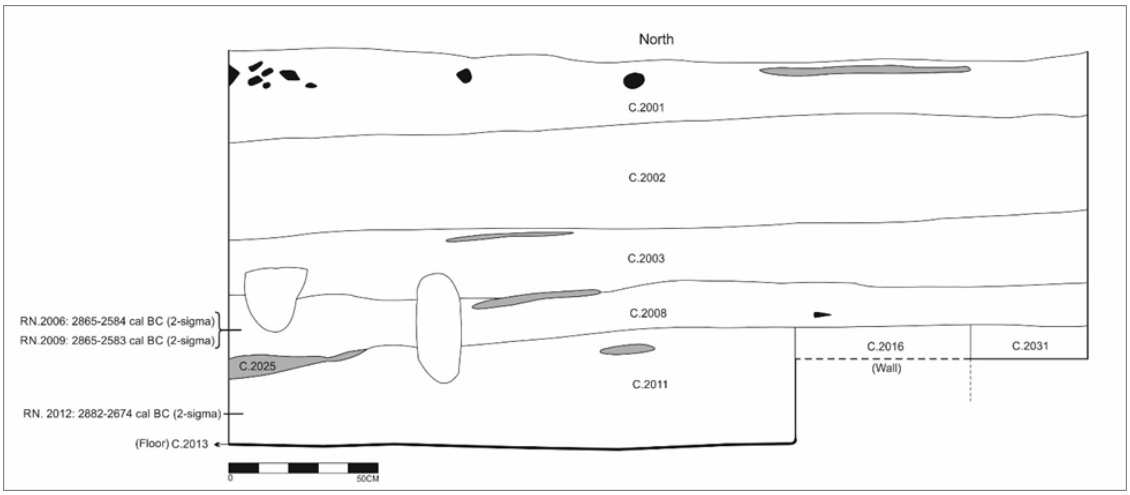


Fig. 4 Qaleh Tepe, the stratigraphic section of TT.2

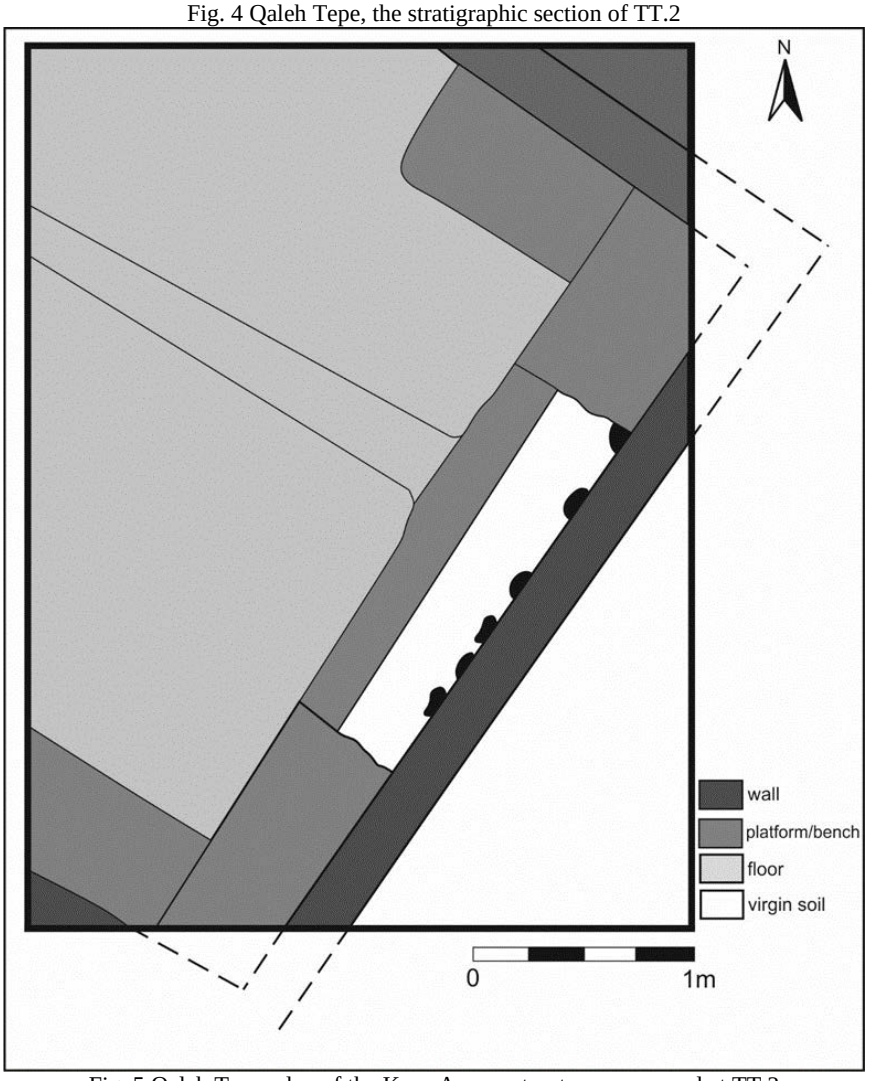


Fig. 5 Qaleh Tepe, plan of the Kura-Araxes structure uncovered at TT.2

Pottery sherds associated with the Early Bronze Age settlement at Qaleh Tepe display characteristics of the Kura-Araxes pottery tradition (fig. 6). They are mainly hand-made

and in their clay paste used mineral (grit) or rarely ground potsherd (grog) temper. The predominant color of wares is gray and the surfaces are usually polished. Some fine wares are decorated with geometric designs, the most frequent of which is the zigzag pattern (fig. 6 nos. 1 and 5). These zigzags were also common on the Kura-Araxes ceramics in the Zagros region (Young and Levine, 1974: fig. 19, n. 3; Rothman 2011, Fig. 5.60, a.b; Mohammadifar et al, 2009: fig. 3; Heydarian and Safari 2015, Fig. 4,7.9.10.13; Sharifi 2021, fig. 10, 16-17), the Alborz region (Fahimi 2005, Fig. 3, b; Mousavi et al. 2007, Pl. 3,1; 5,9) and the Central Plateau (Burton Brown, 1981: Pl. X, 152; Piller, 2012: Abb. 3, 4 a & b, 5, 6 a & b; Fazeli Nashli et al. 2013, Fig. 7.23; Kleiss, 1996: Abb. 18, 16). Generally, the Kura-Araxes pottery at Qaleh Tepe has more parallels with Kura-Araxes pottery on the Central Plateau and in the Zagros than in northwestern Iran, the southern Caucasus, and Anatolia, and therefore can be similarly dated to the first quarter of the 3rd millennium BC.

