

# On the Lion Harbour and other Harbours in Miletos:

*recent historical, archaeological, sedimentological, and geophysical research\**

HELMUT BRÜCKNER, ALEXANDER HERDA, MARC MÜLLENHOFF, WOLFGANG RABEL & HARALD STÜMPPEL

Καλοὶ δὲ Μιλησίων εἰσὶ λιμένες  
“But beautiful are the harbours of the Milesians”  
(Chariton, *Chaireas and Kallirhoë* 4.1.5)

## 1. Introduction

The Lion Harbour was Miletos’ most prominent harbour during antiquity. It can be envisaged as the heart of the Ionian metropolis in western Asia Minor. Originally situated in a bay of the “(I-)Karian Sea”, Miletos is now fully incorporated into the plain of the Maeander river, today’s Büyük Menderes.

In this article we combine results from historical and archaeological research with those from palaeo-geography and geophysics. This geoarchaeological approach offers new insights into the dynamic evolution of the harbour basin from the time of the marine transgression in the early Bronze Age (c. 2500 BC), when the area formed part of an island, until its final siltation by the sediments of the river Maeander c. AD 1500.

The Lion Harbour’s outstanding significance is clear

from its strategic role as one of the closable war harbours of Archaic and later times. Its central position in the Archaic insula street grid, lining the agora and the main city sanctuary of Apollo Delphinios, made it a gate through which, so to speak, gods and humans entered the city; it was also the point from which Milesians left the city to start their sailing seasons or found their many colonies. The Lion Harbour is likely to be identified with the “Harbour of Dokimos” mentioned by the 1<sup>st</sup> century AD novelist Chariton (*Chaireas and Kallirhoë* 3.2.11)

The commercial relevance of the Lion Harbour, however, was quite limited in antiquity. Miletos had a series of other harbours that fulfilled this function: the Theatre Harbour is perhaps the oldest of Miletos’ harbours; it also served as a closable harbour in Geometric-Archaic times. Other important harbours are the Humei Tepe Harbour

---

\* This research on the harbours of Miletos (state: spring 2013) has been made possible through generous funding by several institutions and persons, namely the German Research Foundation (DFG, Bonn), the Gerda Henkel Stiftung (Düsseldorf, Germany), the Center for Hellenic Studies (Trustees of Harvard Foundation, Washington D.C., United States of America), and Dietrich Groh and Barbara Blümel (Dortmund, Germany). Our fieldwork in Miletos has been supported by the excavation director Volkmar von Graeve (Bochum/Izmir), the staff of the Miletos Museum, and the Turkish government authorities. We would like to thank the two anonymous reviewers for their helpful suggestions. Special thanks go to Naomi Carless Unwin (London/Manchester) for improving the English. The photographs for figs. 3 and 27 by Erhan Küçük (Antalya) we owe to the generosity of Helga Bumke (Halle). To Stefan Gräbener (Berlin) we are grateful for providing us with the photograph for fig. 14. Finally, we are much obliged to Rune Frederiksen and Søren Handberg, who offered us the opportunity of publishing this voluminous study as well as carefully editing it. Translations from Ancient Greek are by A. Herda, if not otherwise indicated.



**Fig. 1.** Miletos seen from the German excavation house in the south (Akköy). The Hellenistic-Roman theatre with the Byzantine-Turkish castle on top is situated on Kale Tepe. The Lion Harbour lies in the natural depression between this little hill and the one to the right (Humei Tepe). The floodplain of the Büyük Menderes valley in the middle ground occupies the area of the former marine embayment (part of the "(I)Karian Sea"). The mountain chain of the Mykale is visible in the background. Photograph: H. Brückner (28 August 2010).

and the Eastern Harbour at the eastern fringe of the peninsula; one of them, most probably the Eastern Harbour, should be identified with the *emporion*, or commercial harbour, where the slave market was located. Together, this quartet might be equated with the four harbours of the city Strabon mentions (*Geographica* 14.1.6). Finally, there are the Athena and Kalabak Tepe harbours, both of only minor importance. An overview of the evidence for all these harbours is given at the end of the article.

### 1.1 The setting (H.B. & A.H.)

The spectacular view from the German excavation house in Akköy reveals the natural setting of Miletos (Fig. 1).

Towards the north, behind hills and fields, lie the ruins of this famous ancient city, the "ornament of Ionia",<sup>1</sup> with its prominent Hellenistic-Roman theatre, situated at the southern flank of the Maiandros valley (modern Maeander, Büyük Menderes). The river's extended floodplain dominates the middle ground. In the background, the limestone mountain range of the Mykale (modern Dilek Dağları, formerly Samsun Dağı) reaches nearly 1300 m asl. (above mean sea level). Towards the east, the granite massif of the Latmos Mountains (modern Beşparmak Dağları), rises up to 1332 m asl. Lake Bafa, at its foot, is the brackish remnant of the formerly marine Latmian Gulf.<sup>2</sup>

The Lion Harbour was the most prominent harbour of Miletos from the Archaic period onwards. Since early

<sup>1</sup> Herodotos 5.28: "τῆς Ἰωνίης πρόσχημα".

Hellenistic times it likely had the name λιμὴν ὁ Δοκίμου, the “Harbour of Dokimos”.<sup>3</sup> One of the reasons for the harbour’s importance is its natural setting: it lies in a deep indentation between two limestone hills of the so-called Nergiz Tepe Formation, an outcrop at the southern flank of the Büyük Menderes Graben.<sup>4</sup> Its U-shaped form with a relatively narrow opening that could be closed, its great depth of more than 20 m that prevented it from early siltation, and its stable flanks made it an ideal anchoring ground (Figs. 2-3).

The “Lion Harbour” owes its modern name to two marble lions guarding its entrance and greeting the incoming ships.<sup>5</sup> They are, besides the grave lions of Amphipolis and Chaeroneia, the largest Greek lion sculptures known to date.<sup>6</sup>

The lion was the holy animal of Apollo, the main god of Miletos. From Archaic times onwards a reclining lion, and from the 4<sup>th</sup> century onwards a standing lion, facing backwards, acted as the civic badge on Milesian coinage (Fig. 4).<sup>7</sup> Lion sculptures as dedications to Apollo or as grave markers are especially frequent in Miletos (Fig. 5).<sup>8</sup> A late Archaic statue of a reclining lion was relocated to the front of the southeasternmost gate of the Milesian land wall when the streets of Miletos were rebuilt by the Roman emperor Trajan in AD 101; it is consequently

called the “Lion Gate”.<sup>9</sup> Lions protecting city gates are a longstanding tradition in Asia Minor as well as in Greece, going back to the Bronze Age. The Lion Gates of the Hittite capital Hattusa-Boğazköy and those of Mycenae are both well known.

Today, both Milesian harbour lions are partly buried in the ground. The western lion is broken into two pieces and strongly weathered (Fig. 6). The nearly complete eastern lion (Fig. 7) was first unearthed fully by Theodor Wiegand in 1900, then again in 1993 by Volkmar von Graeve. The latter was the first to recognise that both lions date from the late Classical period (the second half of the 4<sup>th</sup> century BC).<sup>10</sup> The eastern lion is 4.00 m long, 2.20 m tall, and weighs about 23 tons.<sup>11</sup> In the late 1<sup>st</sup> century BC or early 1<sup>st</sup> century AD, a metric inscription was placed on its right shoulder and breast by the *epimeletes* Sophilos, who was in charge of the harbour. It clearly hints at the use of the lion as the badge of the Milesian mint. Lines 3-9 read:<sup>12</sup>

[οὐνεκα δὴ γλαφυρῶς εἶδεος ἄπο] τοῦδ' ἐχαρά[χ]θη[ν],  
 [εὐσαμον τεύξας πᾶν τὸ] νόμισμα πόλει,  
 5 [βαιὸς ἔτ ἀρχαία]ς [ρά]μας τύπος· ἀ[λ]λ' ἀρετᾶς μοι  
 Μίλατ[ος χετέρ]αν ἀν[τιδ]έδωκε χάριν.  
 Ὠμ[ηστᾶν μετὰ γὰρ κείναν] ἐν ὄρει τε διαίταν

2 Strabon 14.1.8 p. 635: “Λατμικὸς Κόλπος”. The ancients used the name “Latmian Gulf” to designate only the small embayment at the northwestern foot of the Latmos Mountains, where Herakleia-Latmos was located. This is evident in Strabon’s description of Ionia (14.1.1-40 pp. 632C-647C), which runs from south to north, with the Milesian Peninsula and Miletos. After Miletos he continues along the coast to the east (Strabon 14.1.8): “Afterwards follows the Latmian Gulf, at which is located ‘Herakleia under Latmos’, a small city with an anchorage.” (ἐξῆς δ’ ἐστὶν ὁ Λατμικὸς κόλπος, ἐν ᾧ Ἡράκλεια ἢ ὑπὸ Λάτμω λεγομένη, πολίχνην ὑφορμον ἔχον). The bay of the Maeander mouth (Strabon 14.1.9, 12: ἐκβολὰς τοῦ Μαιάνδρου) was instead part of the “Karian (or Ikarian) Sea”: Herda 2009, 43-4 n. 106, 45 fig. 3.

3 *Chaireas and Kallirhoë* 3.2.11; see below, § 3.1.

4 Schröder *et al.* 1995, 239.

5 Cf. Kekule von Stradonitz 1900, 106; Wiegand 1970, 42 (letter dated 15 October 1899); Wiegand 1901, 197: “Diese von den milesischen Münzen her bekannten Wappentiere der Stadt hüteten die Einfahrt des Hafens, ganz wie der bayrische Löwe die Einfahrt in den Hafen von Lindau. Der Kürze halber haben wir der ganzen Gegend den Namen ‘Löwenbucht’ gegeben.”

