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Short Paper

# A short note on the geo-archeological significance of the ancient Theodosius harbour (İstanbul, Turkey)

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ABSTRACT

The sedimentary sequence discovered at archaeological excavations in ancient Theodosius Harbour at İstanbul contains the records of sea level, environmental changes and the cultural history of the region. The cobbles at the base of the sequence include archaeological remnants of Neolithic culture that settled in the area between 8.4 and 7.3 $^{14}$C ka BP, and are located at 6 m below the present sea level. The sediments representing a coastal environment indicate that the area was used as a harbour from AD 4th to at least the 11th century and were filled by the sediments derived from Lykos Stream after 11th century.


## Introduction

As the capital of two world empires, the historic significance of İstanbul is self evident; furthermore, due to its strategic location at the crossroads connecting Anatolia with southeastern Europe and the Black Sea basin to the Mediterranean, it has always been of prime importance in the history of civilisation. Along with its historicity, the geographical setting of the city is of significance, featuring unique but at the same time environmentally critical characteristics. First, it is located at the narrow neck of a shallow and long water channel, the Bosporus, connecting two inland seas, Marmara and the Black Sea. The controversy on the water exchange system between those two inland seas, coupled with the impact of the active neotectonic structure of this particular region, presents İstanbul as a unique case for geoarchaeology.

This short note is based on the preliminary assessment of the data that became available through the rescue excavations conducted through the construction works at Yenikapı, located along the northern coast of the Sea of Marmara, in the historic core of İstanbul (Fig. 1). The construction activity at Yenikapı is being carried out within the framework of an urban development program of İstanbul, a large-scale undertaking to connect the new urban areas on the Asian part of the town with the historic core on the European section by building a tube tunnel resting on the sea floor. During the initial stages of quarrying for the construction of the Marmaray Rail-Tube Tunnel, remains of a Byzantine harbour dated to the time of the Emperor Theodosius was recovered; later the excavations were carried out by a team of the İstanbul Archaeology Museums (Kızıltan, 2007). Underneath what remained of the harbour, the sedimentary sequence has revealed stratified deposits displaying the records of changing environmental conditions in the Sea of Marmara together with the well-preserved archaeological material of ancient İstanbul. The outcome of these rescue operations have revealed results far beyond all anticipations, not only disclosing a rich and a unique assemblage of archaeological material, but also broadening our understanding of the changing paleoenvironmental conditions of the Marmara basin during the Holocene and compiling the lacuna in the geological history of the Sea of Marmara.

The evidence at Yenikapı now provides a much-needed time scale to correlate environmental history with the cultural sequence as an indicator of human adaptations patterns to changing conditions. In this respect, the numerous artifacts and architectural fragments that could be ascribed to previously known cultures being imbedded in natural sedimentary sequence has provided a unique opportunity. Within the frame of a multi-disciplinary research programme, this short note is the presentation of first results based on field observations and some radiocarbon dating results of geological