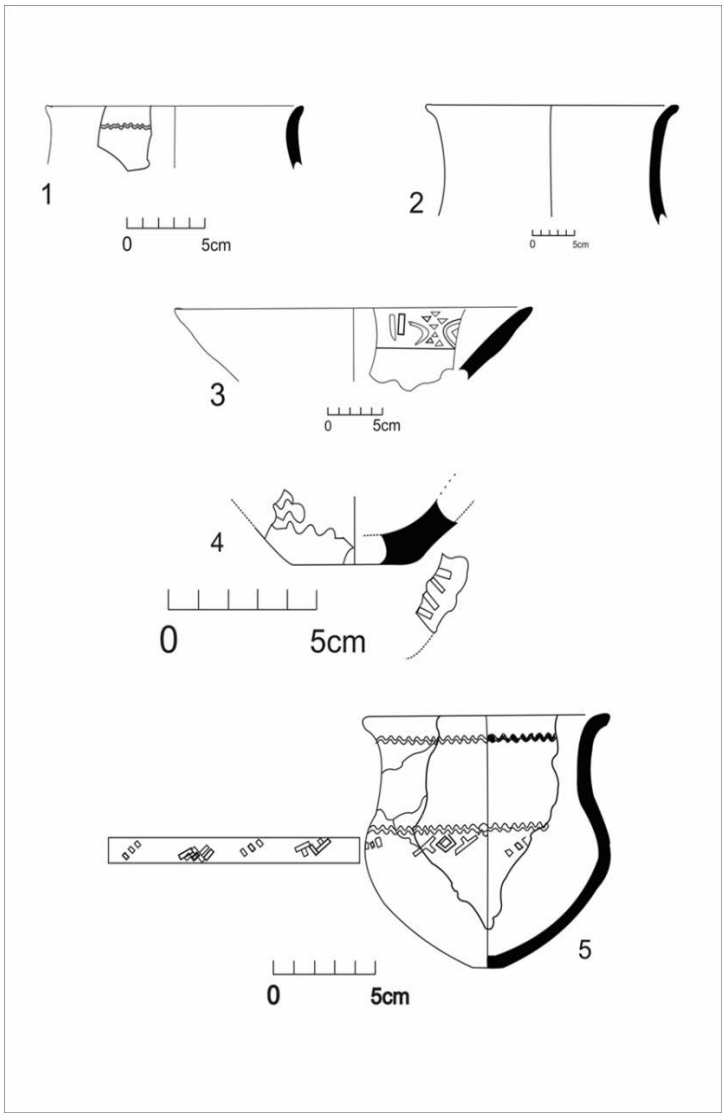

Fig. 6 Qaleh Tepe, Kura-Araxes pottery, TT.2, 1, 3-5 c.2008, 2 c.2006

## 5.Radiocarbon dates from the Kura-Araxes settlement at Qaleh Tepe

Only the excavation in TT.2 provided usable radiocarbon samples from contexts associated with the chamber (figs 4 and 5, table 1). One sample (RN.2012) was retrieved

from context 2011 that consisted of debris on the floor of the northern half of the chamber. It yielded a date range of 2882-2674 cal BC at 2-sigma. Two samples (RN.2006 and RN.2009) were taken from context 2008, a layer consisting of soil deposits, thin ash lenses, and a few mud fragments, located within the ruins of the chamber at a higher level than context 2011. These two samples provide the same dates range of 2865-2584 cal BC at 2-sigma. The fourth sample (RN.2010) was retrieved from context 2006, which comprises the contents of a shallow pit formed within context 2008 that destroyed a part of the southeastern bench of the chamber. This uppermost sample from context 2006 provides a date range of 2877-2637 cal BC at 2-sigma. On the basis of stratigraphic evidence, these contexts were formed in the order described above and belonged to the time of the destruction of the room and a very short time after that. The three contexts revealed homogeneous cultural materials characteristic of the Kura-Araxes cultural tradition. The four radiocarbon dates represent the time of destruction of the room and all fall into the same time range from the 29$^{th}$ to the 27$^{th}$ century BC. This interval describes the chronological span for the beginning t of the Kura-Araxes occupation at Qaleh Tepe. Unfortunately, due to the destruction of the upper layers at the site, neither the duration and nor the end of this occupation can be clearly determined, but the shallow depth of Kura-Araxes deposits in Trench A, and the small amount of surface materials from this period, point to a short-term Kura-Araxes occupation at Qaleh Tepe.

Table 1

| Lab-No. | Sample name | Context | CAL 1-Sigma | CAL 2-Sigma | Material |
|---|---|---|---|---|---|
| MAMS-29957 | 1-QALEH TEPE RN. 2012 | TT.2, 2011 | cal BC 2876-2702 | cal BC 2882-2674 | Animal Bone |
| MAMS-29958 | 2-QALEH TEPE RN. 2006 | TT.2, 2008 | cal BC 2856-2631 | cal BC 2865-2584 | Animal Bone |
| MAMS-29959 | 3-QALEH TEPE RN. 2009 | TT.2, 2008 | cal BC 2856-2631 | cal BC 2865-2583 | Animal Bone |
| MAMS-29960 | 4-QALEH TEPE RN. 2010 | TT.2, 2006 | cal BC 2872-2681 | cal BC 2877-2637 | Animal Bone |

## 6.The site of Ali Yourd Tepe and its excavations

Ali Yourd Tepe (Lat. 36.1921°; Long. 49.0152°, Elevation c. 1768 m asl.) is located in the eastern part of Zanjan province on a natural terrace on the right side of the Abhar Rood River, on a strategic position overlooking a narrow plain that connects geographically the northwest to the Central Plateau of Iran. The site is an oval settlement mound with dimensions of nearly 160x120 m (c. 1.8 ha) that rises 26 m on the northern side and 15 m on the southern side above the surrounding lands (figs 7 and 8).

