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Protection of Access to Water Outside Fortified Sites in Ancient Iran: Protected Surface or Underground Access

حفاظت از دسترسی به منابع آب در خارج از استحکامات ایران باستان: دسترسی محافظت‌شدهٔ سطحی یا زیرزمینی

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ABSTRACT

Since the earliest antiquity, access to water and its securing around the fortified sites in Iran have led to both underground and surface water infrastructures. Depending on the era and the dominant civilizations—from the Medo-Urartian periods to the Sassanids—the methods evolved. However, the concern with securing access to water supply points, both for people and for livestock sheltered within fortified spaces, remained a constant response to times of uncertainty. Thus, in western Iran, efforts to obtain water mainly involved accessing springs and watercourses, often by building access tunnels for protection. In the east and center of the country, in semi-arid and arid zones, wells were dug. However, settlements located on elevated terrain were far from groundwater sources, and to avoid the difficulties of digging extremely deep wells, these were instead constructed outside the sites, lower on the slopes, with fortified access corridors leading to these water points. Observation and analysis of the location of these infrastructures reveal two main periods, each with distinct characteristics: the Medo-Urartian period on one hand, and the Sassanid period on the other.

INFO

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چکیده: از کهن‌ترین دوران، دسترسی به آب و تأمین امنیت آن در اطراف استحکامات و قلعه‌های ایران، به ایجاد زیرساخت‌های آبی سطحی و زیرزمینی منجر شده است. بسته به دورهٔ تاریخی و حکومت‌ها، از دورهٔ ماد-اورارتو تا ساسانی، روش‌های ایجاد زیرساخت‌های آبی تحول یافته است. بااین‌حال، دغدغهٔ تأمین امنیت منابع آبِ مورد استفاده برای مردم و دام‌هایی که در قلعه‌ها پناه گرفته بودند، همواره پاسخی پایدار به شرایط ناامن و دوران بی‌ثباتی به‌شمار می‌آمد. در غرب ایران، این تلاش‌ها عمدتاً به شکل ساخت تونل‌هایی به منظور دسترسی به چشمه‌ها و رودخانه‌های اطراف این استحکامات صورت می‌گرفت. در حالی‌که در شرق و مرکز ایران که مناطقی با اقلیم خشک و نیمه خشک هستند، این نیاز با حفر چاه برطرف می‌شد. اما اگر سکونتگاه‌ها در زمین‌های مرتفع قرار داشتند و از منابع آب زیرزمینی دور بودند، برای پرهیز از دشواری‌های حفر چاه‌های بسیار عمیق، آب‌انبارها و چاه‌هایی در خارج از محوطه، در ارتفاعات پایین‌تر و در دامنه‌ها ساخته می‌شد و برای دسترسی به آن‌ها راهروهایی ایجاد می‌گردید. با بررسی و تحلیل موقعیت این زیرساخت‌ها می‌توان دو دورهٔ اصلی را برای آن‌ها در نظر گرفت که هرکدام ویژگی‌های خاص خود را دارند: دورهٔ ماد-اورارتویی و دورهٔ ساسانی.

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واژگان کلیدی
ایران
فارس
معماری نظامی
زیرساخت‌های آبی
ماد-اورارتو
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1. Introduction

The issue of water supply for fortified sites in Iran—particularly in arid and semi-arid regions—has been a major concern of military authorities since the earliest antiquity (Voisin, 2025), While the most commonly used methods for provisioning water in fortified locations involved cisterns or wells, often integrated into a tower of the outer curtain wall (as seen at Tūl'e Kale or Tūl'e Qal'eh, Fārs) (Voisin, 2023: 393), or access to *qanats* running through the site (e.g., Qaleh Kashei, Esfahān) (Voisin, 2023: 309), certain sites identified during our field surveys drew our attention due to distinctive features that warrant particular emphasis.

Access to water located outside fortified sites was addressed through various strategies: unprotected access to a nearby watercourse (e.g., the ruins of the ancient city of Lāghar, Fārs); protective tunnels channeling water from an external *qanat* (Qal'eh Fūrk, Khorāsān-e Razavī) (Voisin, 2023: 43); or from a river (Gol Khandān[1], Tehran; Qal'eh Djiq, West Azerbaijan) (Kleiss and Kroll, 1979; Voisin, 2023: 198); Qal'eh Qala [2] or Qal'eh Karzin, Fārs); and in some cases, from a spring (Qal'eh Shahtepe, West Azerbaijan) (Kleiss and Kroll, 1979; Voisin, 2023: 198).

At several fortified sites, we also identified wells or cisterns located outside the enclosures, though partial infill prevents definitive interpretation of their original function (e.g., Qal'eh Fendej[3] or Funduz, Shiraz, Fārs), while others appear to be ancient *ostudān* [4]. In some cases, the provisioning system may have drawn directly from a natural spring (Qal'eh Mārān/Murān[5], Golestān). Occasionally, water access protection systems can be inferred at the periphery of the site[6] (Fig. 1).

Our approach takes into account protected access to external water sources. In Fārs, this is characterized by aerial (above-ground) access routes, whereas in other regions of Iran, subterranean backpassages are more commonly employed.

2. The characteristics of the equipment studied

The Fārs region, in southern Iran, presents several specific cases. This study focuses on eight of them. These sites drew our attention due to their deliberate efforts to protect direct access to a large cistern or well, located outside the fortified site itself. An access corridor, made up of two walls—often of unequal thickness—leads from the site to the well[7].

The infrastructures observed at Qal'eh Gabri, or Qal'eh Āshpazkhāne-ye Zahāk in Fasā (Fig. 2 and 10), illustrate the planners' intention to prioritize a water supply unmatched in the Fārs region. The site was probably chosen due to the presence of springs and streams nearby to the north. A dam (*band* or *sadd*), constructed downstream, allowed irrigation of crops in the plain located at the foot of the mountain range, south of the fortified site. While the site includes three cistern wells[8] and four cisterns for human consumption, the management of the water supply for livestock deserves our attention. The installations that caught our attention—and which are used elsewhere to access wells located outside fortified sites—are quite exceptional. Their similarity to those at other sites led us to present this case.

