Review Article

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Structural Measures Against the Risks of Flash Floods in Patara and Consequent Considerations Regarding the Location of the Oracle Sanctuary of Apollo

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Abstract: Located in the southwest of the Lycian Xanthos Valley, the harbor city of Patara and its surroundings are surrounded by hills and ravines. Many of these ravines, which are often referred to as streams by the locals, carry water during heavy rainfall, which can sometimes turn into huge torrents. Even today, this poses a threat to the modern village of Gelemiş and the ruins of the ancient city of Patara. It seems that things were not much different in antiquity. Architectural remains that have been uncovered in recent years bear witness to structural measures taken against such risks. These are canals, bridges, or tunnels that form parts of a drainage system. A brief analysis of this drainage system and the topography of the area surrounding the city of Patara provides valuable information that brings us a step closer to locating the oracle sanctuary of Apollo of Patara, which was famous well beyond the region in antiquity. It was probably located north-northeast of today's marshy harbor bay of Patara.

Keywords: Patara, Apollo, ancient canal, flash flood, drainage

1 Introduction

> O Cragus, lofty mountain of Lycia, a water will gush from your peaks when the rock opens a chasm until it ends the oracular omens of Patara. (*Orac. Sibyl.* 3, 439–441, translated by Onur, 2019)

> O beautiful Myra of Lycia, the shaking earth shall never set you fast; falling with the face downwards on earth you will pray to flee away into another land, like a foreigner, at a time when a dark water shall disperse the din of ungodly Patara together with thunders and earthquakes. (*Orac. Sibyl.* 4.109–113, translated by Onur, 2019)

The oracles quoted above from the so-called *Oracula Sibyllina* deal with the destruction of the Apollonian sanctuary of Patara by masses of water. They come from Books III and IV of the collection, which are dated to the Hellenistic and early Imperial periods, respectively (Buitenwerf, 2003, pp. 124–130; Kurfess, 1951, pp. 16–23; Merkel, 1998, pp. 1059–1065). According to this, a torrent coming from Mount *Kragos* (Turkish Akdağ, Şahin, 2012b) destroyed the Apollonian oracle site. In the second oracle, a "black water" is responsible for the destruction. Whether these reports can be regarded as verified historical facts is a discussion that goes beyond the scope of this article. What is known, however, is that the god of the oracle in Patara, Apollo, was indeed "silent" for a while (Aktaş et al., 2024; Lepke et al., 2015). The period of this silence fell roughly between late

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Hellenistic time and second century AD. However, this silence is not the subject of this article. The following will first deal with the natural hazards (i.e., or rather, the Patareans' structural measures against flash floods) addressed in these two oracles. Then, a brief suggestion is made concerning the as-yet unlocated oracle site of Apollo. We need to address the localization discussion of this sanctuary, as two inscriptions found in Patara report repairs to the canals located in it, which we believe may be related to flash flood management.

These two oracles of the *Oracula Sibyllina* mention a certain type of natural disaster that has always plagued mankind and does even today: the disaster left by a flash flood. It is well-known that natural disasters, such as earthquakes, tsunamis, volcanic eruptions, etc., have left behind manifold traces in numerous written and visual testimonies as well as in archaeological finds worldwide. Accordingly, the number of contributions to the so-called hazard research has increased significantly in recent decades, also given the catastrophic global climate changes (Borsch, 2018, pp. 14–19; Deeg, 2019, pp. 11–16; Hettinger, 2022, pp. 13–39). However, a review of the relevant scientific literature shows that the focus tends to be on major events – usually earthquakes, tsunamis, volcanic eruptions, or major floods (Cooper & Sheets, 2012; Deeg, 2019, pp. 11–16; Hettinger, 2022, pp. 13–24; Sonnabend, 1999; Torrence & Grattan, 2002). In addition, scientists are predominantly concerned with the consequences of a specific disaster or disaster type. This usually involves questions of perception, coping, resilience, etc. Research on countermeasures (especially in Greco-Roman antiquity) on structural, social, and other preparations of people for natural threats, especially about river flooding, is rather limited (Hettinger, 2022, pp. 13–24). There is even only a little scientific work on urban drainage systems and sanitation. Andrew Wilson (Wilson, 2000, p. 151) formulated the reason for this shortcoming more than 20 years ago as follows: "The history of drainage and sanitation has been neglected, perhaps because of its unglamorous nature." This suggestion could also be adopted for architectural flood disaster management, which does not seem to be such a glamorous part of ancient architecture. Moreover, such architectural measures are rather unspectacular when compared to the temple or theater buildings.

The rarity also includes works that focus on a specific type of natural threat, namely, the danger of sudden flash floods in mountainous areas without permanently flowing rivers and streams. Worth mentioning here are, for example, the treatises on the dams, tunnels, and canals in Petra (Al Qudah et al., 2016; Abdelal et al., 2021), Seleukeia Pieria (Bildirici, 2009, pp. 150–152; Hettinger, 2022, pp. 267–275), Antiocheia (Brands, 2009; Hettinger, 2022, pp. 283–295), and some smaller sites in Greece (Angelakis et al., 2020). Further examples of anti-flood architectural remains with brief mentions from Asia Minor can be found at Nysa, Aizanoi, Van, Urfa, and Dara (Bildirici, 2009, pp. 152–169; Kürkçüoğlu et al., 2013). The oracle site of Apollo in Delphi was also permanently threatened by torrents, rockslides, etc., against which various measures were taken – including additional reinforcement of the foundations, construction of wells, or even canals to divert the occasional torrents (Perrier, 2019; Perrier et al., 2022). Such architectural measures were not only used to combat flash floods, but also to harvest water, as in southern Arabia (Harrower & Nathan, 2018).

There were also torrential dangers and structural countermeasures taken in ancient southwest Anatolia. However, there are hardly any studies that deal with such problems. There are therefore no corresponding findings that could be used as examples in this article. The only example known to the authors comes from Myra, albeit from the twelfth century (Akyürek, 2018, pp. 52. 60). In 2010, in the ancient city of Myra, about 200 m southwest of the theater, a church with tombs was excavated, which was located on the bank of a stream bed (Figure 1). This stream only carried water when it rained. During heavy rainfall, floods arose which threatened the church and the adjoining tombs. Various measures were taken to protect the buildings from the floodwater. On the one hand, the openings of the buildings were completely or partially walled up so that no water could penetrate. On the other hand, a 1.5 m thick, approximately 30 m long wall was built, which ran along the outer wall of the apse to the south. One of the tombs was integrated into the wall. This wall was primarily intended to protect the south and east sides of the church. This stream still poses a danger today, so modern channels were built during the excavations to keep the flood torrents away from the church.