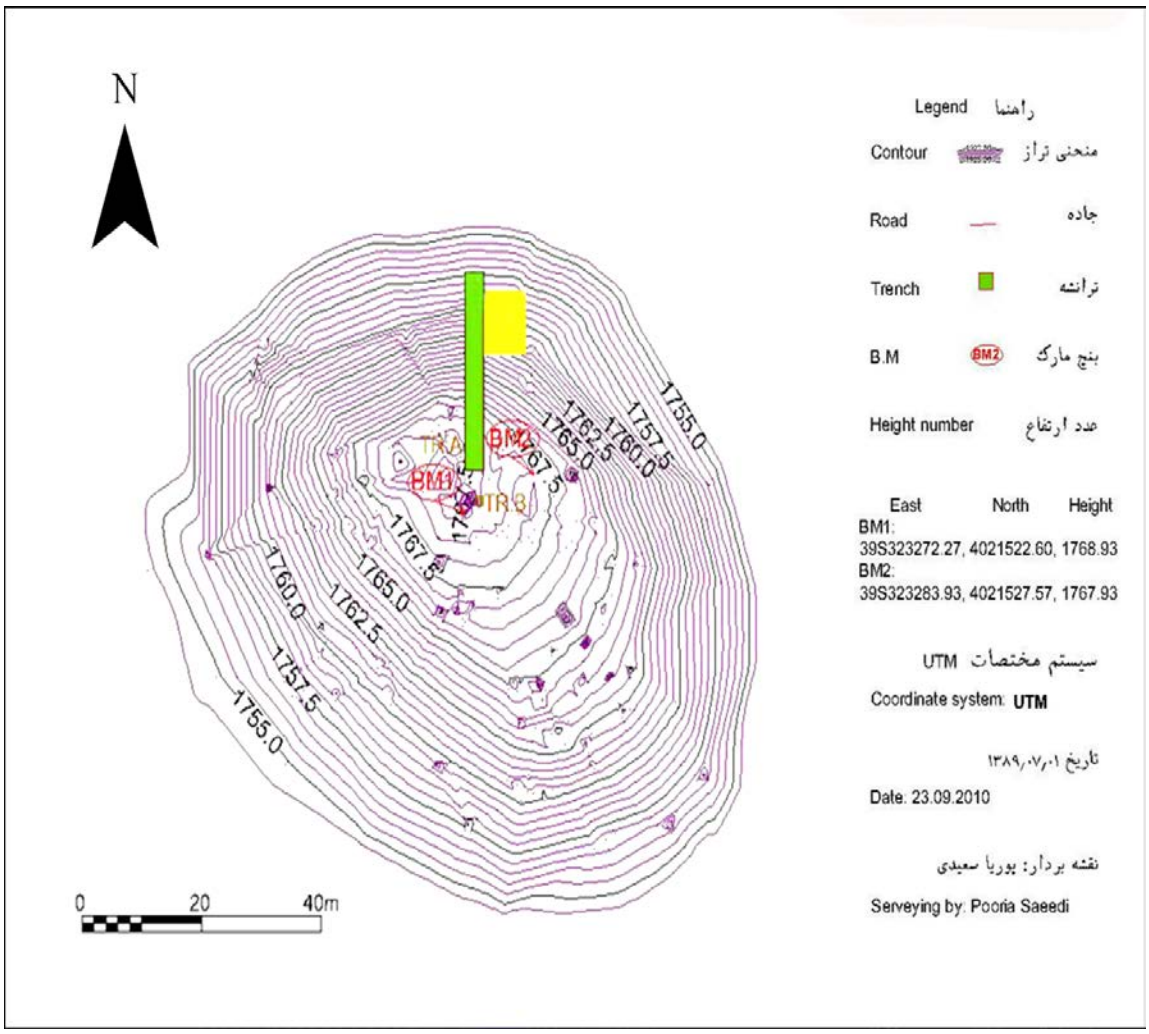


Fig. 7 Ali Yourd Tepe, topographic map indicating locations of excavation trenches

Ali Yourd Tepe was excavated in four seasons (from 2010 to 2014) to establish a complete cultural sequence for the site (Naghshineh, 2011, 2014, 2016). Excavations were carried out with a major step-trench (Trench A) on the northern side of the site, a small sounding (Trench B) on the top of the mound, and an extensive trench (Trench C) adjacent to the bottom part of the step trench. Trench A with a 2 m width and a total length of 30 m was excavated in three 10 m-long sections (A1 to A3 from top to bottom) on the northern slope of the mound. Thereby, natural soil was reached at a depth of 1594 cm below the summit of the mound, revealing that a part of the total height of the site on the northern side is due to the natural terrace underlying the settlement. Trench B was a small sounding (1.2x1.2 m) excavated on the section of an illegally dug pit on the top of the mound, that only exposed a few remains of the Islamic and Parthian periods. Excavation in trench B was stopped at the depth of 330 cm, because of close and limited space. Trench C was an extensive exposure (5 x 8 m) on the eastern side of the lowest section (A3) of step-trench A to find more details from the Early Bronze Age settlement that was inadequately revealed in lower deposits in step-trench A. Because of the end of the excavation season, excavation in this trench did not

continue until natural soil and stopped at a depth of about 1400 cm below the summit of the mound.

Fig. 8 Ali Yourd Tepe, view of the mound from the north onto Trenches A and C

The excavations revealed remains from four major periods: Islamic, historical (Parthian?), Iron, and Bronze Ages. Remains of the Islamic period were limited to a small and short-term occupation on the top of the mound, documented in Trenches A and B. In the upper part of section A1 on the top of the mound, remains of one building phase of the Islamic period were found that consisted of a stone foundation, the bottom parts of three ovens, and three trash pits dug into the lower Parthian layers.

Parthian remains were exposed in all three trenches, especially along the steep northern slope of the mound in Trenches A (all three sections A1-A3) and C. The most important architectural remains were walls constructed from large mud bricks extending in east-west-direction. They were badly eroded in most places. Seven of these walls were identified on the slope of the site at different levels in trenches A and C, the uppermost at 170 cm and the lowest at 1518 cm below the summit of the mound. The most probable function of these walls seems to prevent and control soil erosion and landslides on the steep slope of the site by creating a stepped structure with horizontal and usable terraces along the slope. From the Iron Age, no trace of intact remains was identified in any of the trenches, so this occupation was documented mainly from indicator pottery sherds from disturbed layers and surface, therefore, no sample for radiocarbon dating was obtained from this period. The mound likely served as a graveyard during the Iron Age.