On the western slopes, a curtain wall runs for 275 meters along a ridge, descending to the bottom of a narrow valley occupied by the bed of a seasonal torrent fed by a spring that is now dry. This curtain

[1] 5 km south of the city of Bumahen and south of the village of Gol Khandan, the fortress of the same name was built on a 20-meter-high promontory shaped like a blocked spur, bordered on two sides by a torrent. On the northern side, a narrow passageway, 2 meters by 1 meter and equipped with stairs, allowed descent to the river while remaining protected.

[2] 25 km from Ghir, 7 km from Imam Shahr, 2 km as the crow flies from Karzin, and 3 km from the junction with the Jahrom-Ghir road, southwest of the village of Ali Ābād, the site extends over several hectares. It consists of a large *natural tepe*, a small hill, and an intermediate area, all of which contain numerous remains of dwellings. The *tepe*, oriented southwest to northeast, likely served as the citadel of this complex. On the southern hill, three Sasanian cisterns are still visible, modest in size (4 m by 1.5 m). Most of the pottery shards found at the site date to the Seljuk period. Southwest of the hill, a well about 1 meter in diameter and roughly ten meters deep gives access to a tunnel that leads westward, toward the agricultural plain and the Mând River. Notches carved into the rock walls of the well facilitated easier access. This may be the Qal'eh Karzin mentioned by Ibn Balkhi (Le Strange, Nicholson, 1921).

[3] The site rises 110 meters above the city of Shiraz to the northeast. A circular well or cistern, 2.40 meters in diameter, was built halfway up the northern cliff. It is partially filled in.

[4] Name given to wells built near sites, most of them fortified. These receptacles held the remains of Zoroastrian bones after their exposure to the open air in the famous *dakhmeh*, or Towers of Silence. These *ostudān* have all the characteristics of rectangular wells.

[5] Between Gorgān and Gombad-e Kavus, 90 km east of Gorgān and not far from the old Gorgān–Shahrud route, the refuge site of Qal'eh Mārān occupies a dizzying position in the Alborz mountain range, northeast/southwest of the village of Rustā-e Pā Qal'eh. To the northeast, a spring supplied the site with water

[6] As is the case with Qal'eh Shariari (Voisin, 2023: 384-385).

[7] This research benefited from the support of Davoud Ebrahimi, who spared no effort to ensure that these surveys were carried out under the best possible conditions, as well as from Kamran Safari, Youssef Hosseini, Mustafa Barami, Mehdi Esmaeli.

[8] The filling of these shafts makes it impossible to determine whether they were wells or cisterns. However, the site's elevation—220 meters above the plain—suggests they likely served as cisterns.

wall consists, over a certain length, of two walls with a spacing of 2.20 meters[9].

The outer wall measures 1.20 meters, while the inner wall is only 0.60 meters thick. The masonry uses a mortar (*saruj*) of low strength. This wall closed off the tang to the west and climbed the northwest slopes, making a large circuit back to the citadel in the north. A very large bastion (14 m x 6 m) flanked the wall halfway down the tang. What was its function? The enclosed mountainous area contains no other remains and could only have been used for goat herds. How was the stream's course blocked? By means of a grid? While Aurel Stein depicted the northern outer wall, he ignored the western portion (Stein, 1936: 136).

Further south, in the area formerly known as Lāristān and Khondjistān, the practice of protected external wells is more common. The presence of wells located outside the strict perimeter of each site has so far been identified at the sites of Qal'eh Asemān or Qal'eh Arg, situated north of Pishvar; at Qal'eh Ahmatū or Qal'eh Sia, south of Pishvar; as well as at Qal'eh Dide Ban, near the town of Fedagh; at Qal'eh Sar'e do Āb, northwest of Khondj; and at three sites controlling the bend of the middle course of the Mānd River towards Makuyeh, before the river enters the gorges of the Zagros, near the locality of Makuyeh: Qal'eh Āb'e Garm, Qal'eh Naghaoui, and also Qal'eh Ghodami, located very close by.

Qal'eh Asemān, or Qal'eh Arg (Fig. 11), located southeast of the village of Qalat and 16 km northwest of Ewaz, is situated on an elevated terrain overlooking the surrounding plain by 110 meters. On the northern slope, outside the site, there is a semicircular well or cistern, 3 meters in diameter and currently over 25 meters deep, dug into the rock but topped by 2 meters of masonry made of dry-fitted rubble stones. This remains one of the site's few water sources. If it is a well, its depth would have exceeded 90 meters to reach the foothill's water table. Remains of masonry connect the well to the northern walls of the fortress, which are positioned 25 meters higher on the relief.

South of Fishvar or Pishvar, Qal'eh Ahmatū, or Qal'eh Sia (Voisin, 2023: 342) (Fig. 3 and 12), occupies a slight elevation along the Lār-Khondj road. The site shows two periods of occupation: the first during the Sasanian era and the last during the Seljuk period. A circular well is located 11.20 meters in front of the northern wall and is enclosed by two walls measuring 0.80 meters and 0.97 meters thick. To the east, the wall is doubled to reach 1.40 meters. The two lateral walls are spaced 2.20 meters apart.

Not far from there, northwest of the village of Dideban near Fedāgh, the Sasanian fortress of the same name has a large cistern. On the western slope, at about one-third of the height, a well has been constructed.

Located 22 kilometers west of Khondj, at the site of Qal'eh Sar'e do Āb (Stein, 1936: 374) (Fig. 13), halfway up a relief that served as a refuge, a well was dug directly into the rock. It is situated 2.60 meters in front of the northern wall. The surrounding wall is made of regular facing stones assembled with *saruj* mortar.

The course of the Mānd River features numerous fortified structures. In its middle course, near the present-day locality of Makuyeh, just before entering the Zagros gorges, it is bordered by several fortresses. The rocky ridge of Qal'eh Āb'e Garm, or Qal'eh Nakhl (Fig. 4 and 14), overlooks the left bank of the Mānd, which flows at 690 meters elevation, and houses an observation and control system extending along the ridge from west to east. On the southern flank, outside the site, there is a vast semicircular cistern, 5.70 meters wide, with a 3.70-meter-high retaining wall cemented in place, and 8 meters deep, resting against the southern wall.