This article deals with such threats and structural countermeasures taken in Patara. This is because, during heavy rainfall, destructive torrents sometimes occur that seriously threaten the modern village of Gelemis and the ruins of Patara. The elders of the village can remember torrents (Turkish *sel*) flowing through the Gürlen stream (see below), for example, and flooding the streets and alleyways of the village. In May 2021, after an intense rainfall, such a torrent occurred, flowing down through the ravines (Çakallık Deresi, see

Figure 1: The church and tombs in Myra, view from the east. Red arrows show the protective wall constructed against flood water (Myra/Andriake excavation©).

below) between the hills of Bodrum and Doğucasarı and carrying a lot of sediment with it. The water flowed like a small waterfall over the remains of the Hellenistic city wall into the urban area (Figure 2). The above quotations from the *Oracula Sibyllina* may reflect such torrential water events, which must have caused

Figure 2: Waterfall over the Hellenistic city wall of Patara after an intense rainfall, view from the southeast (photo: Patara excavation©).

considerable damage. As simple observations and previous excavations have shown, the topography of the city and its surroundings has changed over the last 2,000 years to the extent that only the harbor bay has silted up (and sea level has risen) and the lower parts of the valleys have been filled with sediments. So, Patara was and is exposed to such dangers due to its topography. Some architectural remains, which are discussed below, bear witness to such dangers and the countermeasures taken by the people of antiquity.

2 Landscape of Hills and Valleys

The remains of the former harbor city of Patara are located on the southwest coast of modern-day Türkiye, in the ancient landscape of Lycia. Especially in Roman times (first to third century AD), the city flourished due to its large, well-protected harbor bay (Koçak & Dündar, 2019). The city was most likely abandoned in the fifteenth century after this harbor bay was silted up and the harbor facilities could no longer be used (Işık, 2011, p. 24; Şahin & Aktaş, 2019, p. 156). However, the settlement history of the city dates back to the second millennium BC, if one equates the place “Patar” mentioned in the Hittite sources with the later city of Patara (Işık, 2019, p. 114).

Patara is located in the southwest of a plain formed by the Xanthos River (Eşen in Turkish) throughout thousands of years (Öner & Akbulut, 2015). Approximately 100 m high and 1.4 km long ridge (Gürlen in Turkish), which runs from north to south, separates the Patara Trench from the Xanthos Plain (Figure 3). The Alakür hill rises approximately in the middle of this ridge. At the northern end, the ridge bends to the east, runs about 1.2 km, and ends at a hill with the modern Turkish name Kulaksız (122 m above sea level), which in turn forms the western barrier of the narrow Kısık Pass. On the eastern side of the Kısık Pass rises the approximately 120 m high Adatepe (Ada Hill). This pass is the only passage from the Xanthos Plain to the Patara Trench, which extends from north to south to the shores of the Mediterranean. To the west of this

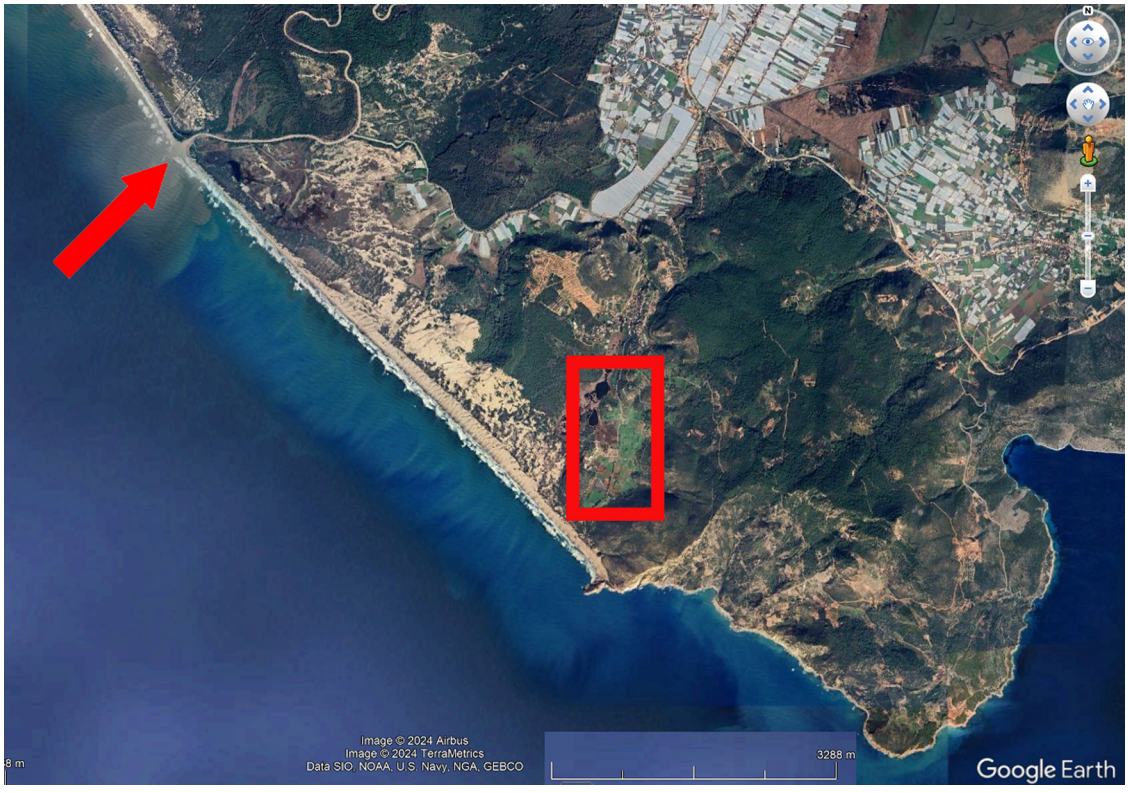

Figure 3: Xanthos plain, red arrow shows estuary of the river Xanthos, in the red frame, the city of Patara (GoogleEarth Mosaic).

trench is the aforementioned Gürlen ridge, and in front of it, on the west side, is the bay of Patara, which is about 1 km long. To the east, from north to south, there are several hills (Ada, Köklük, Çamurlağı, Bodrum, Akdam, Doğucasarı, and Davlum). The ancient city lies where the trench spreads out, surrounded by the hills of Doğucasarı (180 m above sea level), Kurşunlu (64 m above sea level), and Tepecik (30 m above sea level), and the long bay lying to the west.

Between the hills mentioned above, the ravines that carry water during intense rainfall flow into the Patara Trench (Figure 4). Three of them are called streams by modern villagers (Makmara, İbri, and Çakallık). There are two other "streams" that have no modern name. One carries rainwater between the hills of Alakür and Kulaksız (here Gürlen Stream). The other is the gorge between the Doğucasarı and Davlum hills (here the Davlum stream). The İbri and Makmara "streams" meet at a point east of Köklük hill and flow north toward the Kısık Pass.

The south-western stream Davlum hardly posed a threat to the ancient city. This is because its presumed floodwaters remained outside the city walls to the south. However, the last two streams, the Gürlen and the