## 7. Kura-Araxes settlement at Ali Yourd Tepe

The Early Bronze Age remains, the earliest occupation at the site, were exposed mainly in the section A3 of Trench A and adjacent Trench C (figs 9 and 10). Four building phases are stratigraphically confirmed in these adjacent trenches (fig. 11); however, there are probably other remains in the upper and interior parts of the mound. There was no gap between the four phases so in some cases the upper phase wall was built directly on the lower phase wall.

The first phase was founded directly on the virgin soil and was exposed only in the lowest level of section A3, consisting only of a corner of a room and a small part of an associated exterior floor. The floor was located outside the room and was 26 cm below the level of the room on natural soil. Because of this difference in depths, the floor was previously considered as an older phase than the room, while this situation was due to the slope of the natural terrace underneath the settlement. One radiocarbon sample (RN.3192) was taken from the soil and ash layer on this floor. In trench C, the remains of the first phase were not excavated due to the end of the excavation season.

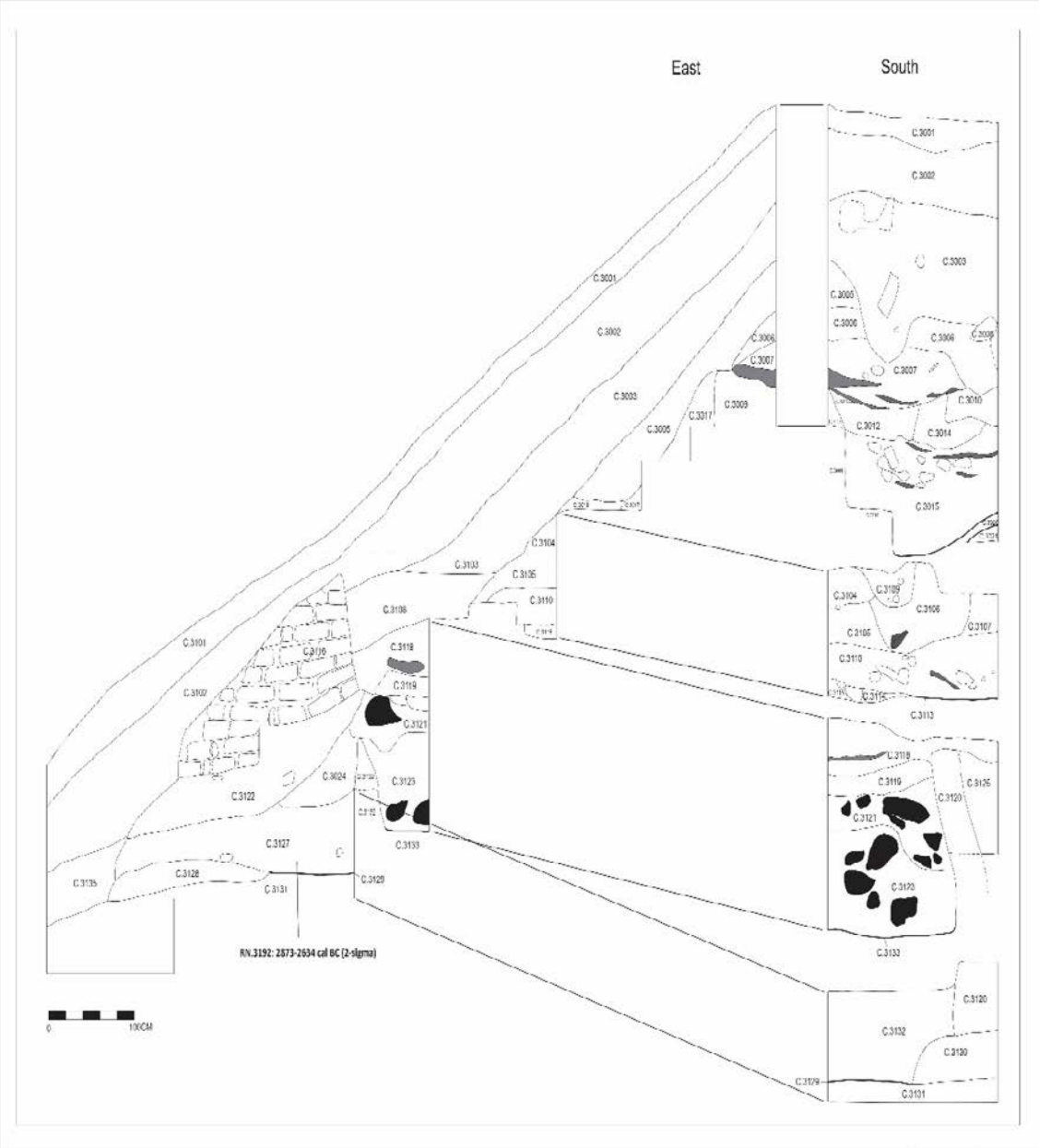


Fig. 9 Ali Yourd Tepe, stratigraphic sections of section A3

The remains of the second phase in section A3 were limited to a clay floor and parts of two heavily damaged hearths. In adjacent trench C, the excavated area in this phase was small, hence only a small part of a room was found in the boundary between the two trenches. From this phase, no appropriate radiocarbon sample was obtained.