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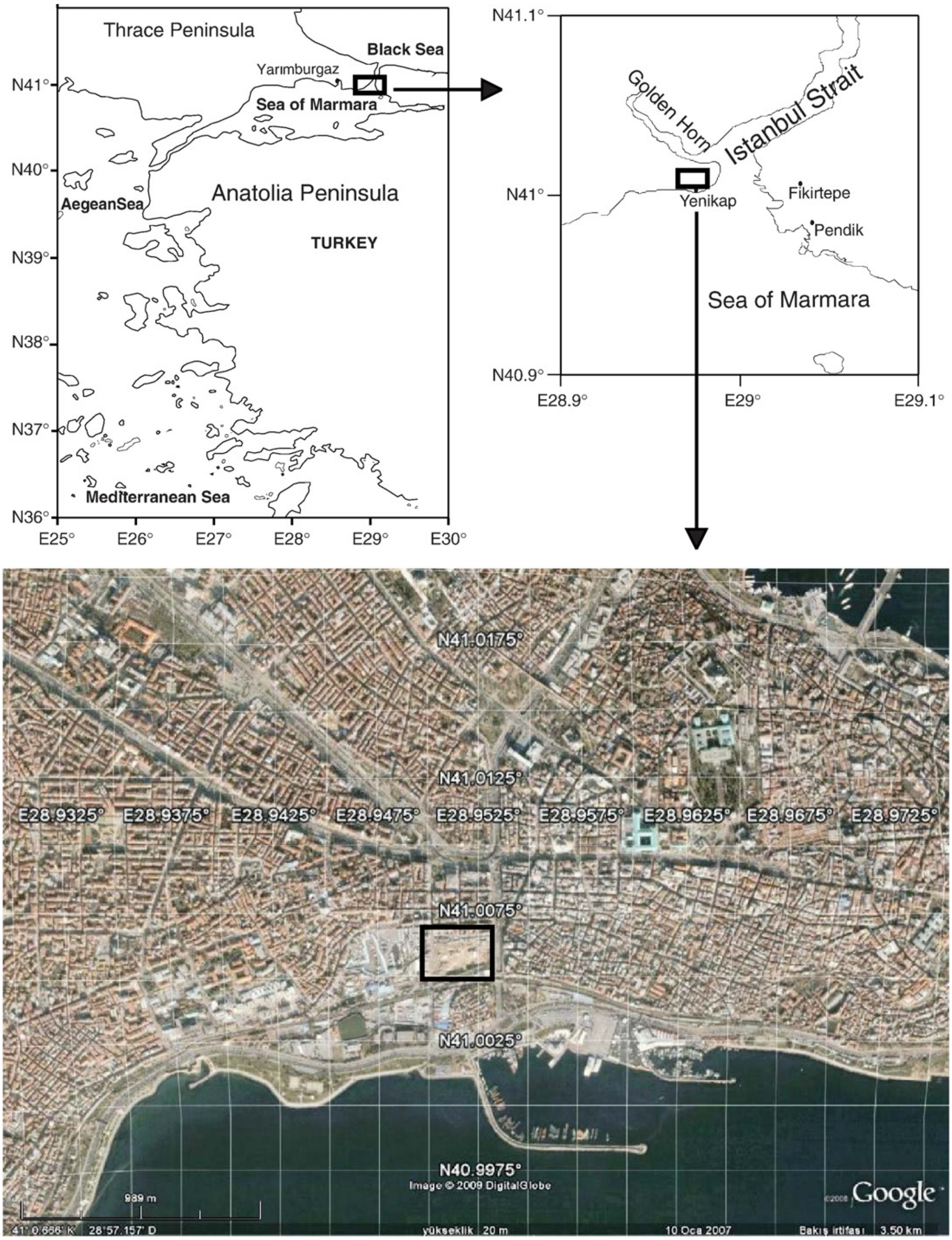


**Figure 1.** The location of the excavation site in İstanbul. Digital image is produced from Google Earth 4.3.

material from the excavation site. Prehistoric archaeological material dating is used by analogy with the material studied by Özdoğan (1997, 2006, 2007) elsewhere in Marmara Region.

## Geological setting

The Sea of Marmara features some unique characteristics that are of high scientific interest. First, it is in a region having continuous tectonic activity over the last 5 Ma from the strike–slip regime of the North Anatolian Fault Zone. It also connects two oceanographically different marine realms—the brackish Black Sea via İstanbul (Bosporus) Strait and normal marine water of the Mediterranean Sea via the Çanakkale (Dardanelles) Strait. The depths of the sills in these straits (Bosporus, −30 m; Dardanelles, −60 m) control the water exchange and bottom-water circulation at present and have played important roles during late Quaternary oscillations of sea level. The shelf areas of the Sea of Marmara were exposed to subaerial erosion and subject to delta progradations, during the last glacial maximum, due to lowering of the global sea level. The connection with the Mediterranean Sea via Çanakkale Strait occurred at ~12 $^{14}$C ka BP as a result of rising sea level (Stanley and Blanpied, 1980; Çağatay et al., 2000; Aksu et al., 1999; 2002).

