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PARTLY SUBMERGED QUARRY IN ANDRIAKE, THE PORT OF MYRA

Hakan Öniz¹, Nevzat Çevik², Çağlar Çakır³

Abstract

Ancient Lycia is a historical region with high archaeological potential that has been the scene of many civilizations for thousands of years. Many settlements, such as ancient Patara, Myra, and Phaselis, were established on these shores, and hundreds of shipwrecks such as the Kumluca, Uluburun, and Gelidonya Bronze Age shipwrecks have been found on this coastline. Aperlai, Theimussa, Simena, Dolikheste, and the Hellenistic-Roman ruins of Beymelek Lagoon constitute the archaeological settlements of Lycia that were submerged due to earthquakes. Earthquakes between the 1st and 5th centuries caused many collapses and slides on the Lycian coast. Underwater research conducted in 2022 and 2023 shows the collapses also affected a quarry on the coast. This sunken quarry is near Andriake, the port of the ancient city of Myra. Saint Nicholas I settled in Myra during the reign of Constantine (306-337) and became a bishop, causing Myra to be known throughout the Mediterranean. This article aims to understand the capacity of this Quarry near Andriake Port and the characteristics of the submerged part.

Key Words

Submerged quarry, earthquakes, underwater archaeology, underwater cultural heritage, Lycia, Aperlai, Myra

Introduction

The Western Antalya - Eastern Muğla coastline of Anatolia, called Lycia, is a region with high archaeological potential that has been the scene of many civilizations for thousands of years. Many significant archaeological remains have been documented on the Mediterranean coast, on the islands, and underwater, and probably many more are waiting to be discovered. Many settlements, such as the important historical cities of Patara, Myra, and Phaselis, were established on these shores, and hundreds of ships, such as the Kumluca, Uluburun, and Gelidonya Bronze Age shipwrecks, sailed on these shores. Aperlai, Theimussa, Simena, Dolikheste, and the sunken Hellenistic-Roman ruins documented in the

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Beymelek Lagoon constitute the archaeological settlements of Lycia that were submerged due to earthquakes. Earthquakes between the 1st and 5th centuries caused many collapses and slides on the Lycian coast. Underwater research conducted in 2022 and 2023 shows the collapses also affected a quarry on the coast. This article aims to understand the capacity of this Quarry near Andriake Port, the submerged part, the intended use of the stone blocks taken, and where they might have been used.

The Mediterranean coast of Turkey, which covers the provinces of Antalya, Mersin, Adana, and Hatay, with a length of approximately 1300 kilometers (Fig. 1), has been examined comprehensively since 2012. During this period, 335 shipwrecks dating from the Bronze Age to the Ottoman Period and hundreds of ship anchors from the same period were found on these coasts, and examinations were made in the ports of many ancient cities. These archaeological studies, carried out with the permission of the Ministry of Culture and Tourism of the Republic of Turkey, cover a wide range of areas, from underwater caves thought to have been used in the Paleolithic Period to early settlements that are now underwater due to water rises in the Holocene Period, from harbor structures buried under alluvial fills to ancient settlements that collapsed underwater due to tectonic movements. Similar submerged settlements known worldwide, for example the ancient city of Baia in front of Naples, are also found on the coast of Antalya. Many buildings in Kekova Island (Fig. 2) and the surrounding ancient settlements of Aperlai (Fig. 3), Theimussa, Simena, Dolikheste, and Andriake, located in Antalya, especially in the Lycian Region, were submerged after ancient earthquakes. The ruins of sunken buildings date back to the Hellenistic and Roman periods (Fig. 4) under the Demre-Beymelek Lagoon, a bay in the Mediterranean in the past that is today connected to the sea by a small channel.

An essential common point of many ancient coastal cities on Turkey's Mediterranean coast is the predominance of stone architecture. Starting from the Bronze Age, almost all cities used stones from the region's local resources in their architecture. Rock architecture and hybrid structures in Lycia began intensively in the Classical Period, and stone blocks taken from quarries were used to construct spectacular architectural structures, especially during the Hellenistic and Roman periods. This habit continued in the Byzantine Period, depending on the natural materials in the environment and the building tradition dating back to the Roman Period. Providing stone materials for buildings on the Lycian coast, consisting entirely of limestone cliffs, was relatively easy. In some coastal cities, ruins of quarries show that the quarries on the coasts were easily cut, and processed stones were available. There is a quarry on the seashore near Andriake Port, and stones from this Quarry must have been used in some nearby settlements, especially Andriake.

Andriake

In the excavations carried out in Andriake within the scope of the Myra and its port Andriake excavations since 2009, the granarium, agora, two baths, honorary monuments, a part of the port shops, workshops, synagogue, three churches and chamber tombs were completely and the shipyard area was partially excavated (Fig. 5). Myra and Andriake are located in the Demre district, in the south of the Teke Peninsula and in the west of the Gulf of Antalya (Çevik 2010b, 53; Çevik Bulut 2010, 37; Çevik 2013, 4-13; Akyürek 2016, 466; Aygün 2018, 34). Andriake, the port neighborhood of Myra, is located 4.7 km southwest of Myra, in the area called Çayağzı today. To the east of Myra is the Myros Potamos/Demre Stream, which flows through a 20 km-long deep valley and into the Mediterranean.