On the right bank, at the bend where the river turns due west, two sites located about one kilometer apart both feature external wells protected by walls connected to the main fortification walls. At Qal'eh Naghaoui (Fig. 5 and 15), the well is situated on the western slope of the site. The rocky bedrock discouraged the masons, who chose instead to excavate further down the slope to reach the water table, which today lies about 20 meters below the base of the site. The two walls protecting access measure 1.75 meters for the northwest wall and 1.60 meters for the southwest wall, with a spacing of 2.20 meters between them. These walls face other installations in the area, including an *ātashkadeh* (fire temple). Currently, they stand separated from the western wall by 19 meters. The walls are made of finely finished facings, assembled with *saruj* mortar.

[9] A case similar to the one observed at the site of Qal'eh Tang-e Dārz, also in the Fārs region (Voisin, 2023: 376).

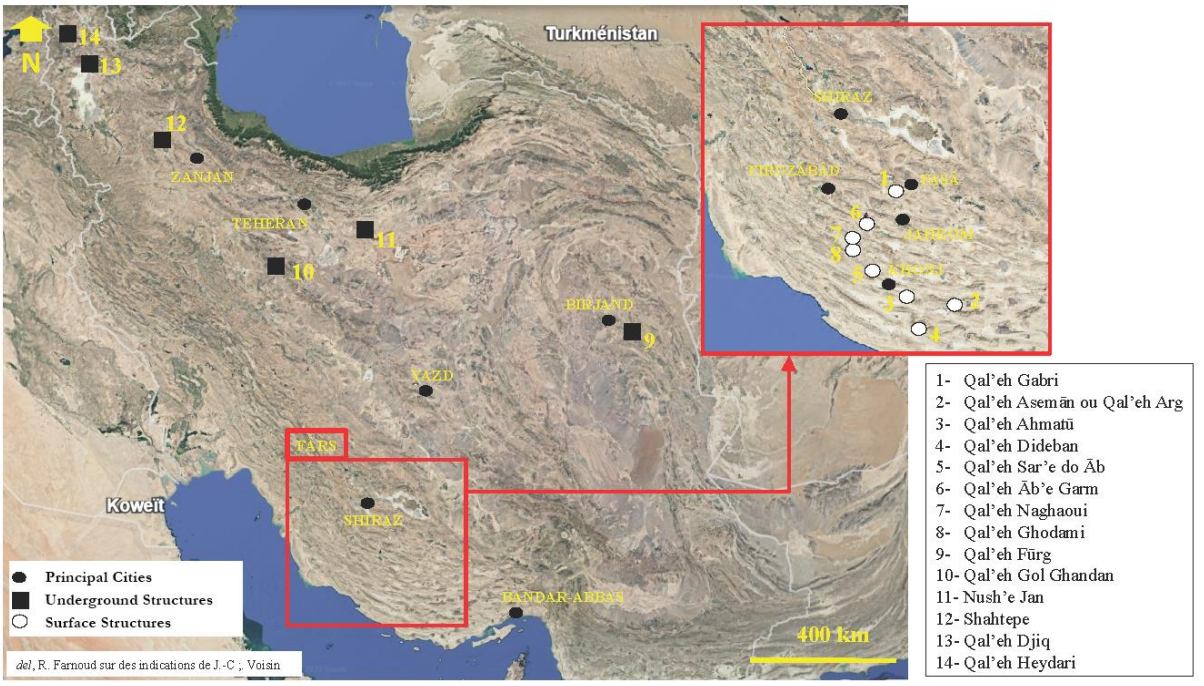


Figure 1. Location of the sites studied.

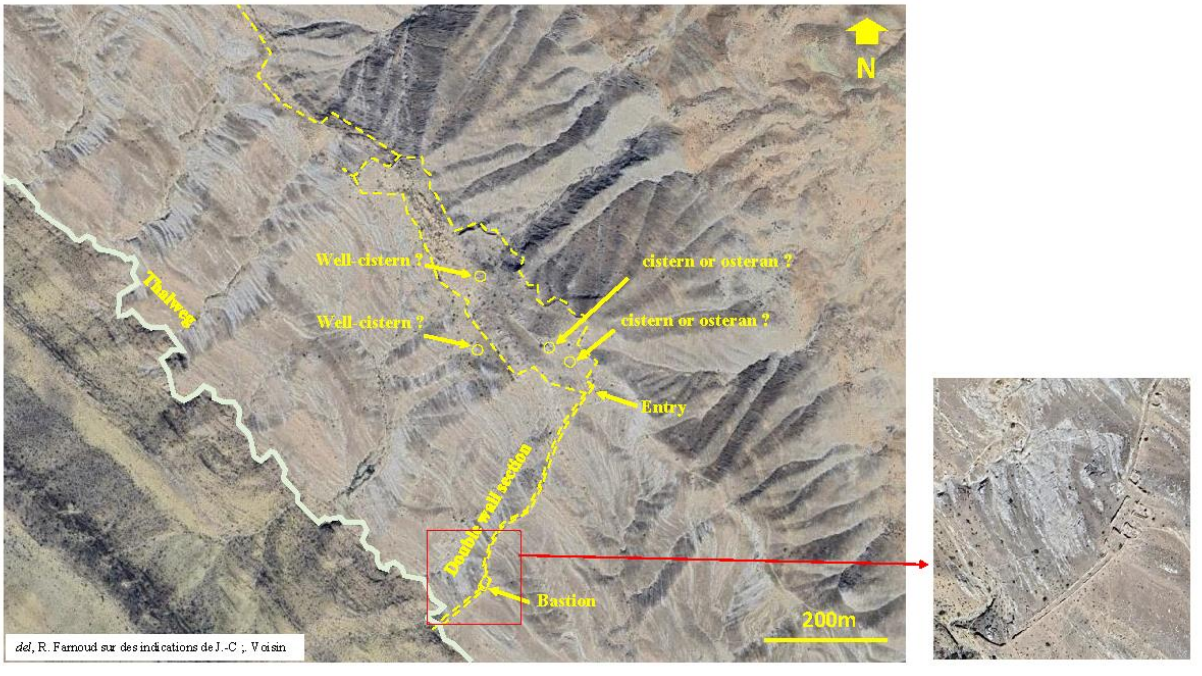


Figure 2. Qal'eh Gabri or Qal'eh Āshpazkhāne-ye Zahāk in Fasā, based on an interpretation of Google Earth.