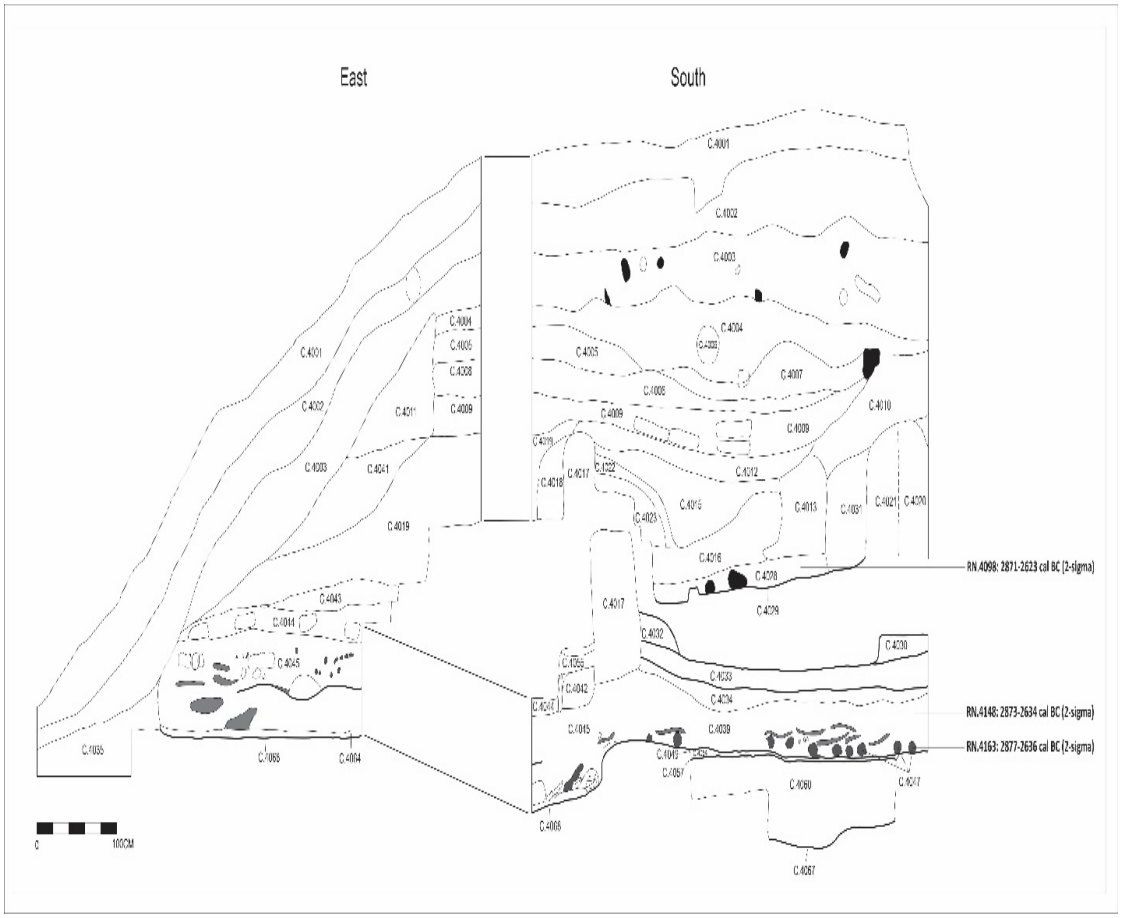


Fig. 10 Ali Yourd Tepe, stratigraphic sections of Trench C

Remains from the third building phase were documented only in Trench C and could not be identified in Trench A. , trench C contained a part of a building consisting of two side-by-side rooms connected by a doorway. The eastern room, of which a small part was unearthed, was placed at a lower depth rather than the western room. A strong fire had destroyed the building and the roof had collapsed on the floor, creating an up to 50 cm thick layer of burnt debris, ash, and charcoal. From this layer, a charcoal sample (RN.4148) was retrieved for radiocarbon dating. In addition, on the floor of the western room, there were remains of the roof's burned beams, of which a radiocarbon sample (RN.4163) was taken.

Remains of the fourth phase were exposed in both trenches A and C, consisting of three side-by-side rooms along an east-west axis, of which the eastern room was located in trench A and the two others extended into trench C. The rooms were placed directly on the burned building of previous phase 3, and some of the new walls were constructed exactly on top of the preserved walls of the burned building. The middle room, which was exposed to a larger extent than the two others, was divided by a bulge on the floor into a northern and a southern part; a thermal structure was found on the edge of the southern part, which was covered several times with thick layers of clay. A radiocarbon sample (S.N.4098) was taken from a soil and ash layer on the middle room's floor.

Fig. 11 Ali Yourd Tepe, Trench C, Kura-Araxes architecture, Phases 2, 3, and 4

Over four seasons of excavations at Ali Yourd Tepe, finds from deposits of different periods were restricted almost entirely to pottery sherds. Sherds from the Early Bronze Age deposits display characteristics of the Kura-Araxes pottery tradition (fig. 12). They are mainly hand-made and polished. The predominant color of wares is light to dark gray, but some pieces have black, grayish brown, or reddish brown surfaces. Temper is mostly mineral, but sometimes organic materials or ground potsherds (grog) are also used as temper. The most common forms include a variety of bowls and jars, which all fit well within the Kura-Araxes corpus of ceramic containers. Around 2% of the ceramics are decorated with incised geometric designs, the most common of which is the zigzag pattern under the rim or on the shoulder of vessels. Best comparisons for this pattern come from the Zagros region, the Alborz region, and the Central Plateau, alike Qaleh Tepe (as seen above). In general, the Kura-Araxes pottery at Ali Yourd Tepe like those from Qaleh Tepe has the most links with the Kura-Araxes pottery on the Central Plateau and the Zagros region. In addition, three broken clay figurines were recovered from a layer underneath the floor of the fourth phase in trench C, which were the most important small finds from the Kura-Araxes deposits.