While the sediments carried to the shore by the Myros Stream and the sea provided plains suitable for settlement in ancient Myra and today's Demre, they also filled Myra and Andriake Harbor over time, causing the settlements to end. Geomorphological research has shown that the delta plain where today's Demre district is located was a gulf 7000-6000 years ago (Öner 2000, 1). Kumdağ Hill, where the central settlement is located in the south of Andriake Port, and Taşdibi, which is seen as a peninsula today (Duggan and Aygün 2014, 245-269), were each an island, and Beymelek Lagoon (Öniz 2016, 151-168) was a bay. About 3000 years ago, the alluviums brought by the Myros Stream and the material carried from the sea filled the bay over time, turning it into a plain suitable for settlement. With this filling, Andriake turned into a peninsula, and a natural harbor with a western entrance was formed. Today's Demre sits on the alluvial fill covering the Ancient Myra with heights varying between 4-9 m.

Four stone axes found on the surface of the northern and southern settlement of Andriake and the western slope of the entrance to the Sura Valley, and the Late Chalcolithic Period ceramic pieces found in the bottom layer during the Myra Theater Orchestra soundings are the earliest archaeological data detected in the settlement to date. These stone axes and Chalcolithic ceramics document early human activities and occupation in the coastal settlements of Lycia, dating back to the Chalcolithic Period. Strabon says that the Lycian coasts were rugged and difficult to pass, but their ports were extremely well-equipped (Geographika XII-XIII-XIV).

In addition to the large port settlements such as Andriake and Patara on the Lycian coast, there are also several small coastal settlements or piers belonging to the inner cities.

The privilege of using the ports and shelters, which are pretty dense in central Lycia, has been a constant subject of struggle between the cities. Ports developed under the auspices of the central city to which they were connected and brought privilege and power to the cities or central rulers to which they belonged. This situation is also evident in Andriake. Andriake has a special type of *epineion*, characterized by the settlement

structure organized with special functions as a trade and industrial center, founded and expanded by the central city Myra (Zimmermann 1992, 219). In addition to being a sheltered port for merchant ships sailing in the Mediterranean with its fortunate topographic nature, Andriake has become an indispensable stopover point for sailors with its facilities providing logistic support (Çevik et al, 2014, 233).

Although our information about the Classical Period of Andriake is quite limited, there are rich Classical Age assets, especially the rock tombs of the central city Myra. Considering the general history of the region (Çevik and Bulut, 2010, 25; Öztürk, 2010, 295) it is understood that Andriake was a crucial regional port in the Classical Period, depending on the power and presence of Myra (Takmer, 2006, 26, 38).

The settlement character of Andriake in the Hellenistic Period is much more evident than in the 4th century BC and before (Wurster 1975, 49-55, Fig.3, 8). Myra's defense system and structures all date back to the Hellenistic Period, and the primary defense point on the seaside of Myra is in Andriake Port. The garrison fortress and the watchtower in the east, seen on the two hills in the south of Andriake, indicate that the settlement and the port entrance were secured during the Hellenistic Period (Çevik and Bulut 2010, 37; Aygün 2018, 139).

The development of the port of Andriake reached its peak in the Roman Imperial Age. The Nero Period customs inscription, which contains the customs rules of the Lycian Union, shows that the port had high activity from the 1st century. It is understood from the Honorary Monuments built on the shores of the quay street in front of the Granarium, the busiest place in the port, that the city of Myra gave special importance to showing their loyalty to the Roman emperors during this period. A decree from the Period of Theodosius I (379-395 AD) regarding grain measurement was later engraved on the body of Monument No. I, whose first construction dates back to the Period of Tiberius, shows that the monument still stood in the 4th century AD.

Andriake port settlement experienced its most intense period during the Hadrianic Period. Along with the Granarium⁴ built in the southern settlement, other parts of the settlement were also expanded in this period. The structure, consisting of eight sections, measures 64.24×38.65 m. The building was consolidated, covered with its original roof, and turned into the Lycian Civilizations Museum (Şengül 2011; Çevik 2016, 18-29). The Commercial Agora to the east of the Granarium was built within the same building program as the Granarium, in the same period due to their complementary functions (Çevik and Bulut, 2010, 38). It is understood from the inscription engraved on the Granarium wall that this intensity, experienced in the port in the 2nd century AD, continued in the

⁴ Excavations in Granarium and Plakoma started in 2009 (Çevik 2010a, 57; Çevik and Bulut 2010, 43; Çevik et al., 2011, 406; Çevik, Bulut, Aygün 2014, 235). See, in general. (Ozturk 2022).