Figure 3. Qal'eh Ahmatū or Qal'eh Sia, on the Lār-Khonj road, based on an interpretation of google earth.

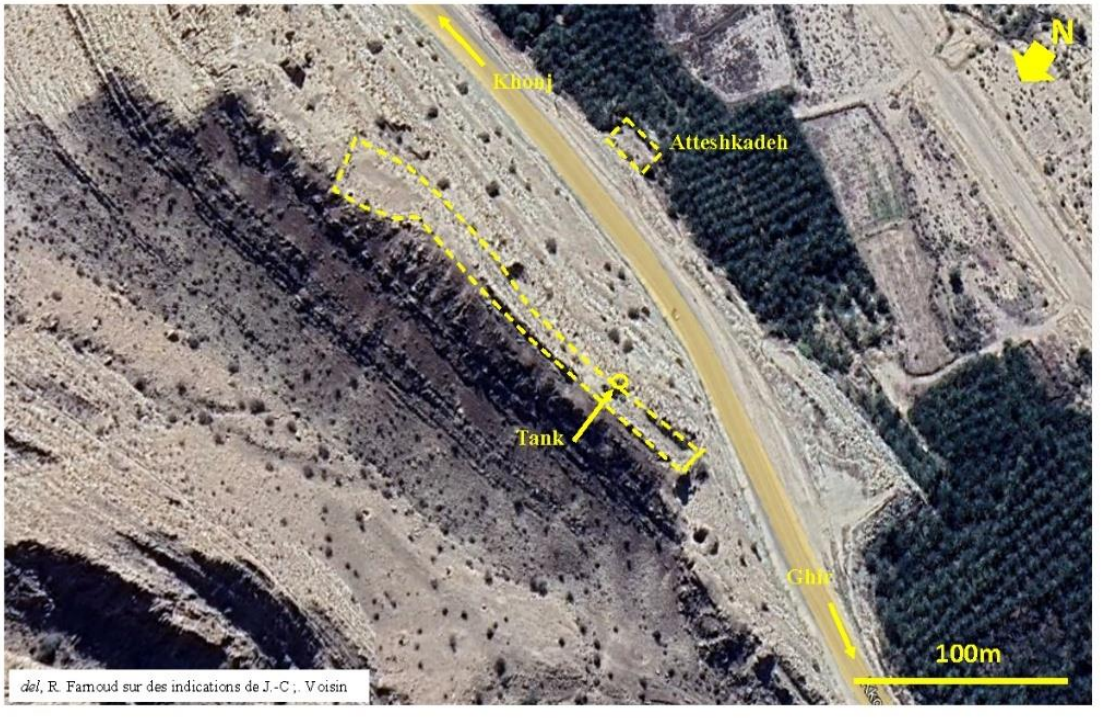


Figure 4. Qal'eh Āb'e Garm or Qal'eh Nakhl, on the Khonj-Ghir road, according to an interpretation of Google Earth.

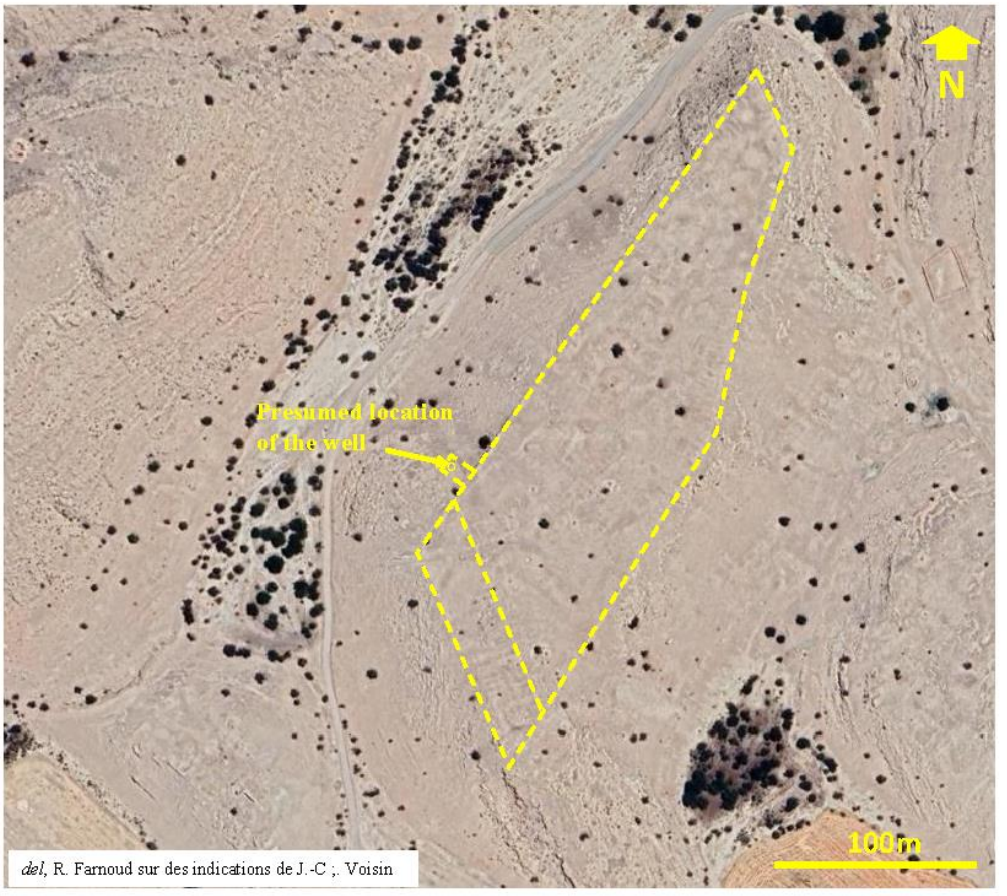


Figure 5. Qal'eh Naghaoui, towards Makuyeh, based on an interpretation by Google Earth.