However, the timing and mode of connection with the Black Sea is debatable. A strong and persistent outflow of the Black Sea into the Sea of Marmara at ~11–9 $^{14}$C ka BP following the intrusion of the Mediterranean waters is supported by Çağatay et al., (2000) and Aksu et al., (2002). On the other hand, an abrupt Mediterranean transgression at ~8.4 $^{14}$C ka BP, submerging the low shelf area of

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the Black Sea (Ryan et al., 1997, 2003), contradicts this view, as does the transgressive and regressive cycles in the Black Sea during Holocene (Fedorov, 1978; Chepalyga, 1984; Yanko-Hombach, 2007). All these studies were based on data collected from the shelves and deeper parts of the Marmara and Black seas. At the coastal area of the Sea of Marmara, faunal compositions of the littoral sediments indicated that various coastal depositional environments drowned with the rising sea level at ~8 ka (Meriç and Algan, 2007).

## Archaeological setting

Throughout the entire span of human past, the region around İstanbul has been of critical importance in understanding past interaction between distant geographical entities. Among the most debated issues is the role played by northwestern Turkey in the dispersal of early food-producing sedentary communities. This era, commonly known as the Neolithic Period, is considered as one of the most significant turning points in the history of civilization, because in the course of this cultural stage a number of revolutionary changes took place in the socio-economic structure of social life that are foundations of our present civilization.

The emergence of this cultural stage has been well-documented through hundreds of archaeological excavations. It has been attested that the incipient stages of Neolithic way of life first began in various parts of the Near East and Central Anatolia as early as ~12 $^{14}$C ka BP. On the other hand, the appearance of earliest Neolithic communities in southeastern Europe, including Thrace, began much later than in the East, about 8.6 $^{14}$C ka BP, implying that the emergence of Neolithic culture in southeastern Europe was triggered by events on the Anatolian peninsula.

The mode of this dispersal is highly disputed (Özdoğan, 2005, 2008); among numerous hypothesis formulated on this issue, migration of the Neolithic farmers, a transfer of commodities and of knowledge, acculturation and autochthonous development in the Balkans are among the suggested solutions. It is evident that the solution of this problem lies in obtaining concrete data from the region of İstanbul, as it constitutes the main contact zone between the Near Eastern–Anatolian cultural sphere and the Balkans. Prior to the recoveries at Yenikapı, the principle source of our knowledge of this subject depended on the excavations at Fikirtepe and Pendik, both on the Asian side of İstanbul, to Yarımburgaz Caves (Fig. 1) on the European side (Özdoğan, 2007). Along with these three excavations, other excavated sites in northwestern Turkey–mainly Ilipinar, Menteşe, Barçın and Aktopraklık on the Anatolian side of the Sea of Marmara; and Toptepe, Aşağı Pınar and Kanlıgeçit in Eastern Thrace–have drawn the main outline of the cultural sequence of this region and have defined artifact assemblages (Özdoğan, 2006). Even if there are gaps in our knowledge, the main line of the cultural sequence of this region from 8.4 to 6.8 $^{14}$C ka BP is more or less clear.

## The significance of sedimentary deposits and archaeological findings from Yenikapı

The excavation site is located at the southern coast of the so-called old town of İstanbul, a peninsula bounded to the north by the Golden Horn and to the south by the Sea of Marmara (Fig. 1). There are two main types of sedimentary sequences below the artificial fillings in the excavation site (Algan et al., 2007), fluvial-deltaic and marine in sequential order (Fig. 2). Artificial fillings (P1) include debris from the Byzantium period to recent and also organic soil of Ottoman period. A fluvial-deltaic sedimentary sequence (P2) is found below the artificial fillings. It has a thickness of about 1 m and was deposited from the detritus of Lykos (or Lycus) Stream (Bayrampaşa Deresi), flowing through the old town until the early AD 1950s. This sequence is represented by alternating graded and non-graded predominantly coarse-grained sediments. The lithological variations within this sequence can be considered as responses of the Lykos Stream to the some short-term climatic changes. Human artifacts, broken and rounded ceramics are common at its upper part. Ceramics pieces range from 11th to 8th centuries. Small distributary channels and their fillings were also observed within this sequence. Channel fillings consist of discrete sandy, gravely layers intercalated with black charcoal and with other organic inclusions.