4th century AD (Wörrle 1975, 70; Foss 1994, 25). This situation coincides with the fact that the majority of the coins found in the excavation date to the same period⁵ (Bulut and Şengül 2010, 119-123, Table 2; Bulut and Şengül 2014, 81 Table 2). These large Granariums, built as 2307 m² in Andriake (Öztürk, 2022) and 1840 m² in Patara, indicate the importance Rome gave to the ports and cities in the Eastern Mediterranean. In this context, cargo ships carrying grain from Egypt to Rome could take shelter in the strategically important ports of Andriake and Patara (Işık 2011; Işkan and Koçak 2014, 271-294) in case of bad weather conditions and necessity. In these large silos, built-in ports, grain, and other products could be temporarily protected and provided logistics services.

The Agora, adjacent to the east of the Granarium, is also known as "Plakoma". It sits on an area of approximately 60x56 m. A monumental cistern measuring 23.6x12.1 m is in the middle of the Agora. The cistern is surrounded by shops with porticoes on all four sides, and their doors face the courtyard. It is understood that the shops were two-storey. Andriake's only square is on the east side of the Agora. As in all Andriake, activity in Plakoma increased parallel with the settlement since the 4th century AD. During this period, it can be seen that the trade center was primarily focused on Granarium and Plakoma. In parallel with the increasing traffic of Andriake Port, structures to meet the social needs of sailors have also been built. Two baths attract attention among these social structures clustered in the eastern part.

The 3rd century AD in Lycia was also when Christianity began to spread. Myra owes its fame in this period to St. Nicholas of Myra. Saint Nicholas settled in Myra during the reign of Constantine I (306-337) and became a bishop. The famous Saint, who founded his church and spread his teachings from here, spent his entire life in this city and was buried in his church in Myra (Ötügen 2006, 523-536). Its church and martyrion continue to be visited as a pilgrimage center for Orthodox Christians today.

With the declaration of the capital of Lycia during the Theodosius II Period (408-450 AD), the metropolitan position of the region passed to Myra, and the city became a religious and administrative capital (Foss 1994, 23). For this reason, Myra reached its most considerable territorial limits in the Late Roman-Early Byzantine Period. Andriake Port has developed due to its location on the main sea routes between Eastern Mediterranean ports. Thus, as the port of Myra, the chief metropolis of the region, Andriake strengthened its position as the region's main port. In parallel with the developments, intense construction activities were carried out in Andriake during this period. Five of the six churches in Andriake date to the 5th century AD. The fact that the churches were built in the same period can be explained by Myra being a metropolis and

⁵ The densest group of jewelry found in the Myra and Andriake excavations dates back to the 2nd-3rd AD. It contains finds dating back to the 19th century. For jewelry in general, see; (Talu, 2020)

that they were built to serve the people who came to visit the martyrs of the saints in Myra during the pilgrimage that increased after the 5th century AD. It is thought that the walls in the east were built during the Justinianic Period, and those in the west were built in the middle of the 7th century AD, when Arab attacks increased, or in 655 AD or later when the empire lost its Mediterranean sovereignty.

Myra was rebuilt after the great earthquake that occurred in 529 AD and affected all of central Lycia. In the port of Andriake, partially revived during this period, trade was interrupted due to security reasons with the Arab raids, and the use of the port began to decline again. On the other hand, Vita Nicolae Sionitae, written after the death of Nicholas of Sion (527-565 AD), not only contains important information about the religious and social life of the region, but also mentions Andriake as an epineon/anchorage or emporion/trade center (Anrich 1913).

Coins from Constans II (641-668) and ceramic finds dating back to the 7th-8th centuries AD show that the settlement began to be abandoned and lost its importance in this period. Only one of the green-glazed Byzantine ceramics, which began to be produced after the 8th century AD, has been unearthed. Unlike in the southern settlement, precautions were taken against Arab raids in the northern settlement, with the walls built to include residences and churches. The city walls extend along the ridge north of the settlement, and after D Church in the east, they turn south towards the Andriakos Stream. In the western part, it turns towards the port where the Andriakos Stream meets the sea. The walls in the northern settlement of Andriake must have been built in the 6th-7th centuries AD. On the other hand, the fact that Andriake is not mentioned in medieval portos suggests that the port lost its importance compared to the Early Byzantine Period.

The lack of sufficient archaeological material to date after the 7th century AD in the southern settlement can be explained by Arab raids or the filling of the harbor with alluvium during this period. Inevitably, Andriake was also affected by the Arab raids that the Lycian coast was subjected to in the 7th century AD. In addition to these data, 21 of 917 of the 4250 coins identified during the excavations in Andriake date back to II. It should also be noted that 11 belong to the Constans Period (641-668 AD), and 11 belong to the 10-13th century AD. In this case, the period between the 7th and 10th centuries AD remains twilight.

As summarized above, local limestone was primarily used in the periods and construction programs of Myra and Andriake. It is seen that building stones were cut and used almost entirely from local quarries in the large building projects of the Roman Period, especially in the granarium, agora, baths, and other structures in Andriake. The same situation is valid at Myra Theatre. Andriake quarries discussed in this research are essential in understanding and documenting building stone resources.