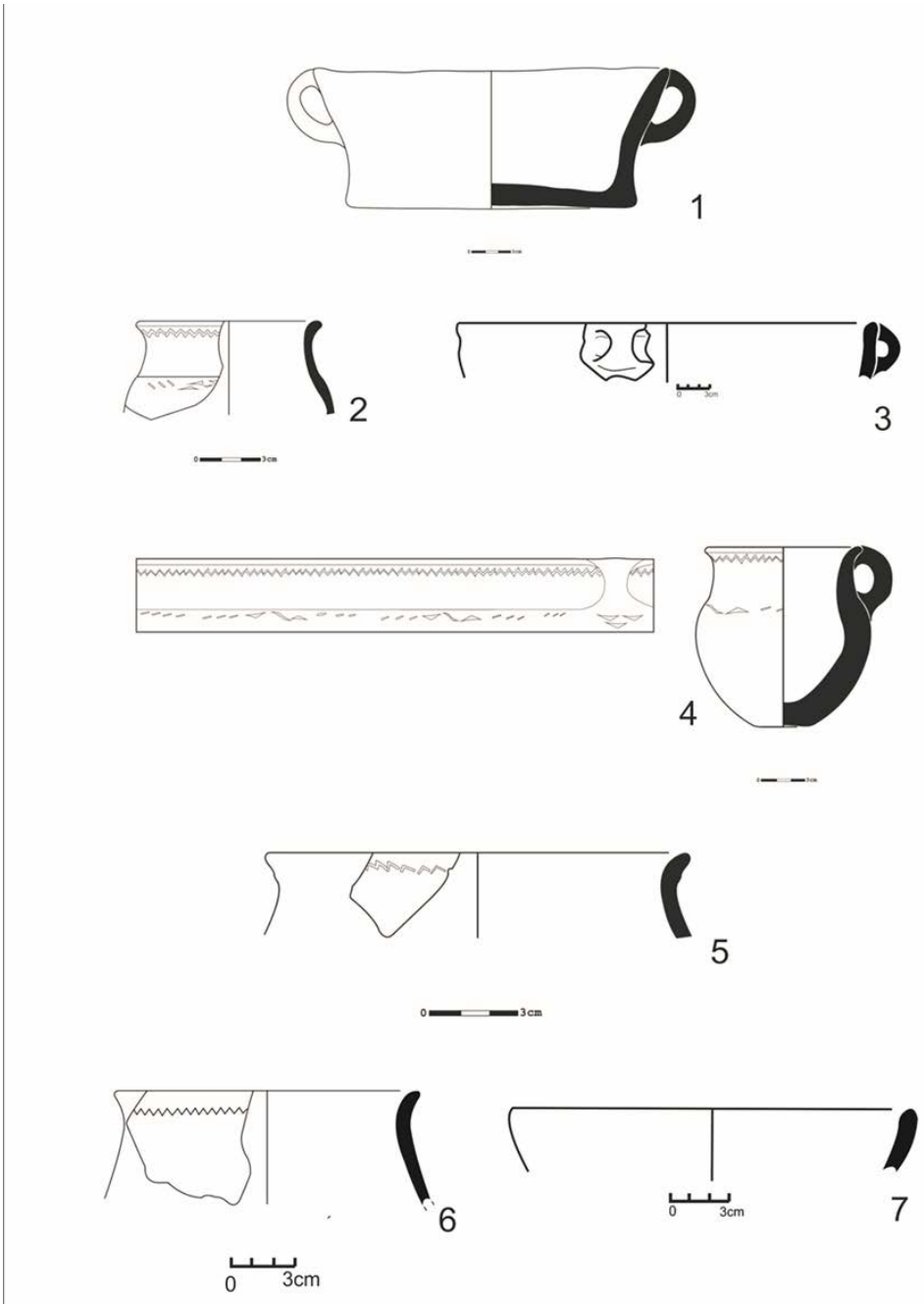


Fig. 12 Typical Kura-Araxes pottery from Ali Yourd Tepe; 1) Conical bowl with two handles from c.4023, phase 4; 2) Small jar with incised decoration from c.4046, phase 2; 3) Handled bowl from c.4064, phase 2; 4) Small handled jar with incised decoration from c.4061, phase 3; 5) Jar with incised decoration from c.4061, phase 3; 6) Jar with incised decoration c.3124, phase 4; 7) Rounded bowl from c.3123, phase 4

## 8.Radiocarbon dates from the Kura-Araxes settlement at Ali Yourd Tepe

Five radiocarbon samples were taken from contexts associated with different phases of the Kura-Araxes occupation at the site excavated in trenches A and C (figs 9 and 10, table 2). These samples were taken from contexts containing cultural materials, particularly

pottery sherds, which display characteristics of the Kura-Araxes cultural tradition. The stratigraphically oldest sample (RN.3192) was taken from a soil and ash layer on the floor of the first building phase on natural soil. The sample yielded a date range of 2873-2634 cal BC at 2-sigma. From the second building phase, no convenient sample was recovered. Two samples were taken from the third phase, one (RN.4163) from burnt beams fallen on the floor of the middle room (fig. 13), as well as another (RN.4148) from the debris layer on the same floor, both in the trench C; the former yielded a date range of 2877-2636 cal BC at 2-sigma and the latter a range of 2873-2634 cal BC at 2-sigma. From the fourth building phase, two samples were retrieved, one (RN.4098) from the debris layer on the floor of a room exposed in trench C and another (RN.2291) from a soil and ash layer higher than the ruins of the fourth building phase in the lowermost level of the section A2, which is the uppermost sample. The former yielded a date range of 2871-2623 cal BC at 2-sigma and the latter a date range of 2867-2587 cal BC at 2-sigma.

Fig. 13 Ali Yourd Tepe, Trench C, burnt beams fallen on the floor of a room from the Kura-Arxes third building phase

These samples set in on the stratigraphic sequence with four architectural phases of the Kura-Araxes occupation at the site. The sample (RN.3192) from the first phase was taken from a layer that was probably disturbed by surface erosion or a stone structure belonging to the later periods because there were many stones on the deposits of the first phase. The sample (RN.4163) from a burnt beam fallen on the floor of a room in the third building phase point to the time of construction of the room (RN.4148). The result of the sample (RN.4098) from the debris of the fourth phase is very close from the third phase; probably, the duration of the third building phase has been very short due to fire accident. The result of the stratigraphically latest sample (RN.2291) from a layer above

the ruins of the forth building phase indicates a longest time span expands to the early 26th century BC. Hence, the beginning of the Kura-Araxes occupation at Ali Yourd Tepe falls into a similar time span as the occupation at Qaleh Tepe between the 29th and 27th century BC. The end of the Kura Araxes occupation is not clear. In levels above the fourth phase in section A2, there are further Kura-Araxes deposits, but due to limited excavation no convenient radiocarbon sample was recovered. Therefore, occupation must continue after the fourth phase, but its extent is not known, likely not for a long time.