A fluvial-deltaic sequence overlays the marine sequence and consists of six different units (P3–P8) (Fig. 2). P3 is represented by beige-coloured fine sands with local cross bedding. It laterally includes silt- and clay-sized bands where some seismite-type bedforms are observed. P4 also consists of light-coloured sands, including mollusk shells scattered and/or as discrete layers. More than 20 sunken ships and wrecks are found at the upper part of this relatively thick (>3 m) unit. Some of these ships docked at the harbour might have possibly sunken during a strong storm (Pulak, 2007). The underlying unit, P5, has a thickness of 20–50 cm and displays a chaotic nature. It includes abundant broken fragments of pottery vessels, bones, marble blocks, coins and broken glasses within a silty-clayey sediment matrix. Its fine-grained component decreases in northward and is represented as discrete silt and clay bands. The erosive base of P5 and its intricate content suggest an abrupt event, such as tsunami, strong storm or a flood. Although it was associated to a tsunami event caused by the AD 553 İstanbul earthquake, considering the amphoras of 5th to 7th centuries (Perinçek et al., 2007), further studies are necessary to clarify this hypothesis. P6 is a sandy unit and includes small-scale cross bedding. P7 is less than 1 m thick and is represented by abundant shell and their fragments (shell hash) with coarse sands in the south. Local gravel clusters intercalated by coarse sands are found in its northern extension. It is underlain by unit P8, which has laterally two different facieses: sands and shell bank.

There are gravels, cobbles and boulders at the base of the marine sequence. Gravels and some of the cobbles are mostly well rounded and include burrows by organisms. They are derived from the Paleozoic and Cenozoic units of the İstanbul area. These gravels and boulders are mainly underlain by Miocene-age formations and locally by a homogeneous dark gray-blackish clay deposit. The thickness of this clay deposit is about 5–6 m, and its external form is circular with a radius of about 250 m. It possibly was formed in a small swamp, as several wood pieces and some big tree roots are found in it. The marine units are characteristics of deposition in a shallow marine-coastal environment, after a transgression of a land area.

$^{14}$C age determinations of geologic material were performed at Arizona University, Geoscience Department (Table 1). A charcoal sample from P2 yielded an age of 1195 ± 100 $^{14}$C yr BP (AD 694–748, Table 1) is comparable with the 8th century ceramics found in the same unit. Mollusk samples from units P2 to P6 range between 1.2 and 2 $^{14}$C ka BP, indicating a high sedimentation rate for about 500 cm of the sequence. Two of the ages obtained from P7 (Fig. 2) are quite close to each other (3.3 $^{14}$C ka BP); but the oldest one (6015 ± 150 $^{14}$C yr BP) just below them suggests a time gap and may imply to a lowering of sea level during 3.3–6 $^{14}$C ka BP. However, this needs to be clarified by further dating efforts.

From the gravel-cobble layer to the Miocene bedrock, the following archaeological assemblages were detected:

A few sherds of Early Iron Age (~3.3–2.8 $^{14}$C ka BP, Özdoğan, 2003) were noted most possibly above the gravel-cobble layer. None of the sherds had any indication of abrasion implying that they have not been washed in through fluvial or marine action.

In the mixed deposits between the *in situ* prehistoric architectural layer and the covering cobble fill, numerous sherds of various cultural stages have been recovered, but with no indication of stratified order. Among the datable sherds, the latest are of the so-called Toptepe Culture (Parzinger and Schwarzberg, 2005), contemporary with middle Karanovo IV of Bulgaria and Aşağı Pınar 3-2 of Eastern Thrace