ANDRIAKE QUARRY (Fig. 6, 7)

Documentation studies were carried out in the Quarry on the south coast of Kumdağ, east of Andriake, in 2022 and 2023. The Quarry in question is 1900 meters as the crow flies from Andriake and 4600 meters from the ancient city of Myra, which is inland. The distance between the Quarry and Andriake by sea is 4500 meters, and the distance to other nearby cities is 10 km to Simena and 12 km to Themisussa. These distances can be reached by a sailing ship in 1 to 3 hours in suitable winds.

The Quarry was opened within the Upper Cretaceous Beydağları Formation, located within the Beydağları Autochthonous. This formation, defined as neritic limestone, was deposited on the carbonate shelf. This rock is rich in organic clastics and has the characteristics of a medium and sometimes thick layer. Dolomitic limestones and recrystallized limestones are occasionally encountered in this formation: beige, light brown, cream-colored, light gray, and dirty white (Şenel et al. 1994: 15).

The studies carried out included taking aerial photographs with a drone, making drawings both on land and underwater, cleaning algae and similar residues in the part that remains underwater today with scuba diving, taking photographs and determining water level changes, and making orthophoto applications from underwater and aerial photographs (Fig. 8). Within the scope of the studies, stone samples were taken from both the Quarry and the crucial buildings in Andriake and Myra, with the permission of the Ministry of Culture and Tourism.

It was determined that stone was taken from an average of 3100 m² of the quarry area, which spread over a total area of approximately 6000 m². Stone was quarried from approximately 900 m² in the western part of the Quarry and approximately 2300 m² in the eastern part. Most of the stones taken are block stones quarried for use in buildings (Fig. 9). However, in some places, there are also cut marks of blocks thought to have been removed to make sarcophagus tombs (Fig. 10) and sarcophagus lids (Fig. 11). An area of approximately 1350 m² in the eastern part is submerged (Fig. 12, 13). In these underwater areas, channels opened for stone extraction and traces of block stones are visible (Fig. 14). In a study conducted before 1999 to determine the Holocene coastal changes between Antalya and Andriake, the Quarry was also examined. In this study, the "Fossil Notch" on the coast was measured as 1.5 m (Fauche et al. 1999, 310), and the sea level change was added to the drawings as approximately 125 cm quoted (Fauche et al. 1999: 308- Fig.4). In the studies carried out in 2022 and 2023 (Fig.15, 16, 17), archaeological data were used and calculations were made based on the traces left by the stonemasons. It is thought that many buildings in Andriake were built in the 4th-3rd centuries BC, the wealthiest period of the city. Accordingly, the average change between 2300 years ago and today's sea level is approximately 2.50 m. Studies carried out in the Quarry show that the depth of the section below today's sea level varies between 1.55 m and 2.80 m (Fig. 6b). The dominant ground, from which stones are taken, is between 2.20 - 2.40 m. There is no impression that

stones were taken from the area measured as 2.80 m, and it may be possible that this pool was opened during cutting operations or could be described as an "intertidal pool."

There are also submerged structures in Beymelek Lagoon, a lake connected to the sea today, and a bay in the Mediterranean when it was used. Of these completely submerged structures, the quay walls and bath structure date back to the Roman period, while the breakwater ruins date back to the Hellenistic period. This breakwater was thought to be an alternative port for both nearby Ission and Myra for a while. According to the measurements made in the Hellenistic breakwater, a water rise of 2.20 m was determined in the deepest part of the breakwater blocks (Öniz 2016, 155). The ancient cities around Kekova Island, located 5500 - 12800 meters to the west of the Quarry, are also located in the same tectonic area, and there are submerged areas on the coasts of these cities. A water rise of 150 cm was recorded in a breakwater structure located on the northern coast of the island (İde, 2011: 66). A study was carried out in the Aperlai Ancient City, located in the west of Kekova Island, between 1997 and 2000. Based on archaeological data, a water rise of approximately 2 meters was measured in Aperlai, which was founded in the 4th century BC and partially submerged (Hohlfelder and Vann 2000, 127). There are active normal faults in the North-East and Southwest directions in the Andriake-Myra region. The distance between Andriake Quarry and Beymelek breakwater is 9300 km, and the distance between Aperlai is 18 km. In this region, which is located in the area of influence of the same fault, earthquakes in 141 AD, 240 AD, and 344 AD (Softa et al. 2018, 51), and in 529 AD and later, damaged the structures in Aperlai in the west, Andriake Quarry in the middle, and Beymelek Lagoon in the east. It can be understood that it caused a collapse of approximately 2.00-2.50 m.

The area where the collapse spread between Beymelek Lagoon and Kekova Region is approximately 23 kilometers long. Another place where this type of collapse occurred in the Mediterranean is off the coast of Naples, Italy. There was a subsidence of 0-15 meters (Bruno et al. 2015, 41) on the coastline of 20 km as the crow flies, 33 km from the sea, between the Port of Naples and the Cuma Archaeological Park to the northwest. Located within the Phlegraean (Campi Flegrei) volcanic complex, this area also includes the famous ancient city of Baiae. The Phlegraean supervolcano region, which includes Mount Vesuvius to the west of Naples, is characterized by hydrothermal manifestations, a slow rise/collapse phenomenon called bradyseismic, and frequent earthquakes (Paeoletti et al. 2005, 51).