6 von Graeve 1996, 317 with n. 2. The famous marble lion from a monumental tomb near Knidos of c. 350-200 BC, now in the British Museum, GR 1859.12-26.24 (Sculpture 1350), is only 3 m long and 2 m high, weighing some six tons: [http://www.britishmuseum.org/explore/highlights/highlight\\_objects/gr/c/colossal\\_marble\\_lion.aspx](http://www.britishmuseum.org/explore/highlights/highlight_objects/gr/c/colossal_marble_lion.aspx) [accessed 7 January 2013].

7 Seltman 1955, 28 pl. II 1; Deppert-Lippitz 1984, 15-6.

8 Ehrhardt 1988, 132; von Graeve 1996, 317; Senff 2006, 269.

9 Wiegand 1911, 7-8; von Gerkan 1935, 49-50 fig. 28.

10 Wiegand 1901: 197 fig. 6; for both lions see Kleiner 1968, 6-7, figs. 6-7; Kleine 1980, 61-2 fig. 25; von Graeve 1996.

11 Measurements and calculation of the lion’s weight according to B.F. Weber: von Graeve 1996, 317 n. 3, 320 n. 7.

12 Herrmann 1997, 9-11, 197 no. 188. The inscription is badly preserved, and some parts are missing, including the beginnings of lines 1-5. We follow the reconstruction of lines 3-7 by W. Crönert, (*SEG* I, 425); reprinted and translated into German by Herrmann 1997, 197, as well as the reconstruction of lines 8-9 by A. Rehm, reprinted by Herrmann 1997, 10 and translated into German, Herrmann 1997, 197. For the office of the *epimeletes* as “inspector” of the Lion Harbour see Kawerau & Rehm 1914, 307-12; Herrmann 1997, 174 on no. 140.31-2, 46-7, 60-1, a treaty between Miletos and Kretan cities of 260-220 BC, mentioning ἐπιμεληταὶ τοῦ ἐμπορίου, “inspectors of the commercial harbour”; see below, § 4.6.

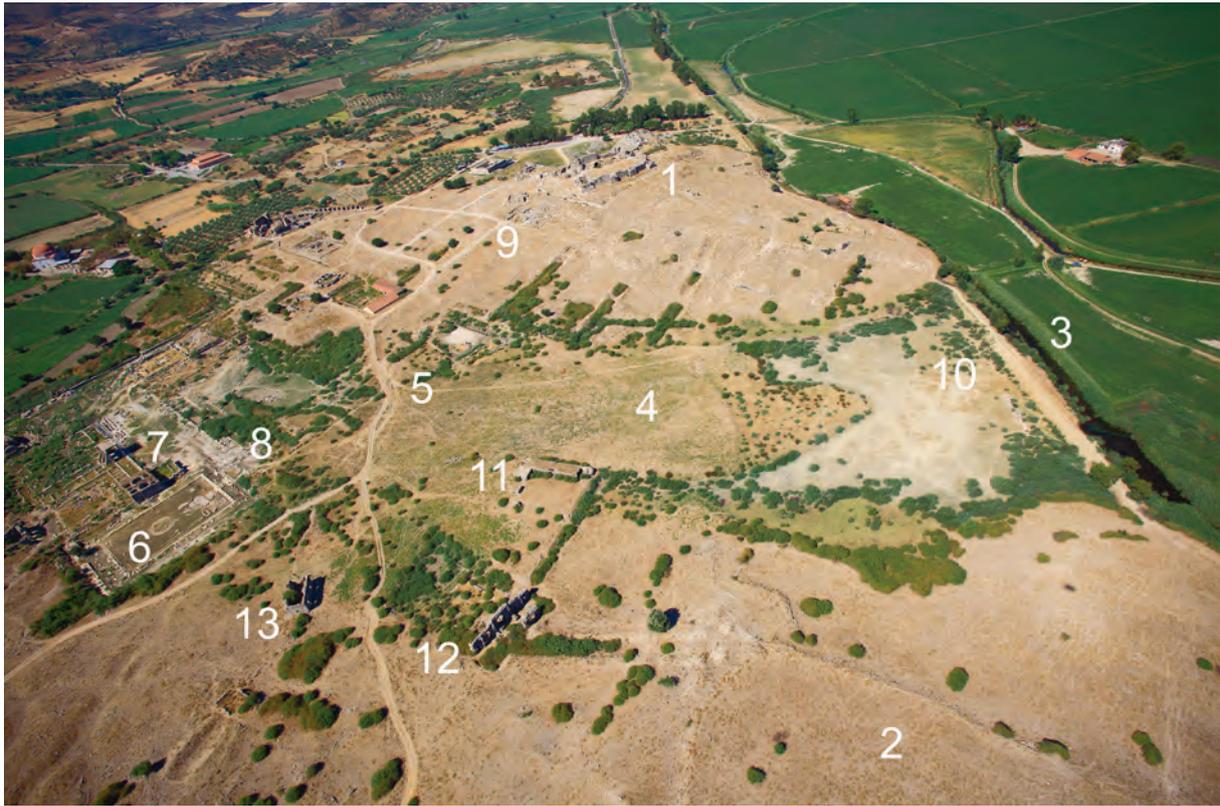


**Fig. 2.** *The Lion Harbour (“Harbour of Dokimos”?) viewed from the Byzantine castle on Kale Tepe. Above: the seaward part of the harbour with the earth dam at its entrance; this was erected in 1984/85 against the regular flooding of the river Büyük Menderes (Maiandros, Maeander) and followed the presumed course of the ancient moles at the closable harbour entrance. Below: the landward part of the harbour is covered by excavation spoil. In the middle ground to the right: area of the Delphinion (sanctuary of Apollo Delphinios), the Selçuk Baths, and the so-called Ionian Hall (building with columns) at the Processional Road. Photographs: H. Brückner (1 October 2008).*

δαμο[σ]ί[ωι κείμαι] τῷδε [ἔ]φεδρος λιμῆνι.  
Σώφιλος ἐπεμελήθη.

Hence I was artfully minted in this appearance  
and so created a coin for this city, easily recognisable,

5 a small copy of my former might. But for my courage,  
Miletos granted me another favour.  
For after I had given up raw meat in the mountains,  
I lie here now, a guard for the public harbour.  
Sophilos was *epimeletes*



**Fig. 3.** Aerial photograph of the Lion Harbour from NE. Kale Tepe with Byzantine-Turkish castle (1), Humei Tepe (2), Earth dam of 1984/5, blocking the harbour mouth from the Maeander plain (3), harbour area filled with excavation spoil (4), western end of the Harbour Hall with large Harbour Monument in front (5), Delphinion (6), Selçuk Bath (7), Harbour Gate (8), Heroon I (of Dokimos?) (9), western lion (10), Turkish caravanserai (Han) (11), Roman baths (12), Turkish Derwish cloister (Tekke) (13). Photograph: E. Küçük (September 2011).



**Fig. 4.** Silver tetradrachm of Miletos, so-called Symmachic coinage, minted under Hecatomnid rule, c. 360-340 BC. Obverse: laureate head of Apollo Didymeus; reverse: standing lion with head reverted, above star; legend: MI(ΛΗΣΙΩΝ) and name of magistrate Demainos. Photograph: Numismatica Ars Classica, Auction 66, 17 October 2012, Los 54; <http://www.sixbid.com/browse.html?auction=472&category=10377&lot=485245> (accessed 1 September 2013).

Indeed, this very lion is depicted on some Milesian bronze coins of the 3<sup>rd</sup> to 1<sup>st</sup> centuries BC, together with

another famous Milesian sculpture, that of the so-called Kanachos-Apollo in Didyma (Fig. 8).<sup>13</sup>

<sup>13</sup> Deppert-Lippitz 1984, 118-20, 193-6 catalogue nos. 941-1028, pls. 30-2 (Deppert-Lippitz (1984), 118 dated the coins 39-17 BC, but see the commonly accepted correction of Marcellsi 2004, 49, 123, 125-6, 128, pls. 2-3 on no. 38 [late 3<sup>rd</sup> century BC] and 56 [late 2<sup>nd</sup>/early 1<sup>st</sup> century BC]). For identifying the reclining lion on these coins with the eastern harbour lion see my comments in Brückner *et al.* in press, § 2.



**Fig. 5.** Archaic and Classical lion sculptures from Miletos and Didyma. New display in the garden of the Museum in Miletos. Photograph: A. Herda (October 2012).

We learn from Strabon that Miletos had four harbours during the first half of the 1<sup>st</sup> century AD (see §§ 3.1, 3.4).<sup>14</sup> Like all the other harbours of Miletos, the Lion Harbour has now silted up entirely. Before the erection of an earth dam at its former entrance in 1984/85,<sup>15</sup> it was regularly flooded by the river Maeander in winter;<sup>16</sup> even during summer it was mainly a muddy area, since the groundwater table is always high.<sup>17</sup> Therefore, no attempts have been made to excavate it; instead, during the early excavations under Theodor Wiegand it was used as a dump for excavation spoil (Figs. 3, 4 & 6).

From a geoarchaeological point of view, the Lion Harbour is an excellent geo- and bio-archive. For this reason sedimentological and geophysical research has been carried out over several campaigns in the last two decades. Excavations at the Lion Harbour might reveal many archaeological surprises, similar to those revealed during the excavation of the Theodosian Harbour in Konstantinoupolis-İstanbul, built in the late 4<sup>th</sup> century AD, where 37 shipwrecks have been unearthed to date.<sup>18</sup> The authors of this article hope that the Roman harbour of

Ephesos, which is supposed to be re-opened for touristic boat travel in the future, will be excavated with the same care, appropriate for this kind of cultural monument.