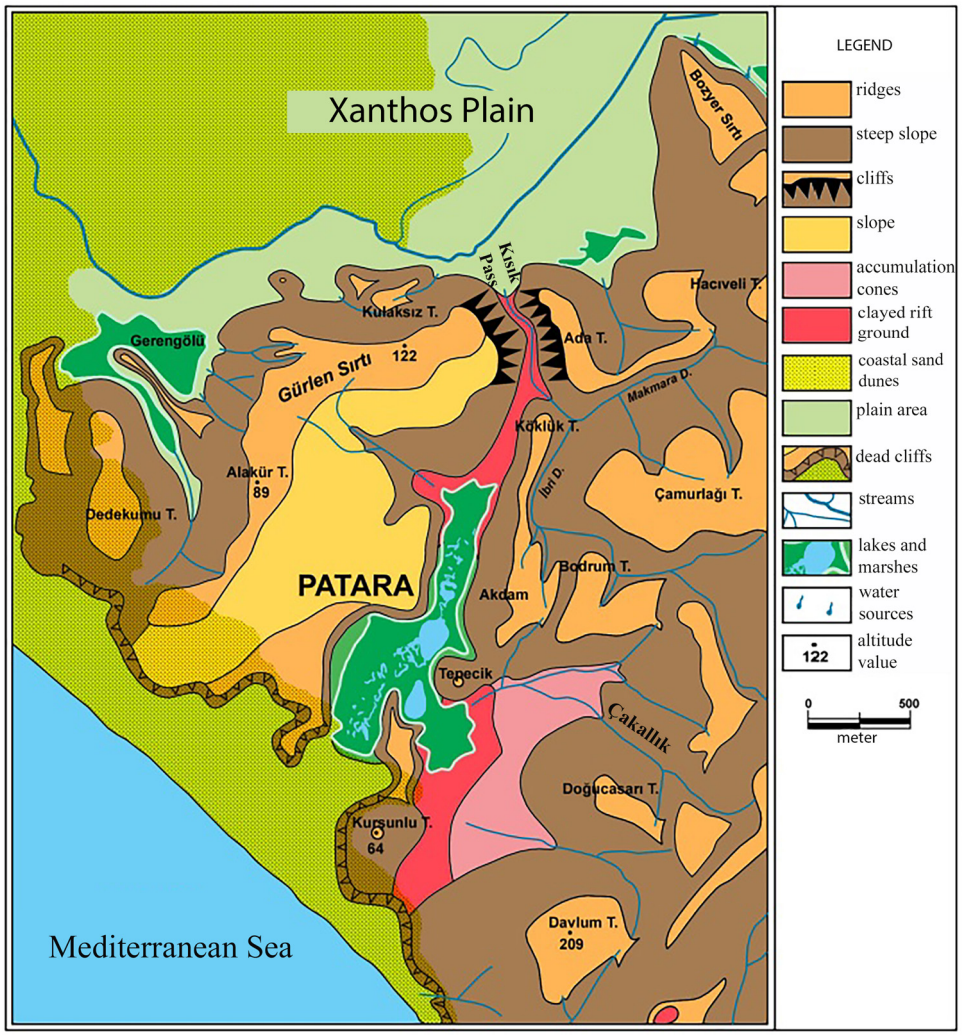

Figure 4: Geological map of Patara with hills and ravines (Öner & Akbulut, 2015).

Çakallık, were certainly sources of danger for buildings outside the city in ancient times during heavy rainfall, especially for roads, tombs, workshops, and possibly for the still unlocated oracle site of Apollo.

3 Architectural Measures for Flash Flood Control in Patara

3.1 Bridge on the Kısık Pass

Even today, the torrents that form during heavy rainfall threaten the Kısık Pass and thus the road that connects Patara with the Xanthos Plain. A stone bridge dating from Roman times (İşkan-Işık, 2019, pp. 396–397) proves that this threat was no different in antiquity (Figure 5). This bridge is located at the Kısık Pass and connects two parts of the ancient Xanthos Road on a northeast-southwest axis, the pass lying about 1 km north of the ancient city.

The first excavations were carried out in 1993, during which the eastern abutment of the bridge was uncovered. However, as the modern road ran over the other abutment of the bridge at the time, the excavations were not continued. In 2017, the western abutment of the bridge was also uncovered, and the course of the old road was determined. The walls of the bridge, which are preserved up to the springing of the arch, are made of isodomic masonry; the piers are 7.80 m wide, and the preserved height is around 3 m. The bridge arch is approximately 4.7 m wide. Many of the blocks were fixed horizontally with iron clamps and lead. The areas where the arch of the bridge is connected to the road were built with large quarry stones mixed with mortar. Ertuğ Öner and Hüsna Akbulut suspected an even longer bridge with several arches (Öner & Akbulut, 2015, Figure 32). However, as far as can be determined, it is a small bridge with only a single arch.

The excavations showed that the riverbed was covered by an alluvial layer about 3 m thick, which reached up to the top of the bridge arch. According to our observations, the bridge was probably still intact until the last century. It was only destroyed by the construction of the modern asphalt road. Chemical analysis identified the

Figure 5: Bridge at Kısık Pass, view from the north, red arrow shows the bank retaining wall (Patara excavation©).

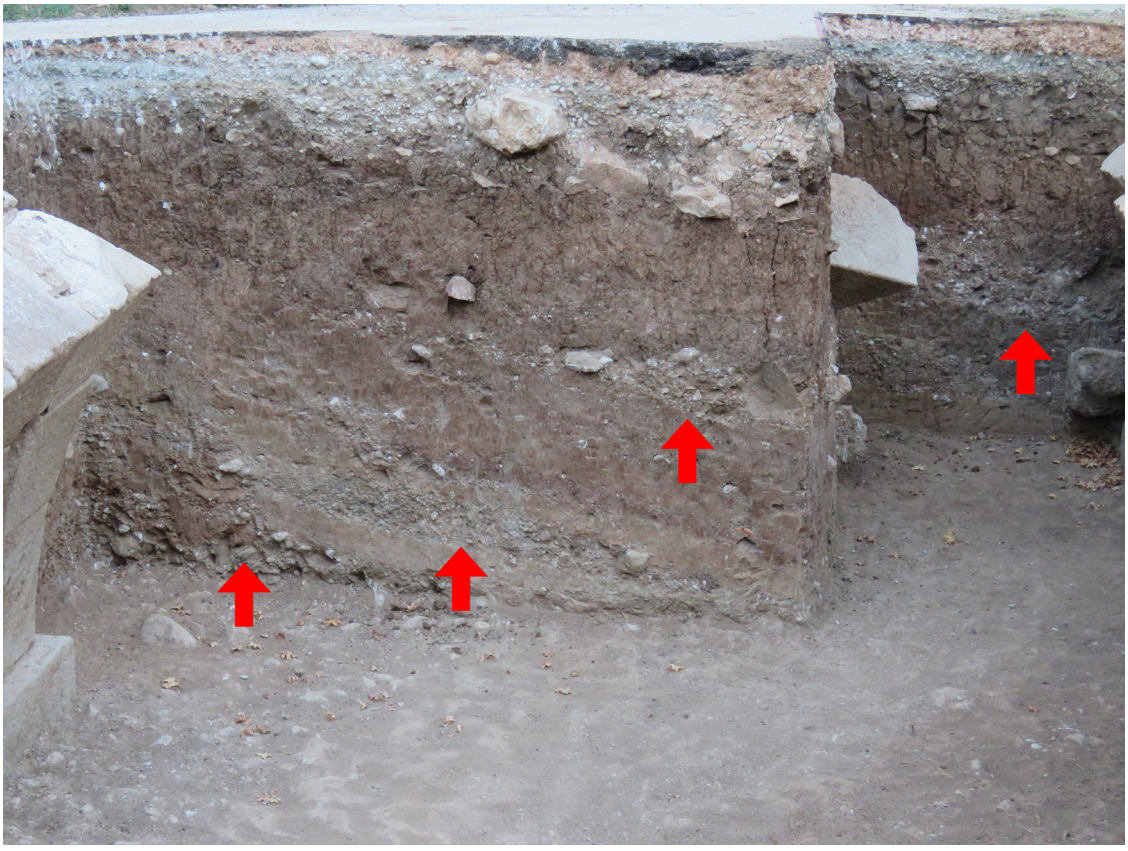

Figure 6: Earth profile after the excavation at the bridge at Kısık Pass, view from the north, red arrows showing the various floodwater deposits (Patara excavation©).

deposits under the bridge as colluvial material carried by the Makmara and İbri streams (Öner & Akbulut, 2015, pp. 81–82) (Figure 6). The bridge was therefore built to ensure traffic on this important road even during flash floods.