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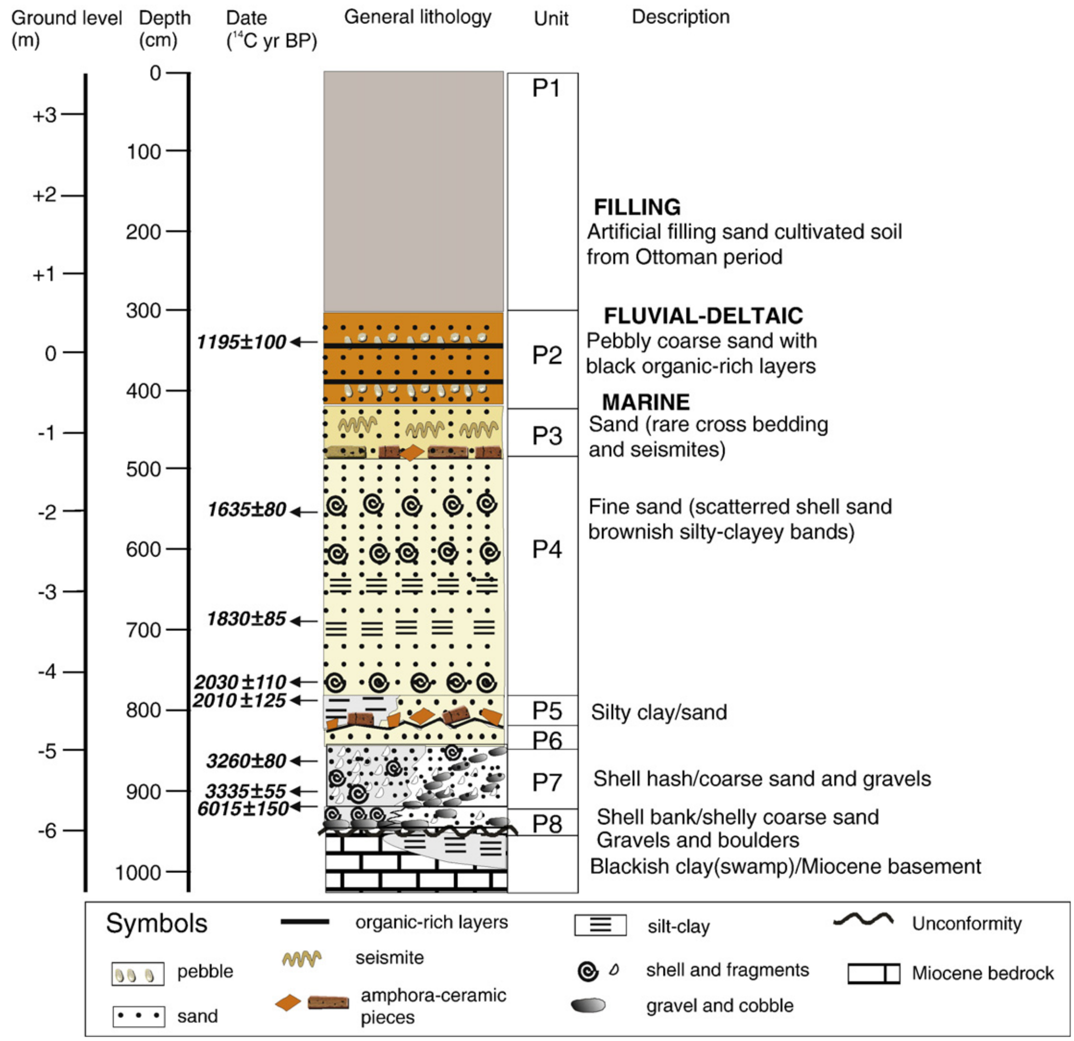


**Figure 2.** Generalized stratigraphic sedimentary section.

(7.1–6.8 $^{14}$C ka BP) represented by a few but diagnostic sherds. Most of the material found in this horizon was of Archaic Fikirtepe, Classical Fikirtepe, Yarımburgaz 4 and 3 horizons, covering the time range between 8.4 and 6.8 ka $^{14}$C BP. There were also a few sherds that are of an earlier age.

Below this mixed horizon and directly overlying the Miocene bedrock, disturbed architectural remains, evidently wattle and daub structures with some stone reinforcements, were recovered. The date of the material found is exclusively of Fikirtepe culture, revealing mostly Archaic Phase of this culture with some mixture of the Classical Phase. It is plausible to consider that the remains of the settlement preserved is of the Archaic Phase, and the contamination of Classical Phase is due to pits dug down from the later stage of this culture that were overlooked during the excavation. The settlement seems to be encircled by the palisade-like construction that has been preserved as an alignment of cobble and gravel cluster. On the other side of this cluster, clay deposits of the swamp running along the edge of the prehistoric settlement has a rich variety of prehistoric material including unique examples of wooden artifacts, and a rich variety of botanical remains. The pottery recovered in this deposit was of the