### 1.2 A short history of Miletos (A.H.)

Due to its setting on a c. 250 km<sup>2</sup> peninsula protruding into the “Ikarian” or the “Karian Sea”,<sup>19</sup> and its natural protection against invaders from the hinterland by the 400 m high Grion Mountains to the southeast,<sup>20</sup> Miletos was always an attractive place to settlers.<sup>21</sup> The first ones arrived in the late Chalcolithic period (the second half of the 4<sup>th</sup> millennium BC, Miletos I). Their indigenous Microasiatic culture already shows contacts with and influences from the late Neolithic culture of the Cycladic Islands. From the beginning, Miletos was located at an intersection of trade routes: east–west, connecting the Microasiatic hinterland with the Aegean via the Maeander valley, and north–south, from the Propontis and the northern Aegean Sea to southern Asia Minor, Cyprus, and the Levant (Fig. 9).

<sup>14</sup> Strabon *Geographica* 14.1.6.

<sup>15</sup> Tuttahs 1998, 161 with fig. 11.4.

<sup>16</sup> Wiegand 1901, 904 fig. 1; 1929, 9 fig. 8, Beilage.

<sup>17</sup> Tuttahs 2007, 443–52 figs. 478, 483.

<sup>18</sup> Kocabaş 2008.

<sup>19</sup> Cf. Homer *Iliad* 2.145: Ἰκάριος πόντος; Ptolemy *Geographia* 5.2.7: Ἰκάριος πέλαγος; Stephanus Byzantius s.v. Μυκάλη· Καρικὸς ἄλς; see also Herda 2009, 44–5 with n. 106, fig. 3.

<sup>20</sup> Strabon 14.1.8: Γρίον; Herodotos 6.20: μλησίη ὑπεράκρια; cf. Wiegand 1929, 1; Philippson 1936, 12–20; Herda 2006, 73 with n. 170; Herda 2009, 60 with n. 173, 78, 91.

<sup>21</sup> Greaves 2000a; 2002; Niemeier 2007; Herda 2009; Herda forthcoming.



**Fig. 6.** The Lion Harbour (“Harbour of Dokimos”?) viewed from the modern earth dam. The excursion group is standing around the weathered and broken statue of the western lion. In the middle ground, the bushy vegetation marks the spoil that earlier excavations had dumped into the silted up, but still swampy harbour basin. In the far background is the escarpment of the limestone plateau of the Stefania (the ancient Akron). Photograph: H. Brückner (1 October 2008).

Settlers from the Cycladic Islands in the early Bronze Age (Miletos II, c. 3000-2000 BC) were followed by Minoans in the middle Bronze Age (Miletos III–IV, c. 2000-1450 BC) and Mycenaean Greeks in the late Bronze Age (Miletos V–VI, c. 1450-1180 BC). The Kingdom of Mira, a vassal state of the Hittites in western Asia Minor with its capital in *Abasa* (today’s Ephesos-Selçuk), gained *Millawanda*-Miletos in the late 13<sup>th</sup> century BC after the collapse of the Mycenaean palaces, and built a fortification wall to protect it. But during the raids of the so-called “Sea Peoples” the city fell under the domain of the Karians of *Karkiša*-Karia (Miletos VII, c. 1180-1050 BC), who were the allies of Troy in the Homeric *Iliad* (2.868-875). Miletos came under Greek control once again in the early Iron Age, after the so-called “Ionian Migration” (Miletos VIII, Iron Age, Protogeometric – Late Roman, c. 1050/30 BC–

AD 400). The city boomed in the 7<sup>th</sup> and 6<sup>th</sup> centuries, colonising the Propontis (Marmara Sea) and the Pontos (Black Sea) regions. Sciences like philosophy, geography, and history also thrived in the city, advanced by the Milesians Thales, Anaximandros, Anaximenes, and Hekataios. Though conquered by the Persians in 494 BC, Miletos remained predominately Greek through Classical, Hellenistic, Roman, and Byzantine times. In the 11<sup>th</sup> century AD the city was first conquered by Turkish Selçuks, and – after another late Byzantine *interregnum* – by the emirate of Menteşe in the early 14<sup>th</sup> century AD. Miletos, then called Palatia-Balat, declined in the 16<sup>th</sup>/17<sup>th</sup> centuries AD due to the Maeander delta progradation. It ended up as a village relocated some three kilometres to the south, and named Yeni Balat (“New Balat”) after a catastrophic earthquake in 1955.<sup>22</sup>

22 Kleiner 1968, 1.



**Fig. 7.** The eastern harbour lion of Miletos, re-excavated in 1993. The late Classical (second half of 4<sup>th</sup> century BC) sculpture weighs c. 23 t. It was probably transported here in late Roman or early Byzantine times. An inscription on its right shoulder and breast reads: “For after I had given up raw meat in the mountains, I lie here now, a guard for the public harbour”. Once it had been studied, this lion was buried again for its protection. Photograph: H. Brückner (September 1993).



**Fig. 8.** Milesian bronze hemibol, late 3<sup>rd</sup> century BC. Obverse: statue of the so-called Kanachos-Apollo in Didyma; reverse: statue of eastern harbour lion, and star/sun, legend: ΜΙΛ(ΗΣΙΩΝ) and name of magistrate Aischylinos. Photograph: Fritz Rudolf Künker GmbH & Co. KG, Auction 133 (11.10.2007), Los 7586; [http://www.acsearch.info/ext\\_image.html?id=31520](http://www.acsearch.info/ext_image.html?id=31520) (accessed 1 September 2013).

A brief history of Miletos and its dynamic palaeogeography in relation to its harbours is compiled in Table 1.

## 2. The palaeogeographic evolution of the Milesian Peninsula (H.B., A.H. & M.M.)

After the Late Glacial Maximum around 20,000 years ago, the sea level steadily rose during the late Pleistocene and early Holocene, due to global warming and subsequent worldwide deglaciation, from –120 m to its present position. The consequence was a dramatic shift in the shoreline. The mid-Holocene sea created several marine embayments at the western margin of the Anatolian Plate, especially in tectonic grabens. In the case of

Miletos, the transgression of the sea inundated the Büyük Menderes Graben, with its peak probably reaching 50 or so kilometres inland, close to Aydın.<sup>23</sup> In Greek and Roman times the bay at the Maeander mouth was part of the “(I-)Karian Sea” (see above, § 1.2).<sup>24</sup>

Geoarchaeological evidence has revealed that the area of Miletos was an archipelago during the time of the first maximum stand of sea level in the 3<sup>rd</sup> millennium BC.<sup>25</sup> The biggest island encompassed the hills Kale Tepe (Turkish for “Castle Hill”)<sup>26</sup> and Humei Tepe (Turkish for “Typhoid Hill”).<sup>27</sup> The c. 300 m long and 100 m broad indentation between them, the future Lion Harbour, was in 2500 BC totally submerged by the sea, which even covered the area of the later sanctuary of Apollo Delphinios, the Delphinion (Fig. 10).

<sup>23</sup> Bay 1999b.

<sup>24</sup> Strabon 14.1.9, 12: ἐκβολάς τοῦ Μαιάνδρου.

<sup>25</sup> Brückner *et al.* 2006. The palaeogeographic reconstructions presented in this paper are based on more than 350 corings carried out in Miletos and its environs. Their interpretation is a combination of sedimentological, macro- and microfaunal and chronostratigraphical data on the one hand, and archaeological and historical evidence on the other. The final publication is in preparation: Herda *et al.* forthcoming. For the geoarchaeological research design, see Brückner 2003; 2007; 2011; Brückner & Gerlach 2011.

After 2500 BC, the siltation of the marine embayment started with the progradation of the Büyük Menderes delta and the formation of the river's floodplain. The different phases and velocities of delta growth have been deciphered by Marc Müllenhoff, based on sedimentological and geoarchaeological criteria (Fig. 11).<sup>28</sup> We know from this research that the delta front did not reach Miletos before late Roman times. However, in the Archaic period the city of Miletos already lay on a small peninsula which formed the northernmost tip of the larger Milesian Peninsula, the *Milesia* (Fig. 12). Since the Maeander delta cannot have been the sediment source, it must be asked how, why, and when the Milesian Archipelago was transformed into a peninsula.

Our corings have shown that the Minoans, arriving in c. 1900 BC (Tab. 1), chose an already settled island close to the mainland for the founding of a trade colony, in an easily defensible position with good harbours to the north, east, and south. The situation changed fundamentally when, in Mycenaean times, the island was connected to the mainland at its southern end via a sandbar. Such a *tombolo* is the result of coastal accumulation processes caused by the longshore current and adequate sediment supply. Coastal dynamics were therefore one agent for the supply of material for the consolidation of the islands. Several corings between the Minoan-Mycenaean settlement and the southern mainland provide evidence of the sandy sediments of the *tombolo*, with a thickness of several

metres. Samples taken from the sandbar in corings Mil 38 and 266 <sup>14</sup>C-date the upper part of the *tombolo* to the 15<sup>th</sup> century BC at the latest.<sup>29</sup>

The adjacent hills were another sediment source, as well as the slopes of the ancient Ἄκρον, “Heights” escarpment, named *Stefania*, “Crowning”, by the 19<sup>th</sup>-century Greeks (Fig. 6).<sup>30</sup> Its steep, nearly 200 m high slope rises some four kilometres to the south of Miletos<sup>31</sup> and is built up by marl-, sand- and claystones of the Neogene Balat Formation, which are weakly consolidated and easily erodible.<sup>32</sup> Big square water pits, dug in the 1990s by farmers for irrigation purposes at the foot of the Stefania Plateau, revealed several layers of colluvium. The formation of these layers had already started with the first farming communities in the fourth millennium BC.<sup>33</sup> Additionally, pollen records from the Lion Harbour and from nearby Lake Bafa indicate a progressive degradation of the so-called climax vegetation – a sparse deciduous oak forest – to a maquis-type vegetation, due to more extensive farming, herding, and the extraction of timber and firewood.<sup>34</sup> This resulted in increased soil erosion with associated sediment accumulation in the coastal zone.<sup>35</sup>

Finally, several cores within the city area show that material had intentionally been dumped by the Milesians for consolidation purposes in order to gain more space for settling. This was especially the case from the 6<sup>th</sup> century BC on, when the city was restructured according to a regular *insula* street grid system.<sup>36</sup>

26 The Turkish “Kale” refers to the Byzantine-Turkish “castle” on top of the hill, most probably standing on the remains of the *phrourion*, built by the Persian satrap Tissaphernes in 411 BC (Thukydides 8.84.4; 8.85.2; 8.109.1; see below, § 3.1). The high standing ruins of the theatre and the baths led to the late Byzantine (13<sup>th</sup>/14<sup>th</sup> century AD) placename of Miletos, τὰ Παλάτια (“the palace”), respectively τὸ κάστρον, ἡ σκᾶλα τῶν Παλατίων, though the old place name was still preserved in the designation “Milesian Lake”, attested for the 13<sup>th</sup> century AD, see below § 3.4 with n. 157. When the Turkish emirate of Menteşe conquered Palatia from the Byzantine Greeks in the early 14<sup>th</sup> century AD, they named the place “Balat”, after “Palatia” (Wiegand 1929, 15; Wittek 1934, 70, 130; P. Wittek in Wulzinger *et al.* 1935, 1; Kleiner 1968, 1, 140-1 fig. 108).