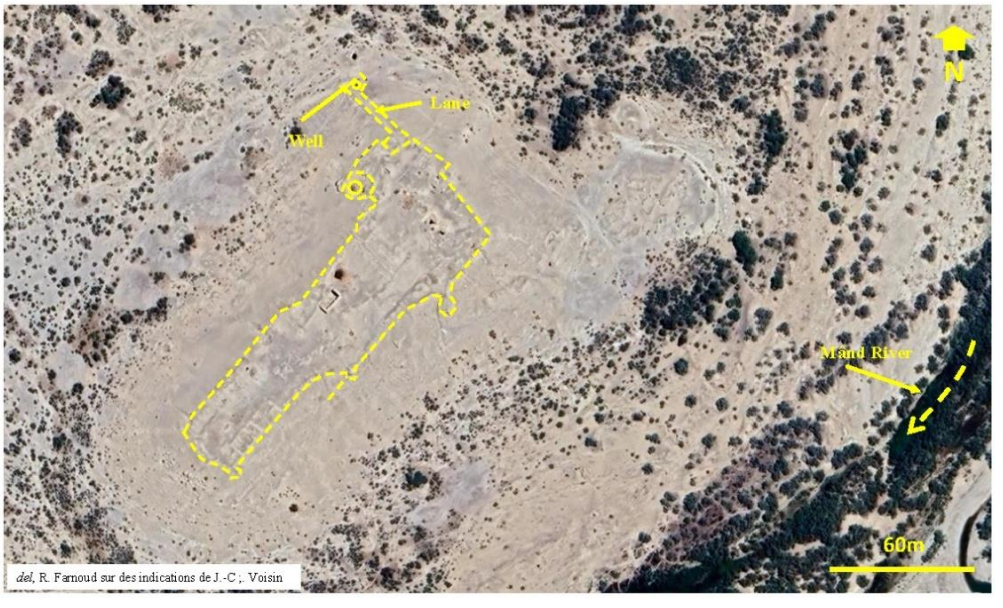


Figure 6. Qal'eh Ghodami or Tepe Ghodami, towards Makuyeh, according to an interpretation of Google Earth.

The second site, called Qal'eh Ghodami or Tepe Ghodami (Fig. 6 and 16), is located at the bend of the Mānd River on the right bank. This site is imposing. Oval in shape, it extends 100 meters in length, oriented northeast/southwest. Its width at the summit is 30 meters. It overlooks the alluvial plain by 10 meters. The site is organized into two distinct parts: a larger northeastern section and a southwestern half.

Around the entire *tell*, walls built with mortar-bound masonry are flanked by massive semicircular towers, three of which face the river. On the western flank, a 38-meter-long corridor, formed by two walls separated by a spacing close to 2 meters, led to the well located downhill to the northwest of the site. Only scattered traces of this corridor remain. The southern wall still measures 0.75 meters in thickness, while the northern wall is too damaged to be measured. However, its outline is visible due to the accumulation of stones.

This arrangement is similar to that found at nearby Qal'eh Naghaoui and Qal'eh Gabri in Fasā. The well, with a diameter of 2.60 meters, was itself protected by surrounding walls. The walls facing the site measure 1.50 meters, while those facing outward reach 2.20 meters. To the south, a quadrangular area within the protected perimeter may have housed the water-lifting system, of which no traces remain.

Outside of Fārs, six specific installations have been identified. In these sites, which are located near Birjand (in the province of Khorasān-e Razavi), in the province of Tehrān, and in that of West Azerbaijan, underground access to water was favored.

The first of these installations is found at the castle site of Qal'eh Fūrg (Nasrabadi, 2012: 115-122; Voisin, 2023: 143) (Fig. 17). Here, an impressive staircase of over two hundred steps begins in the upper part of the site and, following the slope of the hill that hosts the fortress, leads to a *qanat* located in the valley bordering the site to the southwest. Five ventilation shafts are built into its vault. The openings of these shafts are concealed outside by stacks of flat stones.

East of Tehran, south of the city of Bumehen, the fortified site of Gol Khandān (Fig. 18) was built on a 20-meter-high landform shaped like a blocked spur, bordered on two sides by a stream. The site consists of two main parts: the command area at the top and a lower courtyard developed on the southern side, where the curtain walls are best preserved. These walls reach up to 9 meters in height and are made of river pebbles bound together with mortar. Solid circular towers, serving as buttresses, are still visible on this southern face. The entire site was enclosed by this curtain wall.

The overall surface area of the site measured approximately 40 meters east–west and 20 meters north–south. Despite the presence of cisterns, a narrow corridor built into the structure, measuring 2 meters by 1 meter and equipped with stairs, allowed protected descent on the northern face to the river below.

In Hamedān province, the Median temple of Nush-i Jan (Fig. 7), studied by David Stronach (1977), also features a tunnel carved into the rock, starting from the summit plateau and descending toward the base of the site. Only the upper portion, which remains unfilled for 20 meters, can currently be examined. At that point, the corridor measures 1.70 meters in height and 1.80 meters in width.

Near Lake Urmieh—an area that hosts numerous Urartian citadels studied in detail by Wolfram Kleiss in the *Archäologische Mitteilungen aus Iran* during the 1960s and 1970s (Kleiss, 1971; 1976; 1977)—several sites feature such installations. At Shahtepe (Fig. 19), near the city of Miyāndoāb, south of Lake Urmieh, on the southern front of the ancient Urartian-style fortified site, a stepped tunnel descends into the hillside, likely leading to a spring. This tunnel shares similar characteristics with that of the Urartian fortress of Heydari (Figs. 8 and 20), located north of the lake. There, a partially filled tunnel is still visible on the southeastern side of the site, with 29 steps preserved. A stream flows at the base of the site—does the tunnel lead to it? That remains uncertain.