**Table 1**
Radiocarbon ages obtained from samples.

| Lab no. | Sample no/depth (cm) | Dated material | $^{14}$C yr BP | Cal yr BP 1σ (68.3%) | Cal yr BP 2σ (95.4%) |
|---|---|---|---|---|---|
| 14912 | K1/340–342 | Charcoal | 1195 ± 100 | 1001–1031 (AD 694–748) | 935–1289 (AD 661–1015) |
| 14925 | K1/556–561 | *Cerastoderma* sp. | 1635 ± 80 | 1113–1275 | 1002–1336 |
| 14926 | K1/671–676 | *Cerastoderma* sp. | 1830 ± 85 | 1291–1466 | 1220–1572 |
| 14927 | K1/771–776 | *Cerastoderma* sp. | 2030 + 110/− 105 | 1466–1734 | 1348–1853 |
| 14928 | K1/786–791 | *Cerastoderma* sp. | 2010 ± 125 | 1414–1709 | 1305–1855 |
| 14929 | K1/866–871 | *Bittium latreilli* | 3260 + 80/− 75 | 2973–3204 | 2870–3308 |
| 14930 | K1/900 | *Glycymeris* sp. | 3335 ± 55 | 3118–3285 | 3026–3340 |
| 14931 | K1/916–921 | *Paphia* sp. | 6015 ± 150 | 6284–6604 | 6117–6790 |

Calibrated dates are calculated using Calib Rev 5.1. Beta (Stuiver et al. 2005). Charcoal sample is calibrated using IntCal04 curve, whereas Marine04 curve was selected for shell samples.

same time range as found in other sections. A number of burials have also been recovered in this area, including a multiple inhumation burial with typical material of Fikirtepe culture and six cremated burials in various vessels, mostly of Yarımburgaz 4 horizon.

## A preliminary geo-archaeological evaluation

Both the archaeological and geological findings in the excavation site provided evidence to correlate the cultural history of İstanbul with the changes in environmental conditions for the first time. Archaeological remnants found at the base of the sequence among the boulders and gravels indicate the existence of a Neolithic settlement, known as Fikirtepe culture in the region (Özdoğan, 1997) dated to 8.4–7.3 $^{14}$C ka BP. It is evident that here was a relatively large prehistoric settlement of long duration, of which only the architectural remains of the earliest stage and burials dug down from various prehistoric periods have been preserved *in situ*. Size, shape and type of some of the boulders suggested that they have been brought to the settlement area by the Neolithic people and have been used for architectural purposes such as wattle and daub simply as a kind of reinforcement by this culture. The rest of the cultural layers have been washed away, leaving behind an unstratified cluster of material that could somehow be embedded. It is also clear that the architecture of all horizons, like in all other sites in the region, was of very light material, wattle and daub, and so the cultural deposits would easily be washed away.

Considering the long span of time represented at Yenikapı, it is evident that prior to its destruction due to marine transgression, the settlement must have been of considerable size and height. This is rather surprising, as all other known Neolithic sites around İstanbul are of short duration; the nearest multi-layered mounds of this period are known from İznik region. The presence of cremated pot burials of such an early date was previously unknown from this region. There have been some claims of cremated burials elsewhere in the Balkans, but they all are of later stages.

The elevation of the Neolithic settlement indicates that the sea level was 6 m lower than the present-day sea level and hence the coastline was farther south. Marine invasion probably forced the Neolithic people to leave the settlement area. Although the beginning of the marine transgression is not conclusively determined from the available ages, the remnants of the culture support a low sea level at least 8.4 $^{14}$C ka BP. The rising sea level has inundated probably up to the mouth of the Lykos Stream, creating an inlet. Marine sequence representing of a coastal to shallow-water environment indicates that this inlet has been used as a harbour during Byzantian time from AD 4th century to at least the 11th century. Sunken ships during storms belonging to the 10th and 11th centuries found in the excavation site suggest that the harbour was still in use (Pulak, 2007). The coastline must have migrated to seaward after 11th century, as a consequence of filling the harbour by the alluviums of Lykos Stream that have begun to form a small delta.

These findings and proceeding studies from Yenikapi can be applied in integration of the cultural history. They also contribute new information on the changing sea level in the Sea of Marmara and its connection with the Black Sea and Mediterranean via narrow straits.

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