27 For Humei Tepe = “Typhoid Hill”, see Wulzinger *et al.* 1935, 39 and Greaves 2002, 148 (Turkish *humma* designating “any kind of high-fever, including that associated with malaria and typhoid”). This designation hints at the health problems caused by the extremely humid climate in the flooded Maeander plain, where diseases like malaria were common (Wiegand & Schröder 1904, 11-2; Wiegand 1929, 14-5; Philippson 1936, 9; Thonemann 2011, 18, 299). This fact prompted Th. Wiegand to place the excavation house some 5 km away from the dig, on a 134 m high hill close to the village of Akköy (Wiegand 1970, 41: letter dated 28 September 1899).

28 Müllenhoff 2005, see the summary on pages 187-215 with figs. 48-56.

29 Herda *et al.* forthcoming.

30 Herda 2006, 10 lines 28-9 (so-called Molpoi Inscription, Hellenistic copy of a late Archaic sacred law, mentioning the course of the Milesian New Year's procession to Didyma via the *Akron*), 261-5 figs. 9, 17.

31 Wiegand 1929, 3 fig. 4, 10 fig. 9, Beilage; Kleiner 1968, 1-3 figs. 2-3.

32 Schröder 1990, 64-7 figs. 3-4; Schröder *et al.* 1995, 238-40 figs. 39-40; Tuttahs 2007, 28-33.

33 Bay 1999a.

34 Wille 1995; Knipping *et al.* 2008.

35 Brückner *et al.* 2006, 76-80.

36 Herda 2005, 278-285 figs. 29-30; Brückner *et al.* 2006, 73-4; Müllenhoff *et al.* 2009a.

Time	Historic changes	Palaeogeographic changes
Late Chalcolithic (c. 3500-3000 BC)	<b>Late Chalcolithic (Miletos I)</b> The autochthonous population and its material culture show significant influences from the culture of the Cycladic Islands	Postglacial sea level rise had formed the Milesian Archipelago; climax vegetation dominated by deciduous oak forests
Early Bronze Age (c. 3000-2000 BC)	<b>Early Bronze Age (Miletos II)</b> First settlers may have arrived from the Cycladic Islands; people in Miletos at that time already spoke an Indo-European idiom (“Proto-Anatolian”)	Highest position of local sea level; reduction of settlement space due to transgression
Middle to Late Bronze Age (c. 2000-1180 BC)	<b>Minoan – Mycenaean Millawanda-Miletos</b> Colonisation by Minoan settlers from Crete in the Middle Bronze Age ( <b>Miletos III–IV</b> , c. 1900-1450 BC); conquered by Mycenaean Greeks in the late Late Bronze Age ( <b>Miletos V–VI</b> , c. 1450-1220 BC); c. 1220-1180 BC Hittite control over Miletos VI, construction of fortification wall	Intense degradation of vegetation due to increasing anthropogenic impact (introduction of the goat, among other animals); gradual decline of natural fauna; resulting soil erosion together with slight marine regression and longshore drift initiated the transition from the archipelago to the Milesian Peninsula; Athena Temple Island connected to mainland via tombolo before c. 1500 BC
Late Bronze Age – Early Iron Age (c. 1180-1050 BC)	<b>Karian (Miletos VII)</b> Destruction of Miletos VI fortification c. 1180 BC; indigenous Karians from the hinterland gain control over Miletos; allies of Troy against the Achaei/Mycenaean Greeks (cf. Homer, <i>Iliad</i> 2.868-875)	
Early Iron Age (c. 1050-700 BC)	<b>Protogeometric – Geometric (Miletos VIII)</b> Greek-Ionian Migration due to excellent natural harbours and position protected from the hinterland	Kale Tepe – Humei Tepe Island also connected to the adjacent southern flank of the Maeander Graben via tombolo; Theatre Harbour is now an embayment (c. 8 <sup>th</sup> –7 <sup>th</sup> centuries BC)
7 <sup>th</sup> –6 <sup>th</sup> Centuries BC	<b>Archaic (Miletos VIII)</b> Construction of fortifications, including the closable Lion and Theatre(?) Harbours; political, economic and cultural prosperity; foundation of more than 80 colonies (Black Sea region etc.); Thales, Anaximandros, Anaximenes, Hekataios establish Ionian Natural Philosophy and historiography. First half of 6 <sup>th</sup> century BC: re-planning in a new grid system (so-called Hippodamian grid); second half of 6 <sup>th</sup> century BC: enlargement of the city centre around the agora and the Delphinion by man-made infill	Continued degradation of the ecosystem; palynological analyses prove increase in maquis elements and indicators of human impact; siltation especially north of Kalabaktepe and in the Theatre Harbour due to strong erosion and denudation processes
494 BC	Naval battle of Lade, victory of Persians and the destruction of the city	

**Table 1.** Historic and palaeogeographic changes in Miletos. Modified after: Brückner et al. 2006, 68 tab. 2.

Time	Historic changes	Palaeogeographic changes
After 479 BC - 133 BC	<p><b>Classical – Hellenistic (Miletos VIII)</b></p> <p>Building of the new city by enlargement of the late Archaic grid system; industrial processing of wood and wool, metallurgic industry; lion statues installed in the Lion Harbour and construction of the Harbour Hall end of 4<sup>th</sup> century BC; now called “Harbour of Dokimos”(?)</p>	Continued degradation of the ecosystem; palynological analyses prove increase in maquis elements and indicators of human impact; siltation especially north of Kalabaktepe and in the Theatre Harbour due to strong erosion and denudation processes
133 BC – 4 <sup>th</sup> Century AD	<p><b>Roman (Miletos VIII)</b></p> <p>Erection of larger Harbour Monument c. 100 BC, Miletos in conflict with Priene over access to Maeander mouth in 90s BC; C. Iulius Epikrates takes possession of new alluvial lands in Maeander delta with the permission of Augustus; new economic growth, renovation of the theatre in 1<sup>st</sup>/2<sup>nd</sup> centuries AD, dredging of the Theatre Harbour, new city wall end of 3<sup>rd</sup> century AD; dredging of harbours in AD 343 by Skylakios (?), canal in Maeander plain between Miletos and Lade, channelling of the Maeander</p>	Vegetation dominated by maquis and phrygana, endangering of Milesian Peninsula by prograding Maeander Delta, accelerated siltation of the Lion and Theatre harbours
5 <sup>th</sup> Century AD – AD 1327	<p><b>Byzantine Miletos</b></p> <p>Episcopal See since AD 537/8; proconsul Vitianus built a dam “against the winter floods” in 2<sup>nd</sup> half of 5<sup>th</sup> century AD, reduction of fortified settlement in AD 538 with exclusion of Lion Harbour; erection of castle on Kale Tepe (in 7<sup>th</sup>/8<sup>th</sup> cent.); gradual decline; after Battle of Manzikert AD 1071, first invasions by Turkish Selçuks, temporal devastation(?), 13<sup>th</sup> to early 14<sup>th</sup> century AD: late Byzantine “renaissance”, Miletos now called “Palatia”</p>	Increased siltation by Maeander alluvium; gradual integration of Milesian Peninsula into the floodplain; from AD 1000 separation of <i>Latmikos kolpos</i> from open sea, called “Milesian Lake” ( <i>Milesie limne</i> ) in 13 <sup>th</sup> century AD.
AD 1327 – 1955	<p><b>Miletos as Palatia-Balat part of Emirate of Menteşe, since AD 1425 of Ottoman Empire</b></p> <p>Continued decline of the city until the 16<sup>th</sup>/17<sup>th</sup> centuries AD; since then only village left; settlement relocated as ‘Yeni Balat’(New Balat) some three kilometres to the south after a severe earthquake in 1955</p>	Loss of access to open sea c. AD 1500; subsequent siltation of all harbours; finally Maeander river port and open sea harbour 6 km SW of Palatia-Balat (?)