Cult Niche in the Quarry

A niche measuring 45x35x18 cm was opened on the flat cut face of the bedrock that emerged after the first blocks were taken in the western part of the Quarry (Fig. 18). There is a thin channel to direct the

rainwater that will flow over the niche out of the niche and to protect the interior of the niche from water. Under the niche, a herbal ornamental relief of cedar leaves is carved, approximately 100x45 cm in size (Fig. 19a, 19b). It is seen that mortise holes were opened on the reliefs for some application purposes. Above the niche are two crosses, one large and the other small, which were engraved later. The style of the cedar leaves suggests the 4th century AD or slightly earlier. The fact that it is open in the open air opened onto the main rock face, and decorated with kangaroo leaves suggests that it was for cult purposes. Since this place had no function other than a quarry in the Roman Period, it is thought that the niche was probably a cult niche used by stonemasons and workers to protect themselves from accidents and to meet reasonable production expectations. There are similar niches of this type in the region. However, the region does not know a niche arrangement decorated with kangaroo leaves. This makes the Andriake quarry niche a little different/unique.

Similar examples in the Mediterranean

Ancient cities and ports built primarily on the coasts provided their stone needs from the nearest coastal areas. These quarries can sometimes be found even within the city (Öniz, 2021: 86). In many ancient quarries located on the seashore, there are stone-cutting areas that are partially submerged. These partially submerged quarries on coasts with small tidal ranges provide essential data on Late Holocene relative sea-level change and tectonic activity as indicators of ancient sea level (Scicchitano 2019, 81).

A water rise of 6-33 cm was observed in 13 quarries in the Mediterranean where millstones were mined between the last 1450-250 years (Antonioli et al. 2017, 13). These quarries, which will give an idea about the Mediterranean generally, are located in Spain, France, Greece, and Israel. This water rise seen in similar quarries in the Mediterranean is compatible with late Holocene sea level changes. Koyunbaba Quarry, dating back to the Classical Period and serving the ancient city of Myndos, is also located on the seaside, like Andriake Quarry. The sea level change measured here was -30 cm. (Dumankaya 2015, 42). Myndos Koyunbaba Quarry is also compatible with the late Holocene water rise in the Mediterranean regions mentioned above.

There are more than 50 quarries off the coast of Sicily, most of them partially submerged, which have experienced sea level changes under multiple factors (Scicchitano et.al, 2019: 81). Studies conducted in 6 partially submerged quarries in the southeast of Sicily are explained by both late Holocene water rises and regional tectonic activities. Of these, S. Calorio Cape shows a water level difference of -58 cm, one of the two quarries in S. Calorio Bay shows a -61 cm, the other -12 cm, and the quarry in Augusto-Bonico Cape shows a water level difference of -13 cm (Scicchitano et.al, 2019: 88, Table 2). Of these, S. Calorio Cape is -58 cm.

one of the two quarries in S. Calorio Bay is -61 cm, the other is -12 cm, and the quarry in Augusto-Bonico Cape is -13 cm. It shows the difference in water levels (Scicchitano et al., 2019: 88, Table 2). The sixth Quarry is Marzememi quarry. Marzememi, dating back to the 5th century BC, is probably the largest quarry in southeastern Sicily, with a surface of approximately 36,800 m² and various levels of operation. The deepest point of this quarry was measured at 1.34 m, which is thought to be due to tectonic activities experienced in a fault north of the ancient city (Scicchitano et al. 2019, 88).

XRF Analyzes

Samples from different parts of the Quarry were selected to understand where the stones taken from Andriake Quarry might have been used. In addition, to learn about the possibilities of using other quarries, samples were taken from the modern quarry area (Myros Quarry), which could be a possible quarry of the Ancient City of Myra, and from the bedrock in the south of Andriake Granarium, with the thought that it might have been used in the structures in Andriake. Stone samples were taken from important buildings to understand whether the blocks extracted from this Quarry were used in the buildings in Myra and Andriake. These are the theater from Myra, Granarium, Agora, and Synagogue structures from Andriake.

XRF analyses were performed to determine whether the samples from the structures were compatible with the Quarry (Table 1). As a result of the analysis, the Pearson Correlation method was applied between the element values of the stones of the buildings and the element values of the rock samples taken from the quarries. According to the analysis results, except for the sample taken from the Myra Triglyph Metope blocks (TT01), which were reused from older buildings, it was determined that there was a high level of relationship between other building materials and quarries. Since all samples were limestone and the sampled quarries were located on the same lithological formation (Beydağları Formation), a high level of correlation was detected between the building samples and all quarry samples. For this reason, minor differences between high correlation values were considered when evaluating which building material could have been extracted from which Quarry. In this context, the stones used at Andriake Agora 2 (AG02), Andriake Synagogue 2 (SG02), and Andriake Granarium 2 (GA02) are from Andriake Quarry North 2 (TOK02); likely, the building material used in Andriake Synagogue 1 (SG01) was taken from Andriake Quarry West 2 (TOB02). These results support the possibility that the methods closest in distance and most practical in logistics were used.