For the bridge at Kısık Pass, unfortunately, there is hardly any evidence for a close dating. Unfortunately, the excavation there did not yield any useful finds for dating. Due to the masonry technique, which features carefully worked ashlar and barrel stones, it can only be assumed that the bridge must have been built in the Roman Imperial period at the latest. However, due to the location of the pass here, there was in all probability even earlier bridges or bridge-like constructions.

3.2 Structural Measures Taken Against Flood Water From the Çakallık

In Section 1, a flood water event in May 2021 was mentioned (Figure 2). It did not cause much damage, as many architectural remains of the city remain underground. Only some earlier excavation trenches in the necropolis were filled with sediment. However, this event showed how vulnerable this area with tombs, roads and workshops (in late antiquity) must have been in antiquity (Figures 7–10). Consequently, the floodwater of the Çakallık had to be counteracted structurally. In fact, there are architectural indications of such efforts having been made, which are explained below.

Immediately in front of the so-called necropolis church, there is a canal about 2.2 m wide (inside) and 23.60 m long, which is mostly covered by reused marble slabs and limestone benches from an unknown building(s) (Figure 11). The canal runs from southeast to northwest. At its south-western edge, the remains of a wall with entrances have been preserved. The elongated space directly above the canal once formed the narthex of the church (İşkan & Şahin, 2019; Peschlow, 2016). At the western end of the canal, approximately

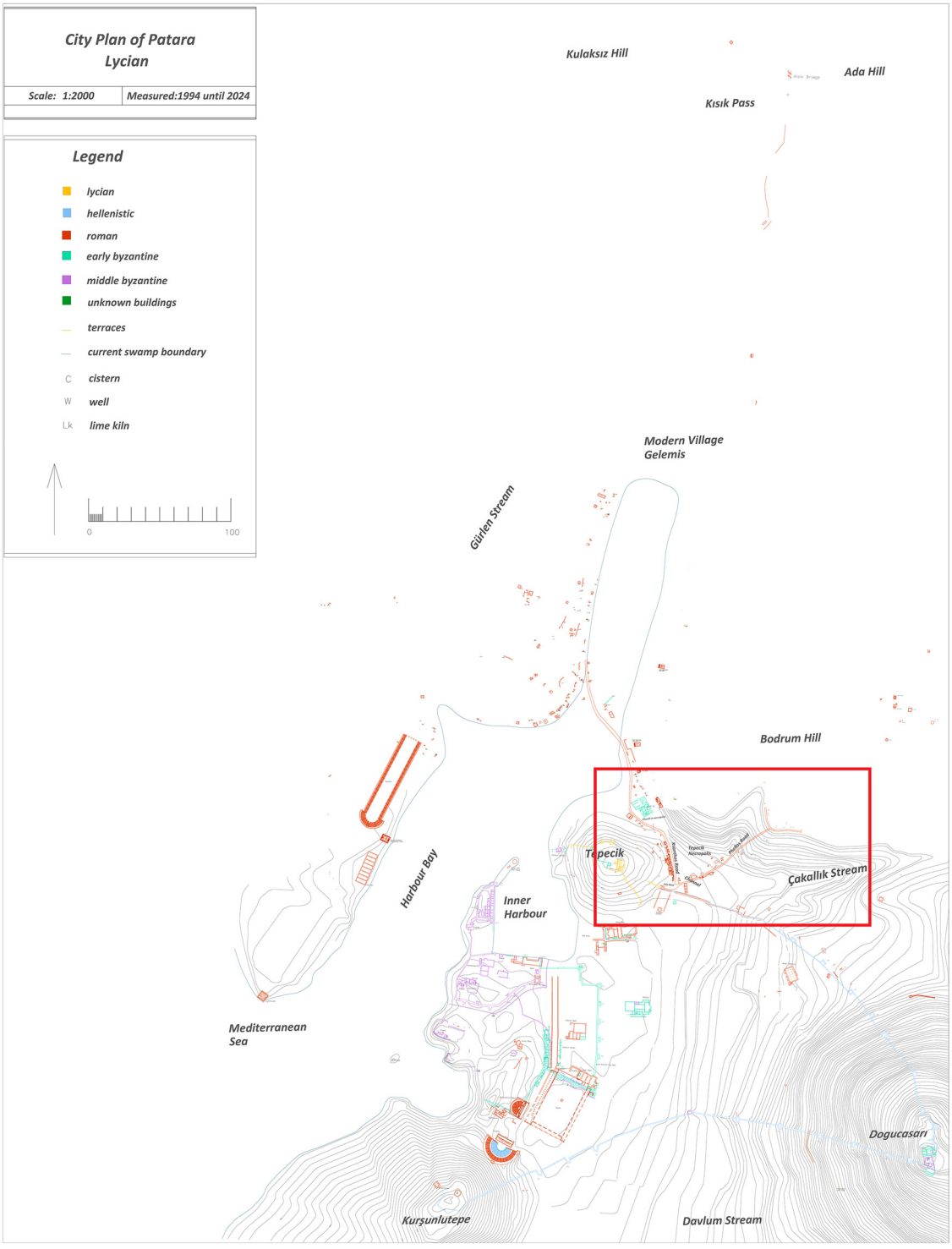

Figure 7: City map of Patara, the red framed area dealt with in this article (Patara excavation©).

2.2 m wide arch made from rubble stones and bricks spans the canal. It appears that there was also a similar arch at the eastern end, but this is poorly preserved. These two arches were preserved outside the aforementioned narthex and probably served as bridges. There are stone packings on both sides of the western arch, which allow a road connection. The place where the church, the canal, and several Roman sarcophagi are