**Table 1.** Historic and palaeogeographic changes in Miletos. Modified after: Brückner et al. 2006, 68 tab. 2.

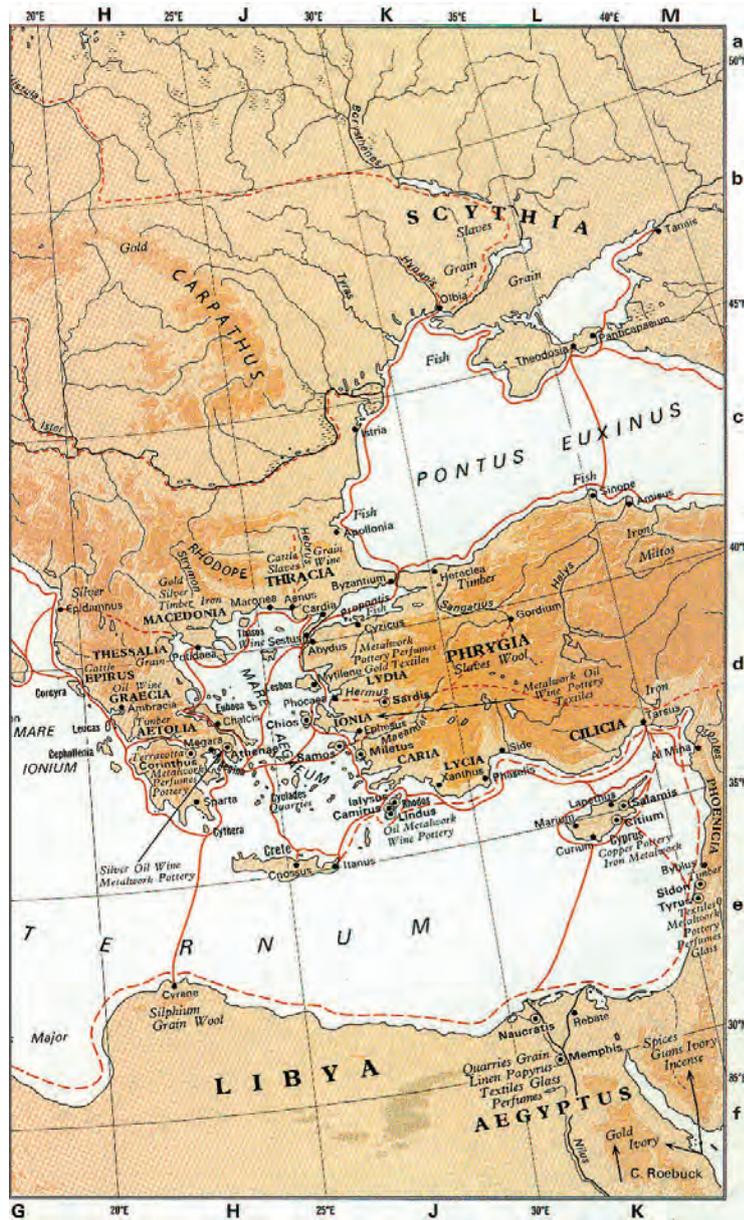


Fig. 9. Sea-borne trade routes and resources in the eastern Mediterranean in the Archaic period. Source: Hammond 1981, map 7a (right section).

A summary of these findings leads to the conclusion that the transformation from archipelago to peninsula started around 1900 BC. Several corings around the Temple of Athena reveal the siltation process and the gradual changeover from shallow marine to coastal and finally terrestrial conditions.<sup>37</sup> A slight marine regression, together with the natural and human-induced areal denudation and accumulation processes described above, contributed to

the consolidation, which in the western part of the peninsula (south of the island in the area of the later Temple of Athena) most likely occurred in the late Bronze Age (15<sup>th</sup> century BC) at the latest (see above).

It is astonishing what Milesian myths tell us about the Minoan-Mycenaean times. One story is about the eponymous founder hero Miletos, who had come from Minoan Crete, fleeing King Minos.<sup>38</sup> It is preserved in

37 Brückner *et al.* 2006, 70-3 fig. 3; Tuttahs 2007, 343-5.

38 Herda forthcoming, § 2.2.1.



**Fig. 10.** Miletos in Hellenistic-Roman times and the position of the shoreline during the maximum marine transgression, Archaic, and Roman Imperial times. Around 2500 BC, the Milesian Archipelago consisted of several islands. It is interesting to note that by 2500 BC the totally submerged indentation that later hosted the Lion Harbour even encompassed the area of the later Delphinion. Source: modified after Müllenhoff et al. 2009b, 20 f. fig. 1.

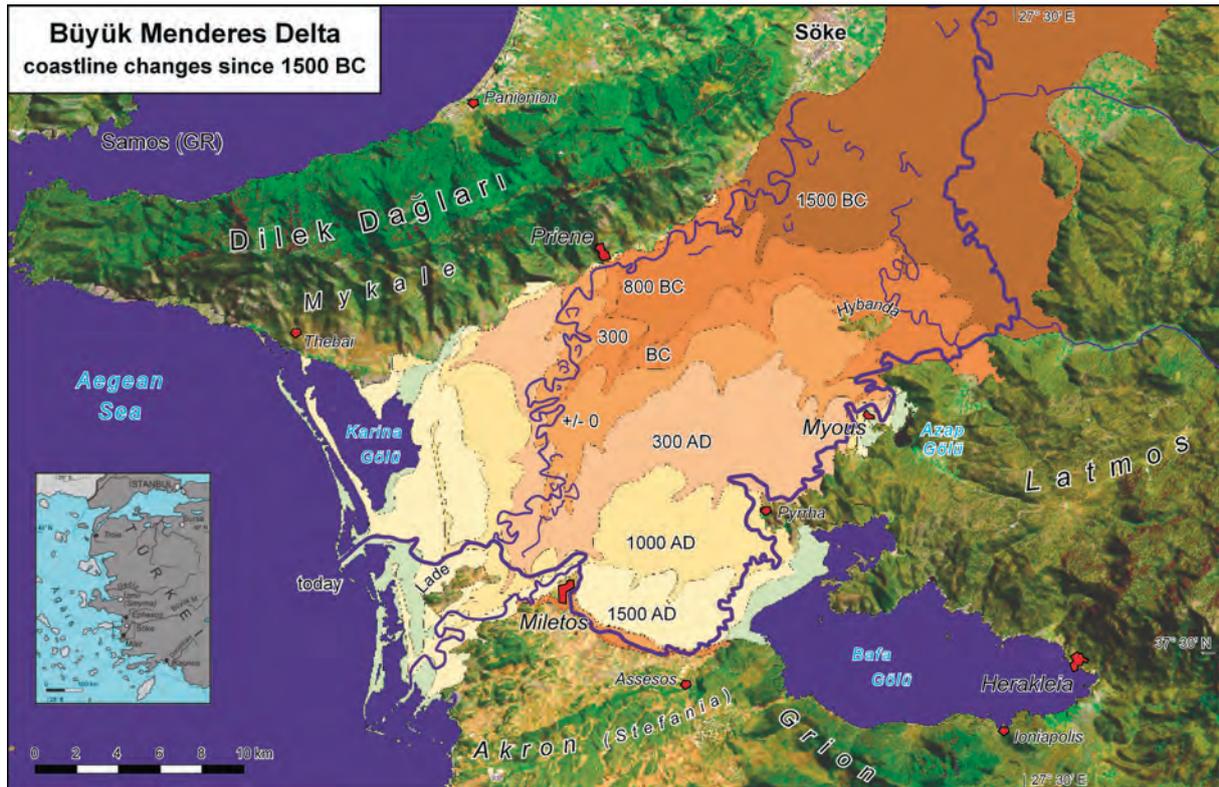


Fig. 11. Progradation of the Maeander Delta from 1500 BC until today. Source: modified after Müllenhoff 2005, 214 fig. 56.

a late Antique *scholium* on the Hadrianic geographer Dionysios Periegetes.<sup>39</sup> Miletos had first settled on the mainland in a place called *Oikous*, “The Houses”. *Oikous* was a suburb of Miletos, where a famous sanctuary of Aphrodite was located on a small hill at the ancient sea shore, modern Zeytin Tepe (“Olive Hill”), some 2 km southeast of the city (Fig. 26.11).<sup>40</sup> After Miletos’ death the following happened:

Κελάδων δὲ ἄρξας Οἰκοῦντος τὸν πατέρα ἐς τὴν πλησίον νῆσον ἔταπεν, οὗ καὶ αὐτὸς μετῴκησεν κατὰ χρῆσιν, καὶ Μίλητον αὐτὴν ὠνόμασεν. Γέφυρα δὲ διορίζει τὰ νῦν Οἰκοῦντα καὶ Μίλητον.

But Keladon, who ruled over *Oikous*, buried his father on an island nearby where he himself went to dwell because of an oracle. He called the island ‘Miletos’. A dam connects today’s *Oikous* with Miletos.

The Greek term used to designate the connection between island and mainland is γέφυρα. In the Homeric epics *gephyra* is a natural or artificial “dam”.<sup>41</sup> In later sources it can also mean “bridge”, distinct from the term γαιεῶν (Latin *pulvinus*), designating a separate “sandbank” or “river island” without a connection to firm ground, being the result of natural alluviation.<sup>42</sup> That the term is used here in the Homeric sense becomes clear from the afore-

39 *Scholium* on Dionysios Periegetes 825.

40 It was identified only in 1990 through the find of an Archaic dedicatory inscription to “Aphrodite in *Oikous*”: Herrmann 1995, 282 fig. 82 [A]φροδίτη | τὴν Οἰκόντ[ι]; N. Ehrhardt in: Herrmann *et al.* 2006, 174-176 pl. 28 no. 1279; cf. Theokritos *Thalysia* 7.115-6; *Alakata* 28.3-5; Poseidippos *Anthologia Palatina* 12.131.1; *Scholium* on Dionysios Periegetes 825. For the excavation, see Senff 2003.

41 For instance in *Iliad* 5.88-9.

42 *Gephyra* as “bridge” e.g. Herodotos 4.85, 97. The term γαιεῶν is attested for Augustan Miletos: P. Herrmann in Herrmann *et al.* 2006, 82-5 no. 1131.7 γαιεῶνας. For γαιεῶν/*pulvinus* as “sandbank” or “river island” see Herrmann 1994, 212-3; Herrmann 1996, 6 with n. 10; see below, § 3.4 with n. 154.