It is seen that the sample taken from Andriake Agora 1 (AG01) was taken from the bedrock (GK01) in the area where the Granarium is located. The existence of a quarry within Andriake is still being determined. However, during the studies carried out in the region, it was learned that there was a small, partially submerged quarry in the past, now under the construction of a modern dock 800 meters from the port. In addition,

while laying the foundations of the large structures that make up the settlement, blocks should have been removed from the primary rock and used in the structures as a practical and economical method. The exact process was also used when opening cisterns and other structural deposits. Analysis results support this idea. A similar situation must have occurred in Myra as well. It is thought that the stones used in the Myra Theater 2 (TY02) structures were quarried from the Myros Quarry 2 (MY02) location (Table 2). However, the values here are very close to those of Andriake Granarium (GK01), which is in the same limestone formation. Although the XRF analyses generally support possible applications, the following two results do not seem compatible with the general picture. Accordingly, it seems that the stone in the Myra Theater 1 (TY01) sample may have been quarried from Andriake Quarry South 2 (TOG02), and the stone used at Andriake Granarium 1 (GA01) may have been quarried from Myros Quarry 1 (MY01). However, bringing stone from stone beds far away from these structures seems economically and technically difficult and unnecessary. The main reason for the similarities between quarries/stone resources is that the quarries in the region generally have the same lithological formation.

Analysis results confirmed that the stones taken from Andriake Quarry were used in Andriake Port structures. However, the quarry capacity is only sufficient to build an average of 2/5 of the Andriake East section. This situation shows that Andriake also took stones from the bedrock in its immediate surroundings for its structures. Since there is no road visible in the land part of the Quarry, it is clear that the stone blocks were transported from the coastal Quarry to Andriake by sea. The rocky structure on the seashore served as a natural dock, thus allowing a ship to dock and be loaded. Andriake's docks are also very suitable for unloading stones from ships. Transporting stone blocks of considerable size and weight by sea using appropriate marine vehicles is always the first option that comes to mind. This study has demonstrated the accuracy of this idea. Andriake quarries have contributed to this type of scientific study on issues such as quarry location selection, area planning for cutting, logistics planning, stone-block cutting, extraction techniques, and quarry cult.

The Quarry must have experienced an average sea level change of 6 cm to 33 cm due to the late Holocene water rise in the Mediterranean. However, measurements made based on archaeological data within the scope of this article show a water rise of approximately 250 cm. This water level change can be explained mainly through tectonic movements occurring in regional faults. In other words, the primary factor in the sea level change in Andriake Quarry is tectonic effects, and the secondary factor is the rise of Late Holocene water. The collapse in the region is seen along the coastline of approximately 29 kilometers, both in the structures in the Beymelek Lagoon in the east and in the ancient settlements around Kekova Island, including Aperlai in the west. Similar collapses affecting the archaeological sites in the Gulf of Naples and

Sicily Marzememi in the Central Mediterranean are also located around Antalya-Andriake in the Eastern Mediterranean.