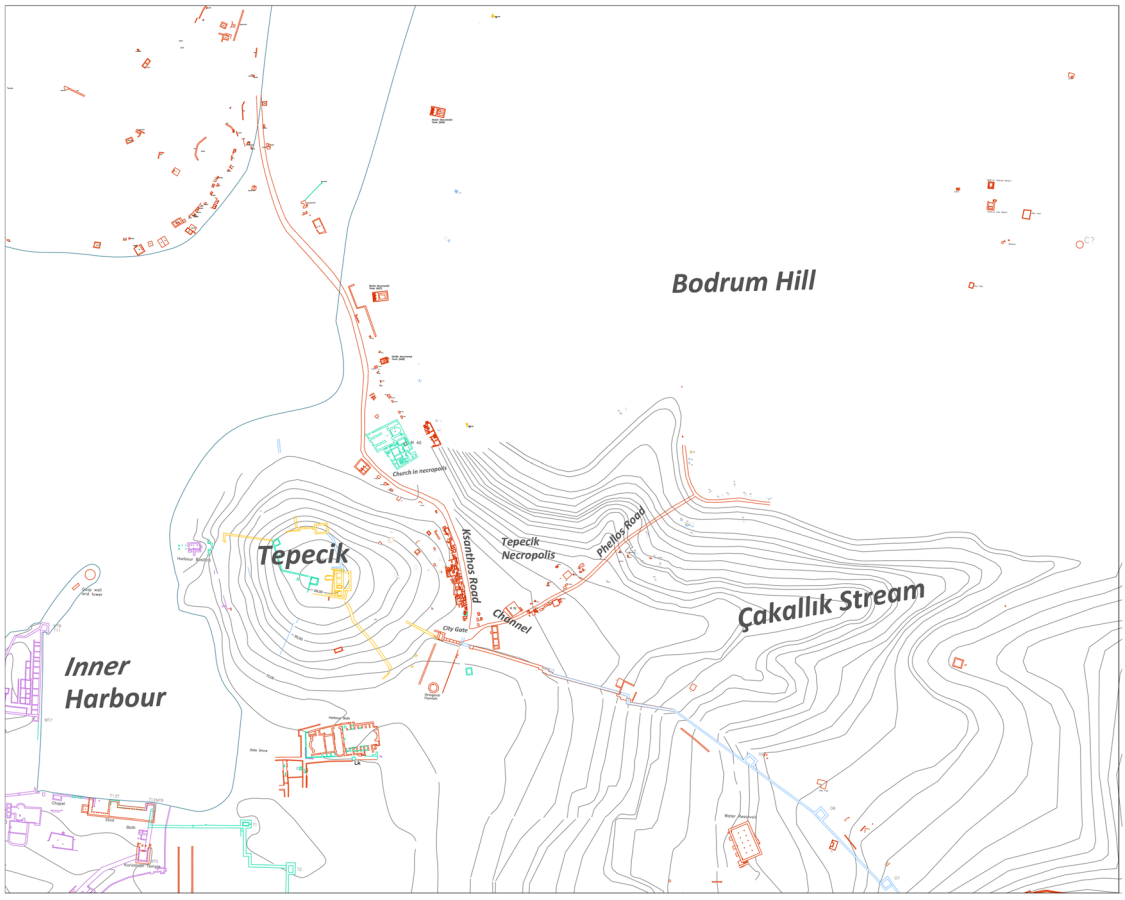

Figure 8: Detail of the city map of Patara (Patara excavation©).

located is a small valley lying between the Tepecik Hill and the Bodrum Hill, which opens up to the harbor bay. The Xanthos road also runs through this valley. The canal lies in the middle, at the bottom of this small valley (Figures 9 and 10).

Water flows into the canal from a small open spring about 40 m northeast of this canal, so that it is almost always full. Sometimes the water flows out of the canal to the west, into the harbor bay. Because of the water, no excavations to date have been carried out in the canal itself. In 2008, however, the water was pumped out to such an extent that at least the canal walls could be photographed (Figure 12). These consist of large limestone blocks with mortar joints. There is no evidence of a barrel vault at the top of the walls. Before the church was built, it was probably an open canal. The depth of the canal cannot be determined at present, but it was at least 2 m deep (a 1.70 m tall person could easily move along this canal in its present state). Urs Peschlow, the excavator of the church, interpreted it as a drainage canal without further elaboration (Peschlow, 2016). A connection between the abovementioned water source and the canal can be ruled out, as the spring carries far too little water for this rather large canal. If one had wanted to divert the spring water, it would have been sufficient to create only a shallow and narrow canal.

The question of what function this canal might have had can now be answered on the basis of a find that came to light after the excavation of the 11 m × 11 m tomb monument M52 in 2012 (İşkan et al., 2014, pp. 276–277; Koçak, 2015, pp. 369–383). It is approximately. 12 m long and 4 m wide tunnel with a barrel vault, which is located approximately 60 m northeast of the city gate in the so-called Tepecik necropolis and lies on a south-east-northwest axis (Figures 13 and 14). The tunnel, which is open on both sides, is neither a tomb nor a bridge. As the structural analysis of the tunnel and the partially overlying tomb showed, it actually served as a substructure for the simultaneously erected tomb monument. It is therefore an unusual “foundation” for a tomb building. An analysis of the topography of the surrounding area revealed that such a measure was

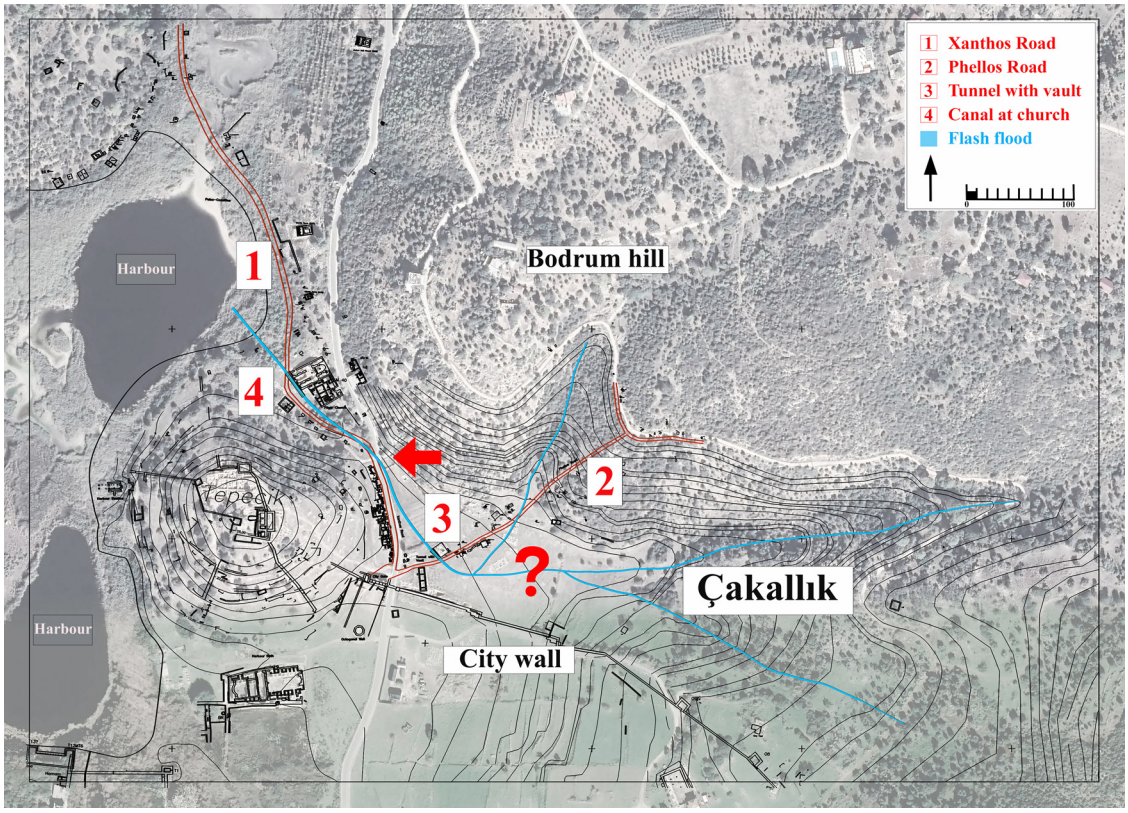

Figure 9: GoogleEarth image mosaic overlaid with the part of the city map showing the Tepecik necropolis. The red arrow shows the presumed location of the tunnel reported by the village elders (Patara excavation©).