**Fig. 12.** The Miletian Peninsula on Google Earth. Even after the total siltation of the area, the former peninsula can still be identified: its barren rock is in great contrast to the irrigated green fields of the Maeander floodplain that used to be part of the “(I)Karian Sea” in Greco-Roman times. The satellite image also shows the hilly hinterland and the meandering river course (*nomen est omen*). View towards SSW with the Aegean Sea in the background. L = Lion Harbour. Source: ©Google 2013, date: 16 July 2008, altitude: 1010 m.

mentioned geoarchaeological evidence of the *tombolo*. We can also draw on how Pindar in his sixth Nemean ode labelled the Isthmus of Corinth:<sup>43</sup> πόντου γέφυρα, “*gephyra* of the sea”.<sup>44</sup>

The question remains of whether and how the ancient Milesians could still know about the landscape transformation of their city in the middle and late Bronze Age. Did they produce a retrospective construction, aided by

43 *Nemean* 6.40.

44 The term *gephyra* is used in the sense of an artificial dam in a Milesian inscription of the second half of the 5<sup>th</sup> century AD: W. Günther in Herrmann *et al.* 2006, 81-2 no. 1129.3-4 γέφυραν ποιήσατ' ὁδίταις | ἄλκαρ χειμερίων πληθομένων ὑδάτων. The “*gephyra* for wayfarers”, initiated by the proconsul of Karia, Vitianus, is designated as “a bulkwork against the winter floods”. Tuttahs 2007, 418 f. with fig. 449 locates the dam within the city, east of the South Market, roughly at the same place as the modern dam (see fig. 27.5). But he does not take into account the process of alluviation between AD 300 and 1000: Müllenhoff 2005, 201 fig. 52, 203 fig. 53. Whether this dam crossed the former neck of the gulf of Latmos-Herakleia, as Thonemann 2011, 317 assumed, remains similarly unlikely. The dam leading to Sarıkemer some 8.5 km to the northeast (named Kız Döşemesi, “Girls Paving”) is most probably only late Medieval: see below n. 191.

observing contemporaneous natural phenomena, as Pausanias did (see below, § 3.4)? Or can we identify a true story within mythical tradition?<sup>45</sup> We leave this issue open for further discussion.

In the eastern part of the peninsula, south of the biggest former island including Kale Tepe and Humei Tepe, marine and littoral conditions lasted until the beginning of the Archaic period, as evidenced by our corings between the later South Market and the Lion Gate in 2009 and 2011, which detected a second *tombolo*. It expanded during the Protogeometric and Geometric periods (10<sup>th</sup>–8<sup>th</sup> centuries BC), connecting the island to the southern mainland. In consequence, the Theatre Harbour, the second important harbour of Miletos, was transformed into an embayment. On the *tombolo*'s eastern shore, a new landing point for ships developed, the “East Harbour” (see § 4.2). In late Archaic and Classical times, the terrain around the agora was further consolidated with infill in the course of the progressing urban development of the city centre.<sup>46</sup>

It was only during Roman Imperial times that the peninsula was finally endangered by siltation from the advancing Maeander Delta (Figs. 10–11). In Byzantine times, the city was still able to communicate with the open sea via brackish waters, until the delta cut off the marine access and finally integrated the peninsula into the floodplain after AD 1500.<sup>47</sup>

### 3. The Lion Harbour

#### 3.1 Evidence from historical accounts and from archaeology: is the Lion Harbour the “Harbour of Dokimos”? (A.H.)

In the first half of the 1<sup>st</sup> century AD, Strabon writes:<sup>48</sup>

ἔχει δὲ τέτταρας λιμένας ἢ νῦν, ὧν ἓνα καὶ στόλῳ ἱκανόν.

The present city has four harbours, one of which is large enough to host a fleet.

The reference to a “fleet” (στόλος) indicates a war harbour, which had to be closable. Strabon is most likely referring to the Lion Harbour, since its narrow entrance fulfilled this prerequisite.<sup>49</sup> A “closed harbour” (κλειστός λιμὴν) is mentioned in the inscription on an altar, found in front of the so-called Lion Gate at the southeastern edge of the city wall. It was dedicated to Apollo Didymeus and Artemis Pytheie, the main gods of Didyma, by a certain Biases, son of Biases, c. 85 BC. He held the office of *epistates* of “the temple of Apollo of Didyma and the walls and towers and the security of the closed harbour [of Miletos, A.H.]”.<sup>50</sup> Obviously the *epistates* Biases was a kind of “supreme commander” of the Milesian defences, which stood under the divine protection of Apollo and Artemis. The state office of the *epistates* might have been introduced under Athenian influence in the 5<sup>th</sup> century BC; but more probably it is an Archaic Ionian legacy, as already the father(?) of Polykrates of Samos, Aeakes, was in charge of *epistasis*, collecting the σύλλη, “seizure”, from ships of foreign merchants arriving in Samos.<sup>51</sup> At least from the early 3<sup>rd</sup> century BC onwards, several *epistatai* formed a board which presided over the state council (*boule*) of Miletos.<sup>52</sup> This stresses the importance of the supreme commander within the political hierarchy of the city, as well as the significance of the Lion Harbour as a war harbour.

It is reasonable to suggest that Miletos already possessed a closable harbour for its fleet in the mid-7<sup>th</sup> century BC, when it started to colonise the Propontis and Pontos as well as Naukratis in Egypt.<sup>53</sup> During the same

45 Cf. Herda 2005, 288–9, 291; Herda forthcoming, § 2.2.

46 Müllenhoff *et al.* 2009a, 105–6.

47 Müllenhoff 2005, 202–8 figs. 53–4, Müllenhoff *et al.* 2004; see below § 3.4.

48 Strabon *Geographica* 14.1.6.

49 Kleiner 1968, 7, 48.

50 A. Rehm in Herrmann 1997, 147 no. 400.1–5: ἐπιστατήσας | τοῦ ναοῦ τοῦ Ἀπόλλωνος | τοῦ Διδυμέως καὶ τειχῶν κ[αί] | πύργων καὶ τῆς περὶ τὸν κλειστὸν | τὸν λιμένα ἀσφαλῆσας; P. Herrmann in Herrmann 1997, 217; Mayer 1932, 1638; Kleiner 1968, 17.

51 Athenian office: Ehrhardt 1988, 214–5; seated statue of Samian Aeakes with votive inscription (c. 550/40 BC): Freyer-Schauenburg 1974, 139–146 no. 67 pls. 56–7; *IG XII* 6.2 (2003), 357 f. no. 561 pl. 4; Ἀεάκεος ἀνέθηκεν | ὁ Βρύχωνος: ὅς τῆι | Ἡρῆι τὴν συλῆν: ἐπῆρσεν: κατὰ τὴν | ἐπίστασιν (“Aeakes, son of Brychon, who collected the *syle* during his office of *epistasis*, has dedicated [this statue] to Hera”); cf. Herda 2006, 342–3 with n. 2438–9.

52 W. Günther in Herrmann *et al.* 2006, 5.

period, a land wall cutting off the peninsula between Kalabak Tepe (“Burdock Hill”) and the later Lion Gate was built.<sup>54</sup> We may assume that the closable harbour was integrated into the defences which also protected the sea side of the peninsula.<sup>55</sup>

In Archaic times, there were two closable harbours: the Theatre Harbour (see below, § 4.1; Figs. 10, 26), and the Lion Harbour. We will concentrate here on the Lion Harbour, which fits the criteria best: (i) its opening to the sea is much closer than that of the Theatre Harbour, which made it easier to defend; (ii) its entrance is better protected against the western winds (Turkish *Imbat*, from Italian *imbatto*, “sea breeze”)<sup>56</sup> by the protruding tip of Kale Tepe; and (iii) it was, therefore, also better protected against siltation, which is clear from its long period of use.

It is unlikely that a fortification wall ran along the inner margins of the harbour. First for strategical reasons, because it would have offered the enemy lots of space to attack; second, it would have diminished the practical use of the harbour. Nevertheless, its existence was assumed by A. von Gerkan for the Classical period;<sup>57</sup> but the 2.25 m thick wall he identified as the city wall could only be detected along the southern and southwestern fringe of

the Lion Harbour (Fig. 13). Therefore, it makes much more sense to interpret it as quay wall for the mooring of bigger vessels.<sup>58</sup> The first phase of this quay may belong to the late Archaic period, when the agora area was extended to the north and the Delphinion was built in marble,<sup>59</sup> serving as it did as the starting point for the Milesian colonial enterprises. The quay wall existed in the late Classical or early Hellenistic period at the latest, when the overall monumentalisation of the harbour was completed with the erection of the Harbour Hall. The L-shaped stoa in the Doric order consisted of a 125 m long southern and a 35 m long western wing, perfectly fitted into the orthogonal *insulae* street grid. The southern wing had a single row of 30 chambers to the south, although initially chambers were missing in the western wing. Its intercolumnia were closed by barriers, and at its northern end a room was built, opening to the north with two columns in antis, perhaps functioning as a small temple.<sup>60</sup> When all the streets of the city were paved under the rule of the Roman emperors Trajan and Hadrian, from AD 100/101 onwards, the southern quay was endowed with an 11 m broad pavement of marble slabs.<sup>61</sup>

The quay clearly points to the double function of the

53 This is also assumed by Olaf Höckmann (Mainz) in a letter dated 29 January 2012. He has kindly provided us with his unpublished manuscript: Höckmann forthcoming.