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Figures



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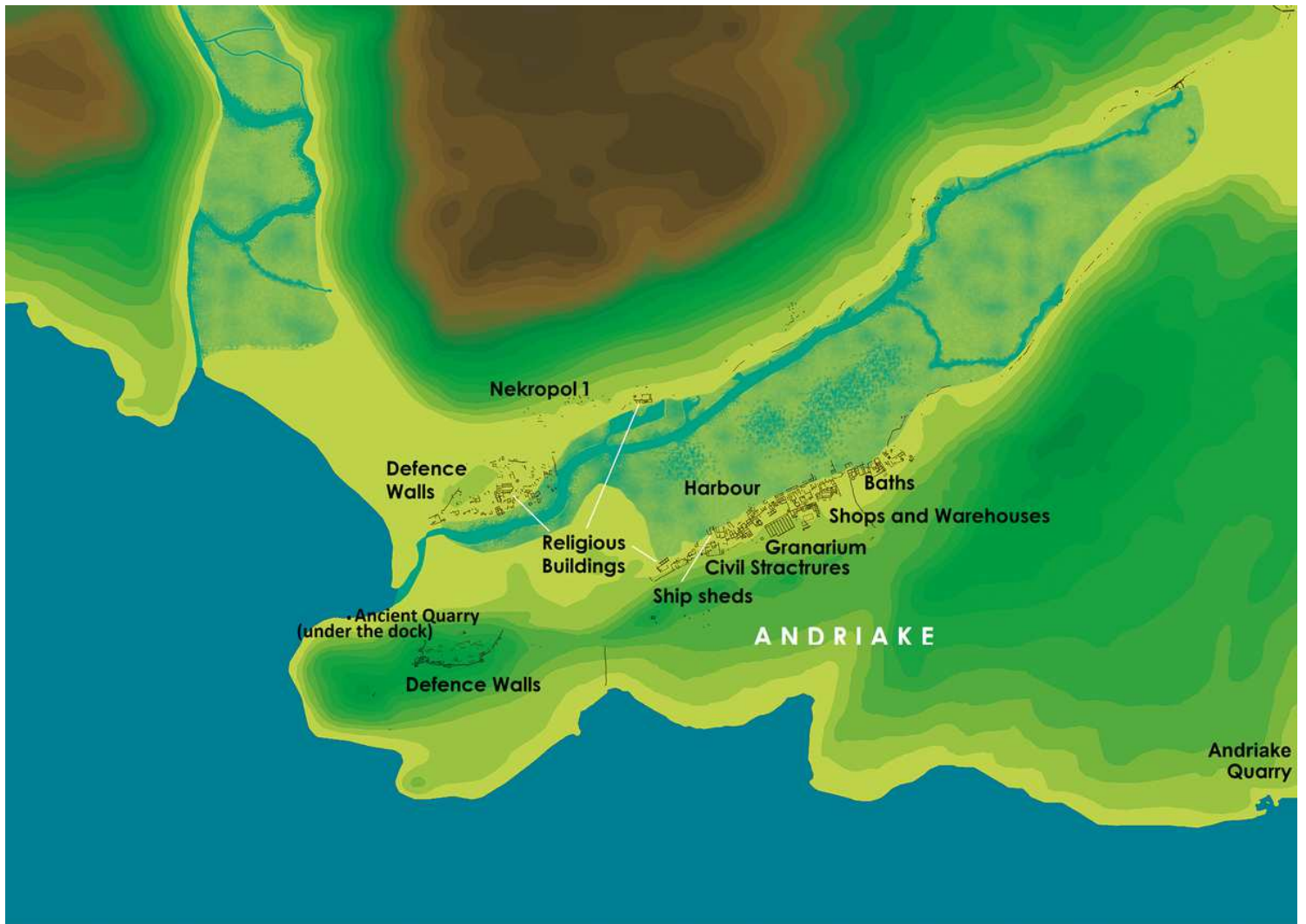
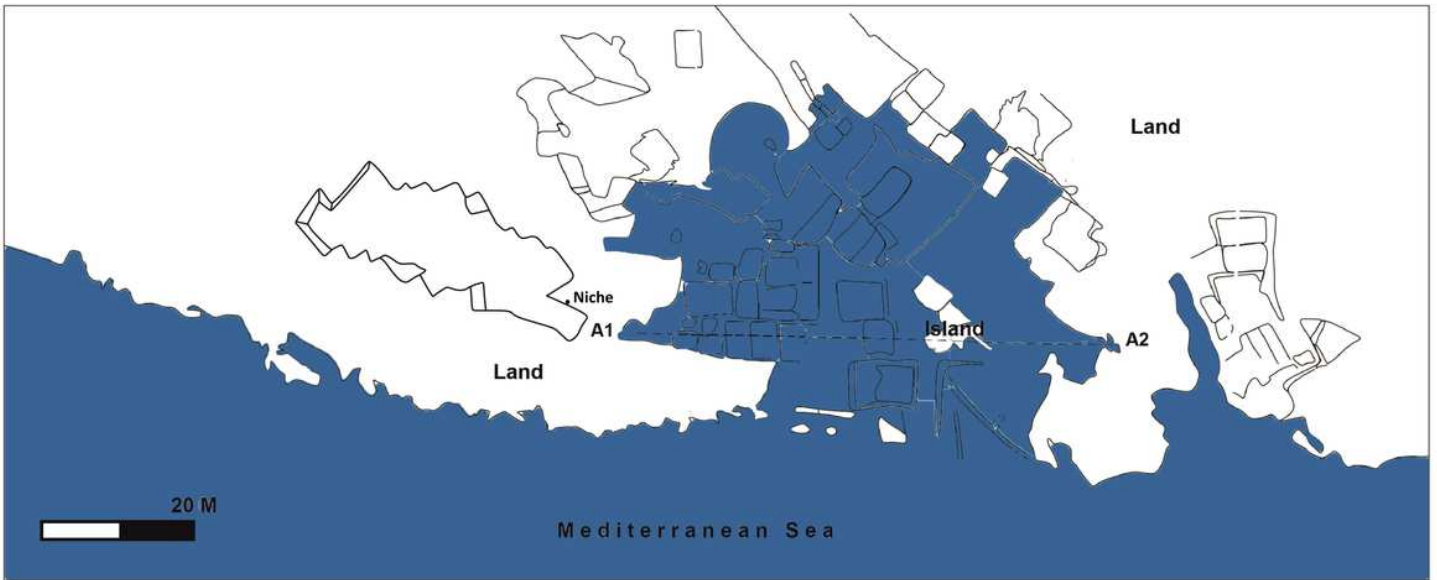
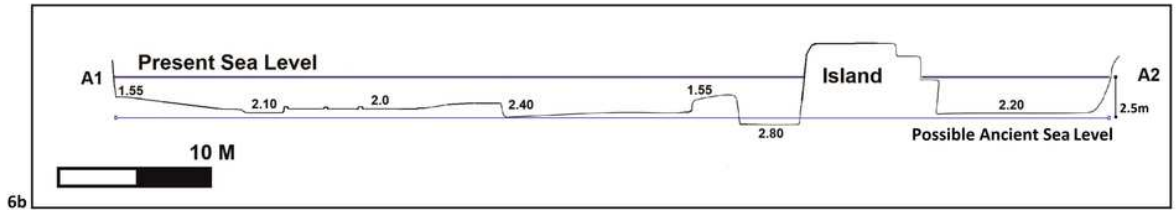