Finally, Qal'eh Djiq (Fig. 9 and 21) completes these examples. Located north of Lake Urmia, this site features on its northeastern side a stepped tunnel measuring 35 meters in length and 1.50 meters in width. Though partially filled, it leads to a river. The tunnel begins 26 meters below the summit of the site but remains within the fortified enclosure. It closely resembles the cases observed at Fūrk and Shahtepe. All of these tunnels share the same structure: hewn directly into the rock, with a square or rectangular cross-section, and are significantly larger than Sasanian-period tunnels, typically measuring between 1.50 and 1.80 meters wide.

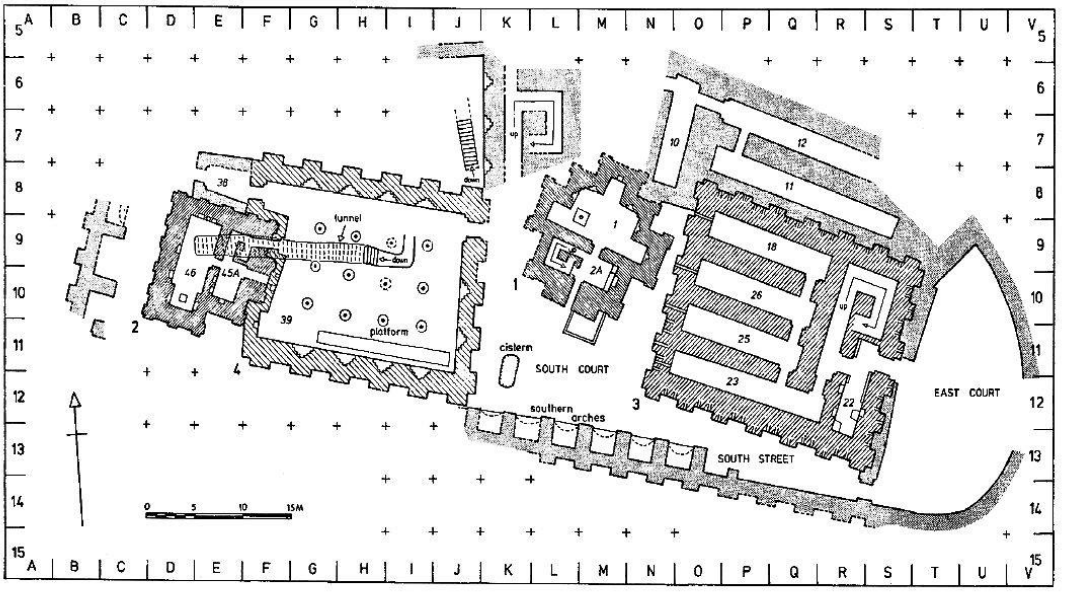


Fig. 2. — Tépé Nush-i Jan. Plan des bâtiments avant leur condamnation.
1. Le Temple central. 2. Le Tempie de l'ouest. 3. Le Fort. 4. La Salle hypostyle.

Figure 7. Nush-i Jan, towards Samen, Malāyer (Stronach 1977: 190).

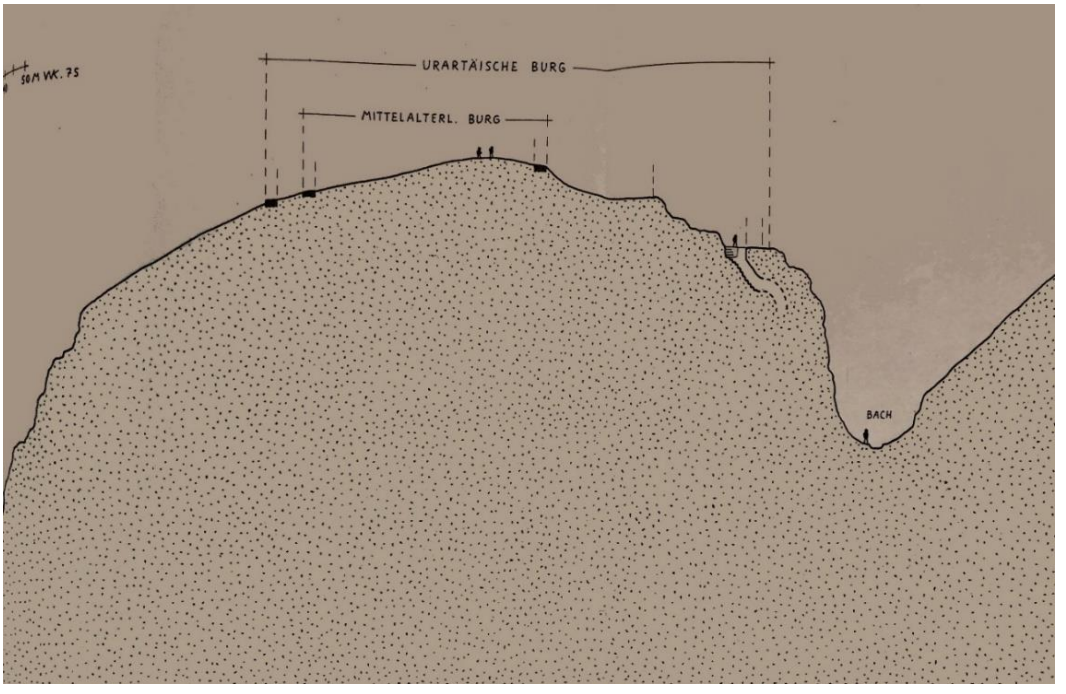
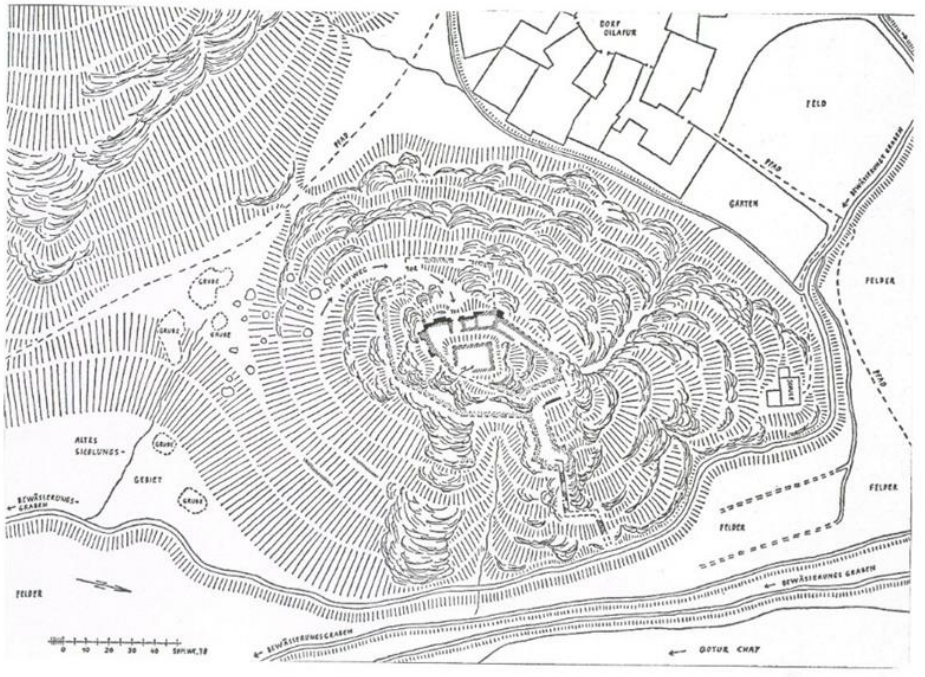