54 Cobet 1997; Blum 1999.

55 Cobet 1997, 257, 263 and Blum 1999, 53 argue that between the mid-7<sup>th</sup> century and the late 6<sup>th</sup> century BC there was no wall facing the sea, but only a land wall cutting off the peninsula between Kalabak Tepe and the later Lion Gate; Lang 1996, 216-7 even neglects the existence of an Archaic land wall connecting Kalabak Tepe with the city districts to the north, cutting off the whole peninsula; but see e.g. von Graeve 1997/98, 80-3 figs. 12-4 (section between Kalabak Tepe and later “Sacred Gate”, detected by geophysics and partly excavated). The lack of a sea wall does not seem convincing for strategical reasons: an open shoreline would have offered too many potential landing places for attackers (von Graeve 2000, 117, 122 n. 21; Frederiksen 2011, 170). Sea walls are not uncommon in 7<sup>th</sup> century cities in Ionia (Smyrna: Frederiksen 2011, 188-90 fig. 100; for Samos a sea wall and a closed harbour are attested in the literary sources in the time of Polykrates: Herodotos 3.39, 60; cf. Kienast 1978, 36-8, 99-102; Frederiksen 2011, 184-5; see below, n. 84), mainland Greece (Halai, East Lokris: Frederiksen 2011, 145 fig. 43; Abdera, Thrace: Frederiksen 2011, 122-24 fig. 11), in the Aegean islands of Lemnos (Hephaestia: Frederiksen 2011, 147-8 fig. 48) and of Naxos (Frederiksen 2011, 173-4 fig. 81), as well as in Sicily (Megara Hyblaea: Frederiksen 2011, 162-3 fig. 67).

56 Turkish *imbat*/*embad* originally stems from the Italian *imbatto*,”the earliest record seems to be the Catalan variant *embat* ... (1313)”: Kahane & Tietze 1958, 255-6 no. 341 *imbatto*. For the difficult *Imbat* winds at the southern coast of the Milesian peninsula east of Cape Posideion/Monodendri/Tek Ağac, see already the portolan of the Ottoman admiral Piri Re’is of 1521 (Kitab-ı Bahriye), who called them “*Inbâd*”, similar to the modern Greek word for this kind of wind, *ἐμβάτης* (Wiegand 1929, 16; Tuttahs 2007, 431 with n. 1210a). In the winter, when the ancient sailing season was interrupted, northern winds may have predominated in the bay of the Maeander mouth around Miletos. But the ancient situation is difficult to reconstruct, as modern measurements relate to a completely different geographic and climatic situation: Tuttahs 2007, 16-28 esp. 20-3 (data of two modern weather stations at the SW and SE foot of Mykale Mountain, c. 5-10 m a.s.l.); P. Wilksi in Wiegand 1929, 46, 48 (German excavation house in Akköy, 137 m a.s.l.).

57 von Gerkan 1922, 55, 82-6, 90 pl. 12; von Gerkan 1935, 110-14 fig. 81; cf. von Graeve 1996, 320-1; Blum 1999, 72-3; von Graeve 2000, 126; Greaves 2000a, 55. Lehmann-Hartleben 1923, 128, argues against this assumption: “im eigentlichen Inneren können die Mauern nicht umgelaufen sein”.

58 Tuttahs 2007, 351-2 fig. 382.

59 Herda 2005.

60 von Gerkan 1922, 89-91; Lehmann-Hartleben 1923, 147-8; Kleiner 1968, 51-3 fig. 29; Kleine 1980, 62-3; Müllenhoff *et al.* 2009a, 99-101 figs. 3-4.

61 von Gerkan 1922, 96, 98 pl. 28; Kleiner 1968, 55 fig. 31; Tuttahs 2007, 354 fig. 384.

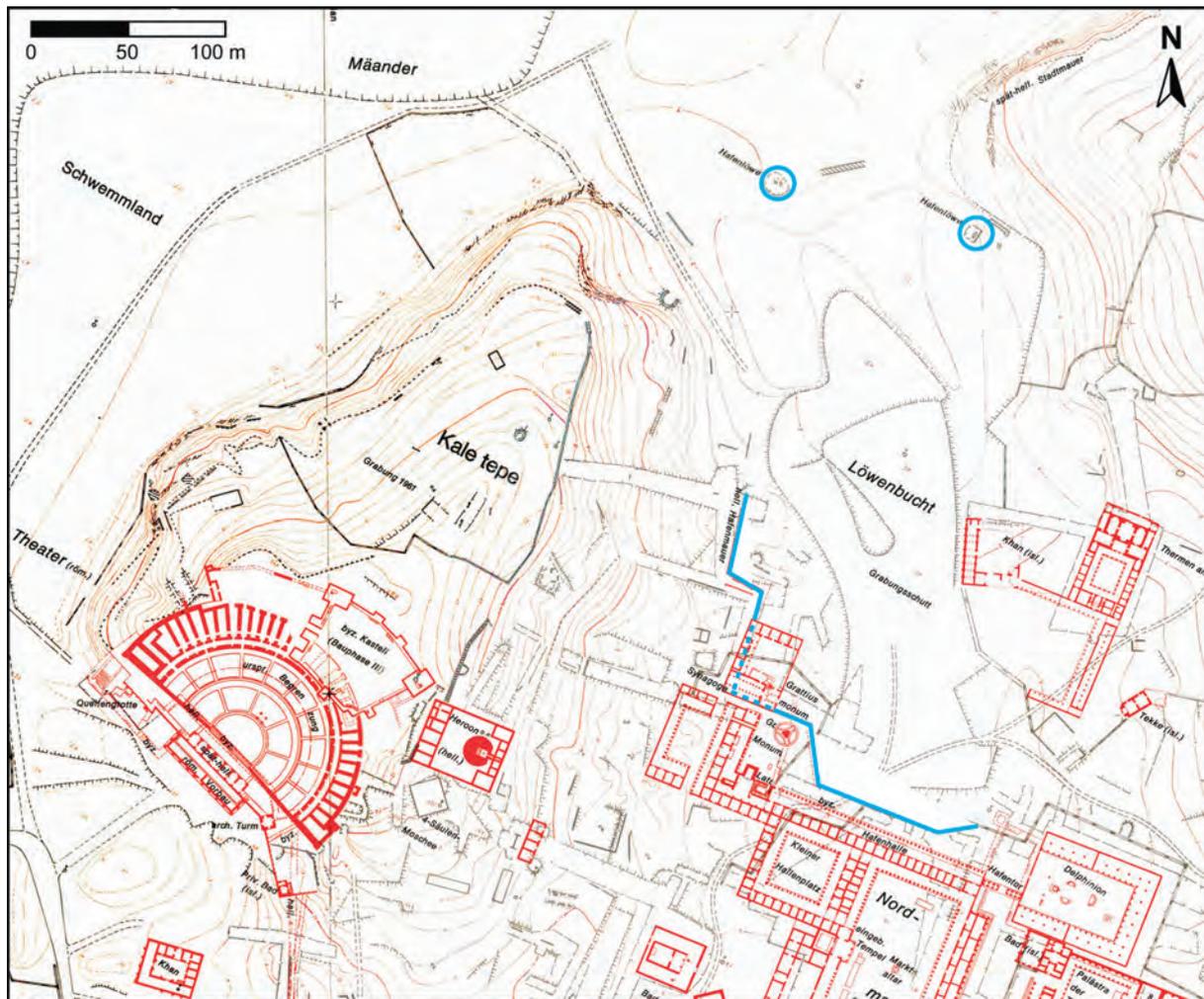
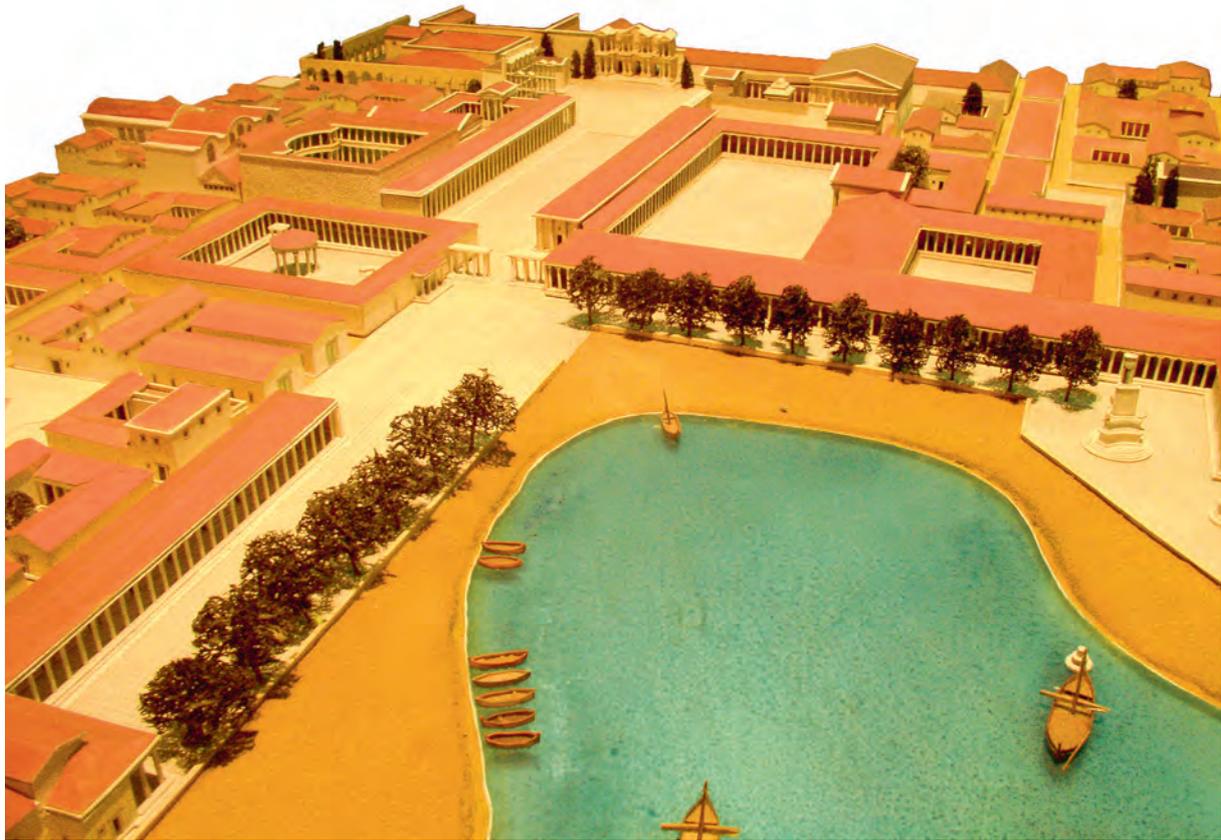


Fig. 13. Lion Harbour (“Harbour of Dokimos”?) showing the course of the detected quay wall (“hell. Hafenmauer”, blue line), and modern position of the Harbour Lions (blue circles). Ancient and Medieval buildings in red. Note Heroon I (= “Heroon (hell.)”) next to the Byzantine castle on top of the theatre, presumably the heroon of Dokimos and the phrourion of Tissaphernes/Asandros. Source: modified after Bendt 1968: Nordblatt (section).