necessary to be able to erect the tomb in its exact size. The location of the tunnel proved to be the lowest point of the surrounding terrain (Figures 9, 10 and 15). The Çakallık stream flows into this part of the Tepecik necropolis. This area is surrounded by hills (Tepecik, Bodrum, and Doğucasarı) and an approximately 120 m long section of the Hellenistic wall to the south (Bruer & Kunze, 2010, pp. 21–48; Dündar & Koçak, 2019, pp. 180–183). The only "opening" is between the hills of Tepecik and Bodrum, through which the Xanthos

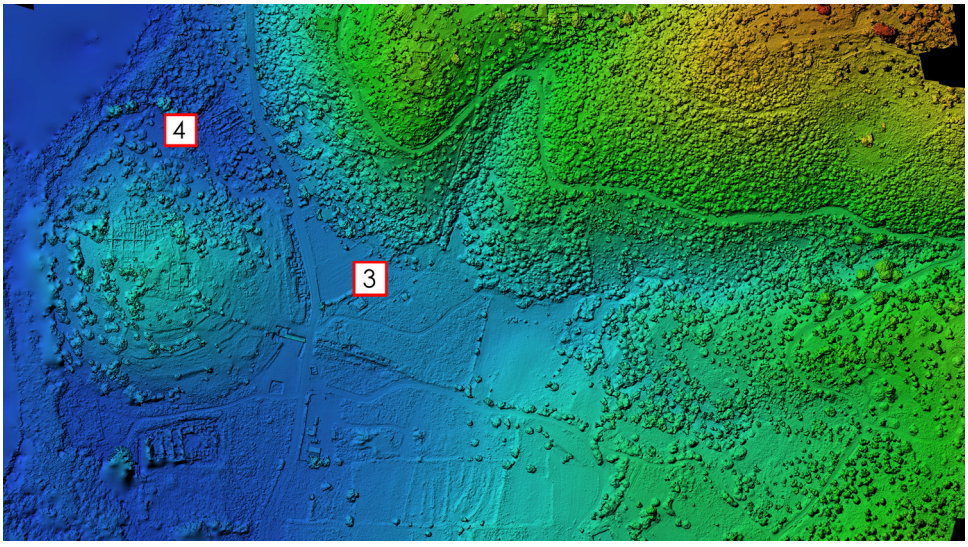

Figure 10: Digital elevation model of the Tepecik necropolis area, 3: the tunnel at tomb M52, 4: the canal at the church (Patara excavation©).

Figure 11: The church in the Tepecik necropolis, view from the west. The red arrow indicates the arch at the western opening of the tunnel (Patara excavation©).

Figure 12: Part of the northern wall of the tunnel at the church in the Tepecik necropolis (Patara excavation©).

Road also passes. This means that through this opening, the torrents of the Çakallık could only flow or be directed northwards toward the harbor bay.

Figure 13: Monumental tomb M52 with the barrel-vaulted tunnel, view from the north (Patara excavation©).

Figure 14: The northern opening of the tunnel at tomb M52. The red arrow indicates the polygonal wall (Patara excavation©).

The tunnel, which served as a substructure, certainly spans a "riverbed" through which the torrents of the Çakallık flowed or were channeled. The north-eastern base of the tunnel (at the northern opening) rests on approximately 70 cm high polygonal wall, which continues in a north-western direction (Figure 16). As it runs into the opposite soil profile, it is not possible to say how far this wall extended. A comparable low wall can also be seen at the bridge at Kısık Pass. This wall may have served to fortify the banks of the postulated riverbed. The deposits, which unfortunately have not yet been scientifically investigated, also show that water

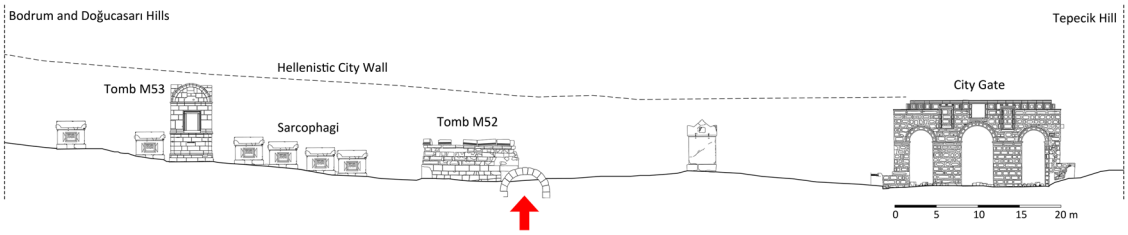

Figure 15: Sketch of a section through the site, red arrow shows the tunnel at tomb M52, at the deepest point in the area (Patara excavation©).

Figure 16: Polygonal wall in front of the northern opening of the tunnel at tomb M52, view from the west (Patara excavation©).

flowed here. However, these are comparable to those observed and analyzed by Ertuğ Öner under the bridge at Kısık Pass. At least four flood layers containing boulders of different sizes can be seen in the soil profile opposite the northern opening of the tunnel. These stones must have been carried along by the torrents of flood waters (Figure 17).[1]

The construction of this tunnel was obviously intended to protect the riverbed and canal at the same time. The eastern part of the Tepecik necropolis contains more than just tombs and sarcophagi. A road also runs through this area. It begins at the city gate and leads eastwards, i.e., toward Phellos (Schuler, 2019, p. 117; Türkoğlu, 2022, pp. 13, 14). Not only the necropolis with the tombs (and in the late antique period workshops), but also this road had to be protected from the non-periodic torrents.

The tunnel at tomb M52 and the canal at the church in the necropolis must be connected, as they both lie approximately on the route that the torrents of the Çakallık must run along to the harbor bay. The water that was collected and diverted in the eastern part of the necropolis of Tepecik must have first passed through the tunnel and then, tangentially to the eastern edge of the road to Xanthos, approaching the canal in front of the church. A geophysical prospectus carried out in 2012 in a small area to the east of the road to Xanthos revealed an elongated anomaly parallel to the said road (Figure 18: no. 1). Without an excavation, it is difficult to draw any conclusion. One could tentatively assume that it was some kind of retaining wall constructed along the postulated riverbed.

The fact that there were no tombs or sarcophagi on the eastern side of Xanthos Road, where the anomaly postulated above was detected, also supports the assumed course of the riverbed (i.e., a drainage system). This side was “empty,” which, it seems, indicated that it was not suitable for construction activities. Only where there are two modern houses, is there again a tomb. The older villagers speak of a “tunnel” under the modern

1 We would like to thank Geologists Prof. Dr. Cees Passchier and Prof. Dr. Erdal Koşun, who visited the site in 2012 and 2023, and confirmed this assumption.

Figure 17: Earth profile in front of the northern opening of the tunnel at tomb M52, view from the south. The red arrows indicate the different layers of deposits with boulders (Patara excavation©).