Table 2

| Lab-No. | Sample name | Context | CAL 1-Sigma | CAL 2-Sigma | Material |
|---|---|---|---|---|---|
| MAMS-29975 | 2871.1 Ali Yourd, RN. 2291 | Trench A2, C.2232 | cal BC 2857-2633 | cal BC 2867-2587 | Animal bone, Caprini, shaft of metacarpal |
| MAMS-29976 | 5 Ali Yourd, RN. 3192 | Trench A3, C.3127, D: 1585cm | cal BC 2865-2674 | cal BC 2873-2634 | Animal bone, Caprini, Molar 3, Right maxilla |
| MAMS-29977 | 11 Ali Yourd, RN. 4163 | Trench C, C.4047, D: 1324cm | cal BC 2871-2680 | cal BC 2877-2636 | Charcoal, large piece |
| MAMS-29978 | 12 Ali Yourd, RN. 4148 | Trench C, C.4039, D: 1318cm | cal BC 2865-2673 | cal BC 2873-2634 | Charcoal |
| MAMS-29979 | 13 Ali Yourd, RN. 4098 | Trench C, C.4028 | cal BC 2860-2636 | cal BC 2871-2623 | Charcoal |

| Lab-No. | Sample name | Context | CAL 1-Sigma | CAL 2-Sigma | Material | Building phase | Stratigraphical description |
|---|---|---|---|---|---|---|---|
| MAMS-29976 | 5 Ali Yourd, RN. 3192 | Trench A3, C.3127, D: 1585cm | cal BC 2865-2674 | cal BC 2873-2634 | Animal bone, Caprini, Molar 3, Right maxilla | 1 | from a soil and ash layer that was probably disturbed by surface erosion or a later stone structure |
| - | - | - | - | - | - | 2 | |
| MAMS-29977 | 11 Ali Yourd, RN. 4163 | Trench C, C.4047, D: 1324cm | cal BC 2871-2680 | cal BC 2877-2636 | Charcoal, large piece | 3 | from a burnt beam fallen on the floor |
| MAMS-29978 | 12 Ali Yourd, RN. 4148 | Trench C, C.4039, D: 1318cm | cal BC 2865-2673 | cal BC 2873-2634 | Charcoal | 3 | from a debris layer on the floor |
| MAMS-29979 | 13 Ali Yourd, RN. 4098 | Trench C, C.4028 | cal BC 2860-2636 | cal BC 2871-2623 | Charcoal | 4 | from a debris layer on the floor |
| MAMS-29975 | 2871.1 Ali Yourd, RN. 2291 | Trench A2, C.2232 | cal BC 2857-2633 | cal BC 2867-2587 | Animal bone, Caprini, shaft of metacarpal | 4 | from a soil and ash layer above the ruins of the forth building phase |

## 9. Discussion

The settlements at the two sites of Qaleh Tepe and Ali Yourd Tepe have several similarities in diverse aspects. Both are located on the natural terraces on the southern side of the main river of the region on the floor of a narrow valley, which geographically connects the northwest to the north central of Iran. These situations enabled the inhabitants of both sites to conveniently access fresh water, agricultural lands, and connecting routes, therefore, they settled in the heartland of the region. The

Kura-Araxes settlements at both sites were small with an estimated extension of around one hectare. In addition, both sites were first occupied by Kura-Araxes populations and after this time abandoned for several centuries until the Iron Age, when they were used as graveyards. On the other hand, no trace of relationships with other cultural traditions was found in the Kura-Araxes levels at both sites, whereas the presence of chalcolithic societies has been documented in the region (Alibaigi et al. 2012, 463). Seemingly, the Kura-Araxes populations occupied the valley and settled at previously unsettled locations, such as the places where Qaleh Tepe and Ali Yourd Tepe formed, and after a period of around one to two centuries these communities disappeared again.

The Kura-Araxes materials from both sites are very similar. Architectural remains at both sites reveal rectangular buildings formed by mud walls. The Kura-Araxes ceramics at both sites are predominantly gray and decorated with some impressed or incised geometric designs, particularly zigzag designs. Some of these designs are filled with a white paste that is "typical
and apparently exclusive" to Iran (Palumbi, 2019: 33). Generally, the pottery forms and decoration style of the Kura-Araxes occupations at both sites are more comparable with the Zagros region and the Central Plateau than with northwestern Iran. Therefore, the similarities between the Kura-Araxes materials from both settlements point to a close date for them.

The results of radiocarbon dating from the Kura-Araxes occupations at Qaleh Tepe and Ali Yourd Tepe are the most important evidence for dating these occupations and also the presence of Kura-Araxes cultural tradition in the region, which generally confirm the relative dating suggested above. All dates are close together and fall on a time span from 29$^{th}$ to 27$^{th}$ centuries BC. None of them extends back to beyond 2900 BC (tables 1 and 2), therefore, the Kura-Araxes occupations at Qaleh Tepe and Ali Yourd Tepe were not begun before this time. The end of the Kura-Araxes occupations at both sites is not precisely identified, because of the destruction of upper levels at Qaleh Tepe and the absence of radiocarbon dates from upper levels at Ali Yourd Tepe. However, it is clear that the duration of occupation at Ali Yourd Tepe was longer because there are four building phases as well as some Kura-Araxes deposits in the upper levels, while the Kura-Araxes deposits at Qaleh Tepe are obviously of a lower depth.

The dating of the Kura Araxes occupations at both sites is equivalent to the second phase of development of the Kura-Araxes tradition in which it extended to the west, south, and east; the phase started about 3000/2900 BC and is characterized as "the period of highest regionalism" (Sagona 2018: 226). Ceramics with incised and excised decorations filled with white paste are typical of Kura-Araxes pottery in Iran and are known from the Urmia region to the Zagros Mountains and the Central Plateau, dating between 3000 and 2750 BC (Palumbi, 2019: 34). This ceramic decoration style is also attested at Qaleh Tepe and Ali Yourd Tepe. All the evidence indicates that the cultural tradition spread in the Zagros region and the Central Plateau of Iran during this period. On the Central Plateau, the Early Bronze Age II, which represents the Kura-Araxes tradition in the region, was dated after 2900 BC, predominantly based on radiocarbon dates of the contexts containing Kura-Araxes ceramics at Tepe Shizar (Fazeli Nashli et al. 2013: 114, tab. 7.1. and 7.3). The site of Shizar is located on the western edge of the Qazvin Plain. One probable route for the spreading of the Kura-Araxes tradition towards the Qazvin Plain and Shizar is through the geographical corridor of the Abhar

Rood basin, where the two sites of Qaleh Tepe and Ali Yourd Tepe are located. It is worth noting the considerable similarity of the Kura-Araxes pottery in these three sites.