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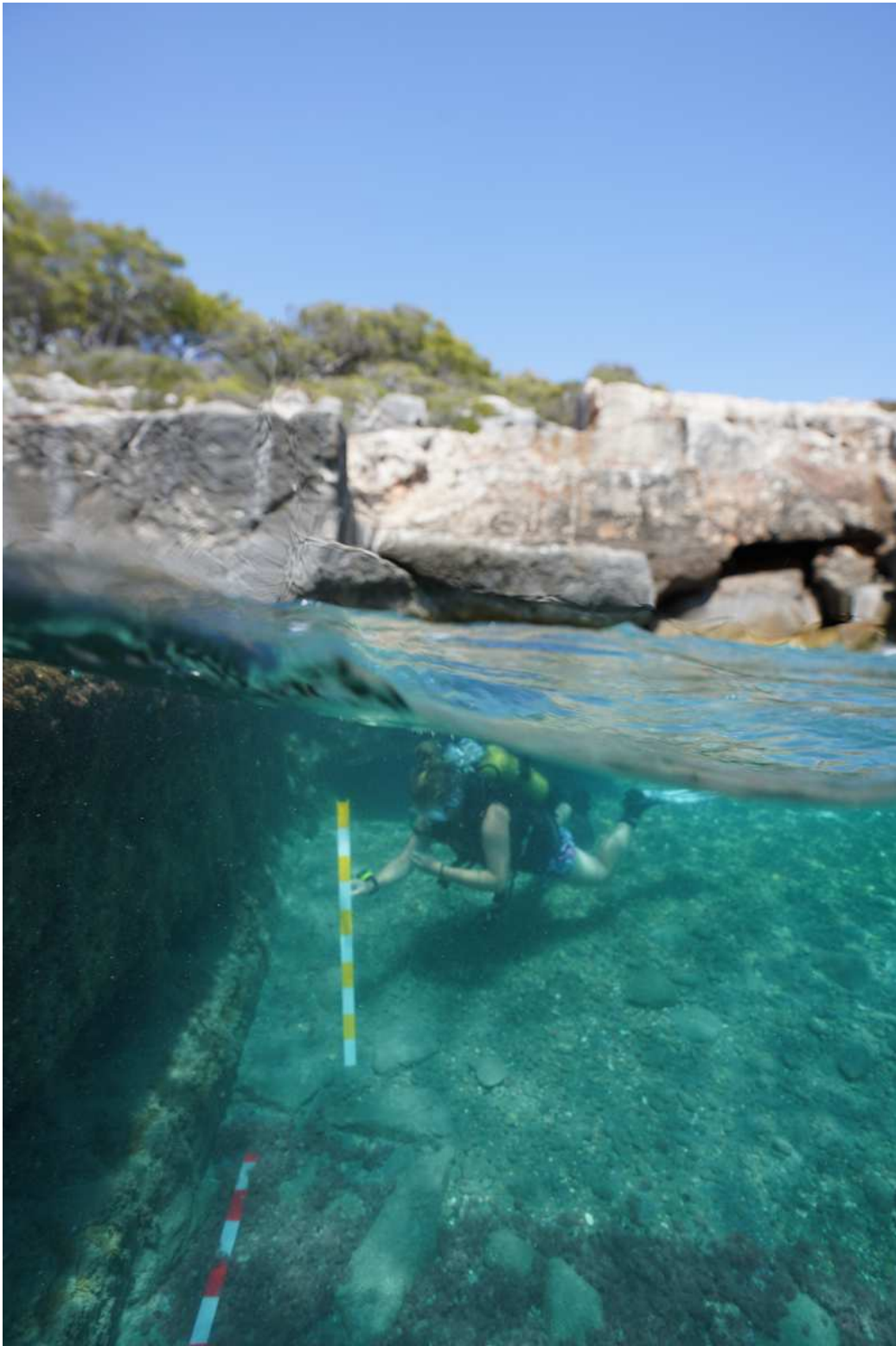


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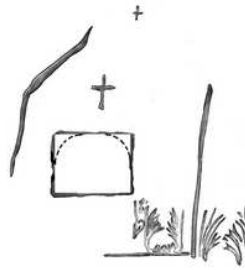


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