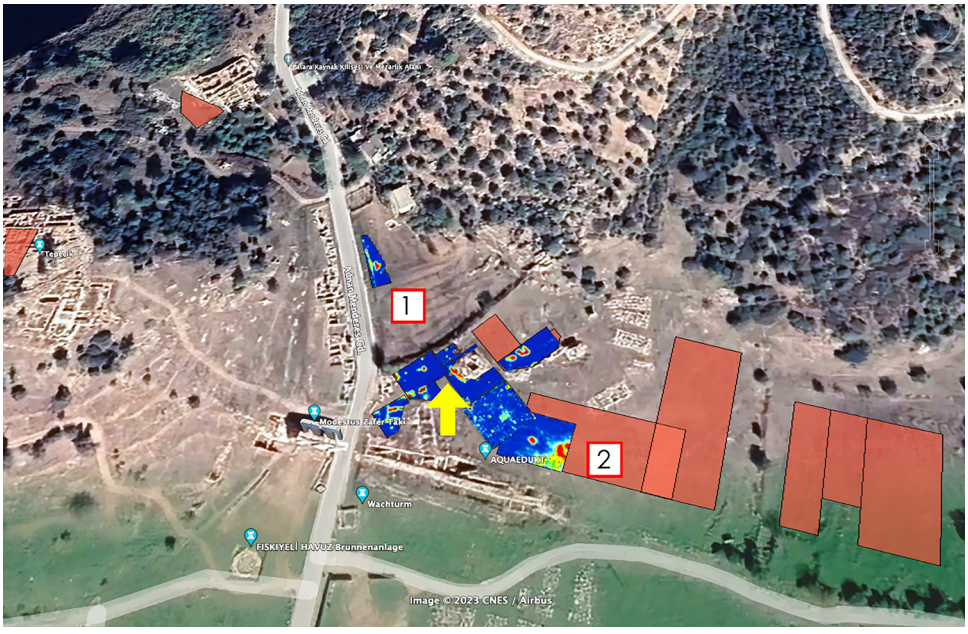

Figure 18: GoogleEarth mosaic, Tepecik necropolis, 1: anomaly at the Xanthos road, 2: anomaly in the southeast of the tunnel at tomb M52 (Patara excavation©).

road through which they could run as children. According to their description, this must have been at the point shown by the red arrow on the plan (Figure 9).

The observations made so far, and the brief explanations of the finds prove the existence of a drainage system in the north of the city, in the Tepecik necropolis. The exact appearance of this system, which was intended to protect the tombs, streets, (in Late antiquity) workshops, and the city gate from the torrents of the Çakallık, is still unknown. However, further structures to the east of the tunnel (question mark on Figure 9) are to be expected, which served to intercept, slow down, or guide the torrents. During the abovementioned geophysical prospecting, a massive anomaly was detected in this area (Figure 18: no. 2), which clearly indicates an architectural structure. If one compares this with the geophysical image of the tunnel at tomb M52 before the excavation (Figure 18: yellow arrow), it becomes clear that this must be a fairly large "building." However, only excavation can provide clarification concerning this structure, which could have something to do with the drainage system in the Tepecik necropolis.

There are also some terraces in the Çakallık. These could slow down or divide torrents. However, it is difficult to date them, although one of them is built with large stones, which is not common for modern terraces. They could be of modern construction for agricultural purposes. Here too, future excavations could provide answers.

The dating of the drainage system in the Tepecik necropolis is also difficult. The canal must be dated before the church, i.e., earlier than the fourth century AD. According to Urs Peschlow, the first church, or the remains of which are still partially visible, was built at the end of the fourth or beginning of the fifth century AD (Peschlow, 2015, 2016). As there are no remains of Roman tombs or sarcophagi in the vicinity of this canal, it is possible that this canal already existed in Roman times, i.e., as early as the second century AD. The majority of the tombs in this necropolis date from the first two centuries AD (Türkoğlu, 2022).

A coin find (Gordianus III) from the lowest layer in front of the northern opening of the tunnel at tomb M52 suggests that it was still completely open, at least around the middle of the third century AD. The other, as yet unpublished coins from tomb M52 show that it was also in use around the middle of the third century AD. In other words, the tomb, and therefore, the tunnel must have been built at the latest shortly before this time. At present, it can therefore only be said that the drainage system in the Tepecik necropolis certainly existed in the High Imperial period.

3.3 Structural Measures Taken Against the Dangers of the Gürlen Stream?

The answer to the question of whether comparable drainage systems also existed for the Gürlen stream depends upon the existence of built structures in this area. First of all, it should be noted that, with few exceptions, no architectural remains are visible above ground in this area. The exceptions are primarily tomb structures, which, however, do not appear to be located in or on the bed of the Gürlenbach, if the topographical conditions are taken into account. However, the Xanthos Road ran through this area, most probably at the foot of the Gürlen ridge. This is because the location of the tombs and sarcophagi at the foot of this ridge suggests such a road route (Türkoğlu, 2022, pp. 16–17, 59–60). In this case, it is to be expected that this road had to be protected from the floodwaters of the Gürlenbach – possibly by a bridge, as at the Kısık Pass (see above). In addition, such a stream had to flow in a southerly direction into the harbor bay due to the gradient. In Roman times, the shoreline was approximately at the level of today's ticket office (Akbulut & Öner, 2016, Figure 12). At this point, about 470 m from today's village square, the waters of the Gürlenbach were supposed to reach the sea. This is an area of approximately 47,000 m^2, which today is almost completely covered by reeds and is a swamp.

4 Canals (ὀχετοί) in the Sacred Grove *(ἄλσος)* of Apollo

The oracle site of Apollo in Patara, which was known throughout the region in antiquity, has not yet been located with certainty. The ancient historian and epigrapher Sencer Şahin attempted to locate this oracle site

in the area of the Kısık Pass on the basis of the two oracles from *Oracula Sibyllina* quoted above (Şahin, 2012b). For him, the bridge, which was only partially excavated at that time, was clearly part of a temple (Aktaş, 2019, pp. 250–251; Işık, 1994, pp. 55–56; İşkan-Işık, 2019, pp. 396–397). Şahin took the oracle of the *Oracula Sibyllina* literally and assumed that the floods of the *Kragos* (the Xanthos River or one of its branches, the Karaçay) must have destroyed the sanctuary of Apollo in this area. However, the work of Ertuğ Öner and his team has clearly shown that the deposits at the Kısık Pass were carried by the Makmara stream from the hills to the south (Hacıveli, Çamurlağı, Hacıhasan) (Öner & Akbulut, 2015, p. 81). Öner and his team were unable to discover any sediments in this area that had been transported from the north, from the Eşen plain. This area must therefore be ruled out as a possible site for the sanctuary of Apollo.

Another location, namely, the one where the church in the necropolis stands, was suggested by Fahri Işık for the oracle site of Apollo (Işık, 2011, pp. 55–56). Two aspects were decisive for him: the phenomenon of cult continuity and the presence of a water source (see above). Recently, two Hellenistic inscription finds from this church were also presented, which contain inventory lists of a sanctuary (Schuler & Zimmermann, 2012, pp. 568–573; Lepke et al., 2015, pp. 293–301). It seems now possible to link the canal in front of the church mentioned above with the canals of the Apollo sanctuary mentioned in the inscriptions (see below) and to claim that additional evidence has been provided for Fahri Işık's thesis. However, there are some difficulties to declare the former place under the church as a possible site of the sanctuary of Apollo.