From the two sites Kelar and Ghal-e Ben, located on the northern side of the Alborz Mountains, Kura-Araxes materials have been found, which are associated with several radiocarbon dates. Although there are more finds at Kelar, the details of their dating have not yet been analyzed, but the dates generally indicate the first half of the third millennium BC (Mousavi et al. 2007: 484, pl. 4, 5; Heydarian and Mousavi Kouhpar, 2021: 5, table 1). At Ghal-e Ben, only a few Kura-Araxes sherds have been found, which were situated within a context containing local ceramics related to a common Bronze Age tradition in northeastern Iran. Seemingly, this limited evidence cannot demonstrate the presence of a Kura-Araxes settlement at Ghal-e Ben, however, based on the results of radiocarbon dating, a date of 2500-2400 BC has been proposed for the presence of Kura-Araxes culture in the region (Fazeli Nashli et al., 2022: 124, 129, drawing 2 n. 3, 4, 15). A similar date has been suggested for Kura-Araxes occupation at the two sites of Barlekin and Tepe Ostur near Tehran (Matthews and Fazeli Nashli, 2022: 248). On the other hand, the Kura-Araxes occupation at Godin IV was dated sometime between 2900 and 2600 BC, on the basis ofradiocarbon dating (Rothman, 2011: 163, table 5.2). In general, it seems that the radiocarbon dates of Qaleh Tepe and Ali Yourd correspond more closely with the dates of Shizar and Godin IV than Ghal-e Ben, which indicates a date later than other Kura-Araxes settlements in the Zagros region and the Central Plateau of Iran.

## 10.Conclusion

The results of radiocarbon dating in the two sites of Qaleh Tepe and Ali Yourd Tepe have shed new light on the time of expansion of the Kura-Araxes cultural tradition towards its eastern borders in the Central Plateau of Iran. These results correspond well with similar dates at Tepe Shizar, the nearest excavated Kura-Araxes settlement, and confirm the presence of Kura-Araxes tradition in the region sometime after 2900 BC. Seemingly, the expansion of the Kura-Araxes culture onto the Central Plateau of Iran occurred a short time after the abandonment of the Proto-Elamite settlements, therefore, no traces of Proto-Elamite traditions have been found in any of the Kura-Araxes sites. This cultural change has been the basis for separating the Early Bronze Age in the region into two phases I and II (Fazeli Nashli et al. 2013: tab. 7.1.). The end of Kura-Araxes in the Central Plateau cannot be dated precisely; the excavations have not exposed clear evidence, and there are no radiocarbon dates in this regard. But it seems that the Kura-Araxes tradition did not last more than 2 or 3 centuries in the region. This timeframe for the Kura-Araxes tradition on the Central Plateau is very close to the period of Kura-Araxes occupation at Godin Tepe that “almost certainly lasted less than 250 years” (Rothman 2011: 167). It seems that the cultural developments in the early centuries of the third millennium BC had a similar trend in the Central Zagros and Central Plateau so that the Kura-Araxes tradition spread in these regions and formed a cultural horizon around 2900-2600 BC.

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## چکیده

جوامع کورا-ارسی با ویژگی‌های فرهنگی و اقتصادی به‌شدت متمایز خود، طی عصر مفرغ در بخش‌های وسیعی از قفقاز و خاور نزدیک پراکنده شدند. عموماً خاستگاه این فرهنگ در جنوب قفقاز در نظر گرفته می‌شود، ولی گسترش این سنت فرهنگی در ایران نشانگر یک گسست فرهنگی در توسعه سنت‌های فرهنگی مرتبط با بین‌النهرین است. همچنین تغییرات محیطی مرتبط با تغییر سریع اقلیم نیز جوامع انسانی را وادار به توسعه راهبردهای اقتصادی جدید کردند. تا حدود دو دهه پیش، آگاهی باستان شناسان از حضور فرهنگ کورا-ارس در ایران محدود به شمال غرب و بخش‌هایی از زاگرس مرکزی بود، ولی پژوهش‌های اخیر در مناطق شمالی و جنوبی رشته‌کوه‌های البرز و بخش شمالی فلات مرکزی، امکان ترسیم تصویری دقیق‌تر از سکونت جوامع کورا-ارسی را در دو چشم‌انداز درزمانی و هم‌زمانی فراهم می‌کند. کاوش‌های اخیر در دو محوطه قلعه تپه و علی یورد تپه، واقع در حوزه آبریز ابهررود در استان زنجان، داده‌های جدید و مهمی را از استقرارهای کورا-ارسی در مسیر طبیعی ارتباطی میان فلات مرکزی و شمال غرب ایران آشکار کرده‌اند. این مقاله قصد دارد بر پایه تاریخ‌گذاری‌های رادیو کربن از این دو محوطه گاهنگاری فرهنگ کورا-ارس در ایران را به‌روزرسانی نماید. لایه‌نگاری و تاریخ‌گذاری‌های رادیو کربن در این دو محوطه نشان می‌دهند که آغاز استقرار جوامع کورا-ارسی در منطقه در بعد از ۲۹۰۰ پ.م رخ‌داده و به دنبال آن به‌سرعت در فلات مرکزی در محوطه‌هایی همچون شیزر، دوران آباد، اوستر و بارلکین گسترش یافته است. مشابهت و متمایز بودن از ویژگی‌های مجموعه فرهنگی کورا-ارس است و داده‌های اخیر ، خصوصاً سبک سفالی و همچنین شواهد و بقایای معماری، نشانگر حضور سنت فرهنگی مشترکی در نیمه اول هزاره سوم پ.م در مناطق زاگرس مرکزی، شمال غرب و فلات مرکزی ایران هستند.

**واژه‌های کلیدی:** گسترش کورا-ارس، گاهنگاری کورا-ارس، فلات مرکزی ایران، قلعه تپه، علی یورد تپه

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