Figure 8. Qal'eh Heydari, in the northwest of West Azerbaijan Province (Kleiss, 1976: 23).



Qaleh Djiq, extrait de KLEISS und KROLL (1979), "Frühармenische Burgen", page 197.

Figure 9. Qal'eh Djiq, north of Lake Urmieh, (Kleiss and Kroll, 1979: 197).

3. Factors that explain positioning

In the case of wells located outside the sites, it should be noted that these wells respond to different circumstances:

- Either the fortified area is too confined to allow for the construction of a well (Sar'e do Āb, Āb'e Garm, Qal'eh Ahmatū-Sia),
- Or the subsoil is extremely hard, leading the builders to reduce the depth to be excavated by placing the well lower on the terrain (Qal'eh Naghaoui),
- Or the water table is very deep, so situating the well as low as possible reduces its overall depth (Qal'eh Ghodami),
- Or the nearby presence of a tahlweg with a stream—at least seasonally—provides water for livestock, supplementing the capacity of cisterns within the site (Qal'eh Gabri-Fasā).

In contrast, when it comes to tunnels, their primary purpose is to provide secure access to water sources such as rivers, springs, or *qanats*, where safety considerations predominate.

4. Can these installations be dated?

In Iran, the oldest military stone architectures can be dated back to the Urartian period (9th–7th century BC). The mastery of stone cutting and exploitation is illustrated throughout all Urartian-origin citadels found in Armenia, Turkey, and northwestern Iran. The concentration of several known examples in this region might suggest an Urartian technique. However, the example of Fūrk, at the easternmost part of Iran where there was no Urartian presence, invites us to look more closely at the Medes population, whose origins lie in regions also occupied by the Urartians but who extended in the 7th and 6th centuries BC into eastern Iran. The tunnels in the Urmieh Lake region all belong to Urartian fortresses, but the tunnel at the Median site of Nush-i Jan supports our hypotheses.

There is no current evidence that this technique was continued by the Parthians[10]. We must also mention the example of the Mansūr'e Kūh fortress (Semnān province) (Voisin, 2023: 126), located west of Damghān near ancient gold mines. Surface

[10] Conversely, it should be noted that some sites may have been used over several centuries, such as Gol Khandān, which exhibits Median features but whose latest occupation dates to the Sasanian period (Barbier de Meynard, 1861, 33). He alludes to a very ancient fortress.

remains do not allow dating this fortified installation beyond the Seljuk period, but most of the cisterns and the keep are from the Sassanid period. However, we identified attempts to dig a tunnel halfway down the slope, heading downward along the relief. It has all the characteristics of the aforementioned tunnels, carved directly into the rock. A *qanat* is visible at the foot of the site. However, the hardness of the rock discouraged further efforts. The excavation carried out in an uncertain period failed to remove the debris from the digging, which remained in the covered access ways.

On the other hand, all surface protections relate to sites whose Sassanid occupation is confirmed, either by the presence of pottery shards, the type of masonry made of small regular stones assembled with mortar (*saruj*), the structure of the rounded wells with masonry in their upper parts typical of the Sassanid period, or by their location within a clearly Sassanid environment[11]. One question remains regarding the tunnel at Gol Khandan. It is not carved directly into the rock but is concealed by masonry, some joints filled with mortar. Over a certain length, the structure of the vault suggests a Parthian construction. Its width already approaches the dimensions of Sassanid tunnels, which are around 0.50m. Only archaeology will determine the dates of its construction.

5. Conclusion

Thus, two main trends emerge: the construction of stairway tunnels, carved directly into the rock and leading either toward the foot of the relief or toward a nearby watercourse, and the surface protection of the pathway leading to a well located outside the fortified area itself. The latter method, which—based on current research—is concentrated solely in the Fārs region, can likely be explained not by a specific climate unique to this area, but rather by political conditions whose details remain unclear. Nevertheless, the distinctive character of these structures merits closer attention, as their construction techniques have received little, if any, scholarly investigation — despite clearly reflecting local concerns for defense in a landscape long shaped by persistent issues of water management. Increased attention to these practices will likely reveal further examples of such constructions that have until now gone unnoticed.

Figure 10. Qal'eh Gabri or Qal'eh Āshpazkhāne-ye Zahāk, the protective corridor © J.-Cl. Voisin.

[11] The site of Qal'eh Naghaoui overlooks and protects an *ātashkadeh*, located thirty meters to the west and still remarkably well preserved. The same applies to Qal'eh Āb'e Garm.

Figure 11. Qal'eh Asemān or Qal'eh Arg, the well on the northern slope © J.-Cl. Voisin.