It is well-known that water and springs played an important role in the oracles of Apollo. In the two other oracle sites of the god, which are also located in Lycia, namely, in Sura and Kyaneai, the reference to water is present (Athenaios, *Deipnosophistai* VIII, 333 d–f; Kolb, 1999; Nollé, 2006; Thomsen, 1995). In Kyaneai, it is an architectural frame that contains water. The architectural situation in Sura is yet unknown. Also, in Didymaion (Birnbaum, 2006, pp. 80–83) or in the sanctuary of Apollo Klarios in Klaros (Şahin, 1998, 2012a), the springs (thus water) are the most important components of the oracle finding process. But in these sites, in Didyma and Klaros, the springs were given an architectural setting – as in Kyaneai. However, as shown above, the small spring at Patara shows no architectural remains of a setting, which one would expect for such a "sacred" natural feature that must have played an important role in the oracle site.

Cult continuity is indeed a well-known phenomenon that can be observed in many places in human history. As expected, some artifacts must be present to establish continuity. In the case of the so-called necropolis church, there are finds that could indeed be associated with the Apollonian oracle site of Patara (according to Bönisch-Meyer, 2019, p. 44). These are two incomplete inventories of votive offerings that were discovered in the church. However, there are two problems with this: first, these stones could have been carried from far away. For example, the large elements of a fountain about 150 m away were reused in the same church (Dündar, 2016, pp. 245–260; İşkan-Işık, 2012, p. 174). This is therefore not direct evidence that the church was built on the site of the sanctuary of Apollo. Second, the name of the god whose offerings were listed as missing in both inscriptions. The authors who published the two inscriptions rightly did not specify the deity worshipped (Lepke et al., 2015, p. 300; Schuler & Zimmermann, 2012, pp. 572–573).

There is also a tomb under the apse of the church, which is said to have prompted the construction of the church – according to Peschlow (İşkan & Şahin, 2019, p. 334; Peschlow, 2016). This tomb was not disturbed during the construction of the church, so that the church may be associated with the veneration of saints rather than indicating cult continuity.

In fact, the church is in the former necropolis of the city, which further complicates the existence of a sanctuary at this location. Surrounding the church, just a few meters away, are several tombs and sarcophagi from Roman times. Based on the ancient tradition, which did not allow burials in the temenos of a sanctuary, only a very small area remains for the oracle site of Apollo, namely, only the area occupied by the church itself with an area of approximately 600 m^2. This small area must have housed canals (see below), a prophet's house, a part of the sacred grove with trees (according to inscriptions), at least one imperial shrine (inscriptions), possibly also a temple for Apollo and others for Leto and Artemis. However, it is clearly difficult to assume that this location formed a well-known oracle site.

Two inscriptions from the middle of the second century AD may provide a clue as to the location of the oracle site of Apollo. These mention construction activities in the god's sacred grove (οἱ *ἐν τῷ ἄλσει ὄντες ὀχετοί*) (Aktaş et al, 2024; Engelmann, 2012, pp. 219–229; Lepke et al., 2015, pp. 357–372). According to the

inscriptions, in addition to a prophet's house, canals were also repaired. Unfortunately, the inscriptions in question do not provide any further information on the function of these canals. The *ὀχετοί* are translated as canals by the epigraphers of the Patara excavation. In the commentary, the authors are of the opinion that these were probably irrigation or drainage canals (Lepke et al., 2015, pp. 369–370). Considering that the inscriptions list major construction activities, these canals must also have been of considerable size. If these canals were used for drainage, it can be assumed from the above that they were part of a drainage system.

Based on the above brief remarks and the two *Sybilline* oracles, one would have to assume that the oracle site of Apollo of Patara was in an area that must have been threatened by flash floods like in Delphi (see above). The area on the north-northeast shore of the harbor bay seems to be more suitable. This is because it is large enough to accommodate a sacred grove with buildings. In addition, as already mentioned, this area required the construction of drainage canals as it was threatened by flash floods. Such canals were probably built and maintained to protect the oracle site mentioned in the above inscriptions.

A brief comment should be made at this point. The corresponding passage of the oracle from Book IV is sometimes translated as follows:

> *When sometime the dark water of the sea*
> *With thunders and earthquakes shall stop the din*
> *Of Patara for its impieties* (Terry, 1899, p. 38)

The Greek text only says, "black water," but not where this water comes from. So, neither the sea nor mountains are mentioned. However, the mention of the earthquake makes us think of a tsunami, especially for a coastal town. So far, there is no evidence of such a natural event in Patara, which of course does not mean that it could not have happened. But even in the event of a tsunami, the area of the oracle site postulated above, which is located on the northern shore of the harbor bay, is in great danger. Whether the canals assumed above also offer protection in the event of (perhaps smaller) tsunamis is a question to which no answer can be given here. Further engineering investigations are required.

The inscriptions that mention the canals in the sacred grove of Apollo date from around the middle of the second century AD. As these canals were repaired during this period, they must of course be earlier than 150 AD.

5 Outlook

The few clues for dating briefly summarized above suggest that the structural measures taken against flood hazards presented here began to be taken in the Roman imperial period at the latest. It is possible that this work coincided with the early imperial building activities in Patara and Lycia. In these early times in the province of *Lycia*, the Romans built intensively and repaired infrastructure such as roads and hydraulic structures (Şahin, 2008). However, the following must be taken into account: the area east of Tepecik Hill has always been threatened by the torrents of the Çakallık. This threatening situation may have worsened after the construction of the city wall at the end of the fourth century BC (Bruer & Kunze, 2010; Dündar & Rauh, 2017). However, apart from the city wall itself, a sarcophagus with a Lycian inscription, and some other Hellenistic sarcophagi at the foot of Tepecik Hill (Türkoğlu, 2022) we have no structural remains to date in this area that are pre-Roman. Although there are no architectural remains, it is highly probable that the classical and Hellenistic arterial road to Xanthos also ran through the Tepecik necropolis, under the later Roman road (İşkan & Aktaş, 2019, p. 198). Due to these structures, the Patareans of the pre-Roman period were certainly forced to take structural measures against the dangers of the Çakallık. However, such architectural interventions and their chronology can only be detected through future excavations.

People's efforts to defy the forces of nature have left their mark. Reading these traces in the context of the respective topography brings us closer to understanding human history, which is characterized by a constant struggle against the forces of nature. The Patareans were able to protect their extramural buildings from the flash floods of the surrounding hills with relatively small structures (canals, small bridges, etc.). Although these

structures were small, as seen above, they were certainly intended to be constantly maintained and repaired, e.g., after an earthquake or a flood disaster. Future investigations may reveal traces of such maintenance and repair work, which is extremely rarely recorded in written sources, as in the case of the oracle sanctuary of Apollo in Patara. Apparently, such infrastructural construction activities were not significant enough to be mentioned in written sources. However, they were/are very important for the functioning of a strong society.

In future studies of extramural anti-flash-flood measures, other aspects that would influence the behavior of rainwater on the ground need to be considered. Both are related to human activities: terracing for agriculture and tree cover. The agricultural terraces can be observed under this aspect. Many terraces were probably also built to slow down the flow of rainwater. Archaeo-botanical investigations could shed light on the contemporary situation of the tree population, which also plays an important role in the flow of rainwater on the ground.

In addition, the finds, i.e., tomb M52 and the church in the necropolis, show that Patareans were very careful when building in places that were sensitive in terms of natural hazards such as flash floods. They did not destroy these structures by new building activities.

In the case of Patara, this also opens ways of approaching the location of the famous oracle site of Apollo. In this way, at least the possible areas for its location can be determined in order to carry out targeted archaeological work such as geophysical surveys and excavations, which can be both time-consuming and cost intensive.

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