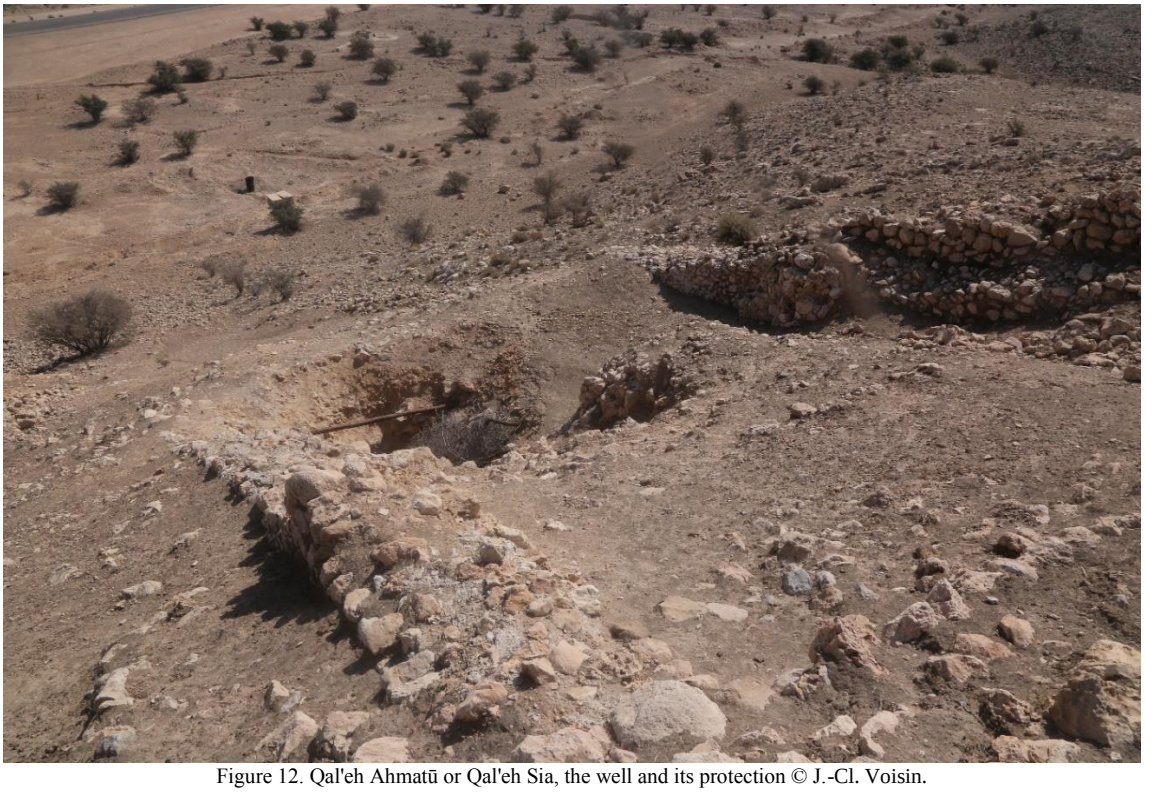


Figure 12. Qal'eh Ahmatū or Qal'eh Sia, the well and its protection © J.-Cl. Voisin.

Figure 13. Qal'eh Sar'e do Āb, the well and its protection © J.-Cl. Voisin.

Figure 14. Qal'eh Āb'e Garm or Qal'eh Nakhl, the cistern on the south face © J.-Cl. Voisin.

Figure 15. Qal'eh Naghaoui, the access walls to the shaft. © J.-Cl. Voisin.

Figure 16. Qal'eh Ghodami or Tepe Ghodami, the access corridor to the shaft © J.-Cl. Voisin.

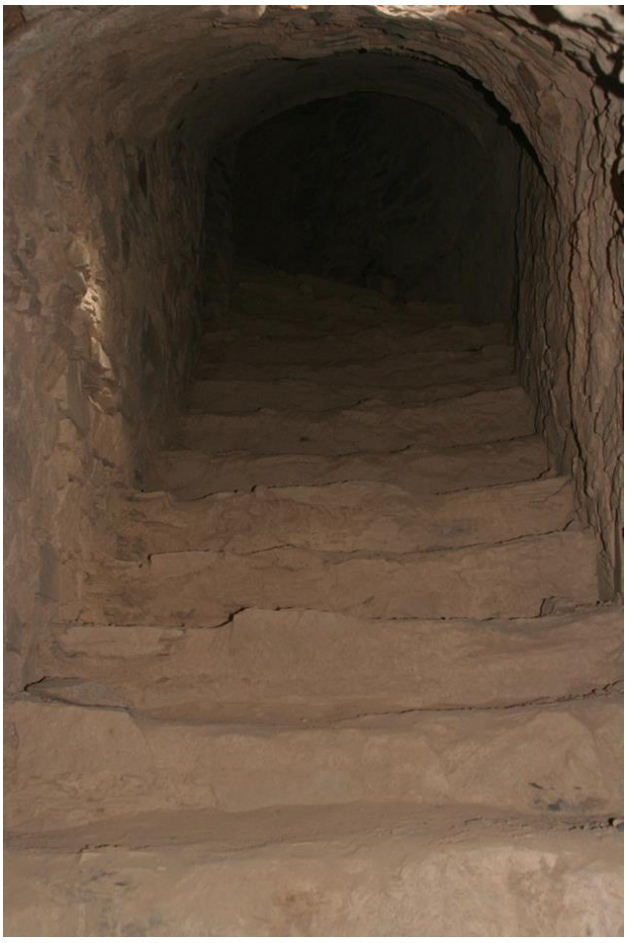


Figure 17. Qal'eh Fūrg, the access tunnel to the *qanat* © J.-Cl. Voisin.

Figure 18. Gol Khandān, the access tunnel to the River © J.-Cl. Voisin.

Figure 19. Shahtepe, the entrance to the tunnel © J.-Cl. Voisin.

Figure 20. Qal'eh Heydari, the tunnel © J.-Cl. Voisin.

Figure 21. Qal'eh Djiq, partial view of the tunnel © J.-Cl. Voisin.

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