Lion Harbour as a war and a commercial harbour,<sup>62</sup> not to mention its symbolic function (Fig. 14) - the role of the Delphinion as the main state sanctuary in the southeastern corner of the harbour has already been mentioned. In the southwestern corner of the quay, close to the quay wall, two monuments were erected at a later point in time: the larger one, c. 18 m tall, was decorated with prows of battle ships in relief and celebrated a naval victory, most probably of the Milesian fleet; the sculptural decoration

depicted a monumental tripod standing on lions, clearly alluding to Apollo, the main deity of the polis Miletos. It was possibly occasioned by the Roman victory of Lemnos (73 BC), or that of Gnaeus Pompeius Magnus over the Cilician pirates in 63 BC. The Milesian fleet had been involved in both events.<sup>63</sup> But a slightly earlier Milesian naval victory around 100 BC also seems a possible candidate: at that time, the Milesian admiral (*nauarchos*) Hegemon, son of a Philodemos, was honoured with a

62 Tuttahs 2007, 352. For this kind of double function of harbours, typical of the Archaic and Classical periods, cf. Lehmann-Hartleben 1923, 105-21, esp. 57: “Die Vereinigung von Kriegs- und Handelshafen im gemeinsamen Stadthafen, der durch die Einbeziehung in den Mauerring gewissermaßen zum öffentlichen Platz der Stadt geworden ist, entspricht recht eigentlich dem Wesen der griechischen Polis.”



**Fig. 14.** Reconstruction of the inner part of the Lion Harbour (“Harbour of Dokimos”?) in the later Roman period (c. AD 200), with the Harbour Gate, Harbour Hall, and the larger Harbour Monument seen from the north. Note the beach in front of the quay, which is supposed to indicate the ongoing siltation of the harbour. The quay on the eastern side of the harbour is not detected by excavations. This is where the shipsheds (*neoria*) are presumed to have been located. Model of the Pergamon Museum in Berlin, by K. Stephanowitz 1968, after a model made by H. Schleif c. 1930, lost in WW II. Photograph: S. Gräbener (April 2003).

statue in the Delphinion “because of his virtue and goodwill”. Perhaps he had successfully battled against the pirates who destabilised the whole Mediterranean at the

beginning of Roman rule, until Pompeius finally defeated them.<sup>64</sup> Another possible background is offered by the conflict with Priene, Magnesia, and other cities of the

63 von Gerkan 1922, 55-73 figs. 66-87 pls. 2, 8, 9.4, 19-22; Kleiner 1968, 54-9 figs. 31-4; Kleiner 1970, 121-2 fig. 1; Kleine 1980, 59-60 fig. 24; Greaves 2000a, 56; 2002, 142; Schollmeyer 2011. In the often reproduced reconstruction of von Gerkan 1922, 70 fig. 86 pl. 22, a dedicatory inscription to deified Augustus is added on the base of the tripod (Αὐτοκράτορι Καίσαρι | θεῶι θεοῦ υἱῶι Σεβαστῶι | ὁ δῆμος ὁ Μιλησίων). This is pure fantasy, dependent on von Gerkan’s dating of the monument to early Imperial times: von Gerkan 1922, 72; Kleine 1980, 59. Kleiner 1968, 56, who preferred an earlier, Hellenistic dating, questioned whether the original inscription, of which nothing is preserved, would have been left untouched under the Roman emperors. For the “Apolline iconography” of the large so-called Harbour Monument and its possible connection with a Milesian naval victory, see Tuchelt 1979, 113-4; Schollmeyer 2011, 15-6; Bol 2011, 4.

64 Hegemon inscription: A. Rehm in Kawerau & Rehm 1914, 390-1 no. 167, 3-5 ναυαρχήσαντα | ἀρετῆς ἔνεκεν καὶ | [ε]ῦνοίας τῆς εἰς ἑαυτὸν; see A. Rehm in Kawerau & Rehm 1914, 390 n. 1 on the prosopography and dating of the office of *nauarchos*; Hiller von Gaertringen 1932, 1612; and Ehrhardt 1988, 194 with n. 117. It is also attested in the Milesian colonies Abydos, Kyzikos, Istros, and Pantikapaion. On the corsairs and Miletos, cf. Cicero *Verres* 2.1.89: Miletos built 10 war ships to help Rome in the war against Mithridates of Pontos and the corsairs in 84/2 BC. In 75 BC, young Caesar was captured and held to ransom by Cilician pirates on the former Milesian island of Pharmakoussa, where he was freed by the Milesian Epikrates, cf. Polyainos 8.23.1; Plutarchos *Caesar* 1-4. Before 67 BC, the sanctuary of Didyma was plundered by corsairs: Plutarchos *Pompeius* 24; cf. Hiller von Gaertringen 1932, 1613. Strabon 14.1.7 p. 653c remarks that the Milesian archipelago of Tragia (Agathonisi) had functioned as a shelter for pirates; cf. Triantafyllidis 2010, 10.

lower Maeander plain in the 90s BC over the “right of sailing in”, either into the Maeander mouth to reach the river harbours further inland, or through the entrance to the Gulf of Latmos. Both accesses had come under Milesian control when the Maeander delta, due to ongoing siltation, cut Priene off from the open sea and progressed to the south in the direction of Miletos, finally reaching its territories (Fig. 11). The conflict was only settled in the late 90s with the help of Rome and some Greek states, in favour of Priene and the other concerned cities.<sup>65</sup>

A recently discovered roof tile stamp from a Milesian *phrourion* on the island of Tragia, today’s Agathonisi, some 20 km west of Miletos, is dated to “the third (year) of the city-god, (the year) of the victory of the safe harbour” (ἐπὶ τοῦ τρίτου | θεοῦ πόλεως ἐϋλιμένου νικῆς) (Figs. 15.a-b).<sup>66</sup> The city-god mentioned is Apollon Delphinios, whose sanctuary is located at the Lion Harbour. Is the “victory of the safe harbour” to be related to the Lion Harbour,<sup>67</sup> the base of the Milesian fleet, and did the conflict take place close by, as so many other naval battles had, starting with the famous battle of Lade in 494 BC?<sup>68</sup> The dating to “the third year of the (eponymic) city-god” places the victory before 89/88 BC.<sup>69</sup> The lettering as well as the find context of the roof tile favour a date c. 100

BC.<sup>70</sup> This date would fit well with the honorific statue of the admiral Hegemon, the construction date of the Great Harbour monument, as well as the conflict with Priene. A few years later, Miletos’ efforts in developing her naval capabilities are also apparent in the office of the supreme commander (*epistates*) Biares, being, *inter alia*, responsible for the security of the “closed harbour”, evidently the Lion Harbour (see above).

The smaller naval victory(?) monument in the south-western corner of the quay repeated the three-sided form of the taller one, and was erected for a certain C. Grattius C. F. Gal(eria) in the late 1<sup>st</sup> century AD.<sup>71</sup> The Harbour Gate was dated slightly earlier, from the first half of the first century AD. It was situated at the opposite side of the quay, between the eastern end of the Harbour Hall and the Delphinion, marking the limit between the harbour and the city centre.<sup>72</sup>

The shipsheds (*neoria*, *neosoikoi*) for warships – in the Archaic and Classical periods usually triremes of c. 5 m breadth and c. 38 m length – may have been erected at the eastern margin and, less possibly, also at a part of the western margin of the harbour, as suggested by Olaf Höckmann<sup>73</sup> and Gerhard Tuttahs.<sup>74</sup> Since the ships were pulled directly into the sheds on slipways, as was also the

65 Cf. Hiller von Gaertringen 1906, no. 111.146-7: καὶ νε[v]ικηκ[ότ]ε[ς] τῆι κρίσει τῆι κατ]ὰ τὸν εἶσπλον (“and in which we were victorious in the judgment concerning the right of sailing in”, restoration and translation by Thonemann 2011, 333 n. 97); see also Hiller von Gaertringen 1906, nos. 120; 121. On the dating of these inscriptions to the late 90s see Thonemann 2011, 329 with n. 84. Hiller von Gaertringen 1932, 1612 thought of the right of entrance to the Latmian Gulf, while Thonemann 2011, 333 preferred the right to “sail up the Maeander from its mouth to the riverine harbours further inland”. Other Greek states like Erythrai, along with Rome, had to arbitrate in the conflict; see Hiller von Gaertringen 1932, 1612-3 and Thonemann 2011, 332-4.

66 For the roof tile stamp from Kastraki on the Milesian island Tragia, today’s Agathonisi, cf. Triantafyllidis 2010, 35-8 figs. 44-5 (= here Fig. 15a-b).

67 For the term εὐλιμενος see LSJ s.v.: “with good harbours”. On the battle of Lade, see Myres 1954.

68 Another famous battle was fought at Lade between the Rhodians and Philip V in 200 BC: Polybios 16.15,6; cf. Kleiner 1968, 18-9; see also Greaves 2000a, 56, who stresses the strategic importance to Hellenistic Miletos of control over Lade. The Lion Harbour itself was the main target of Alexander’s fleet attacking Persian dominated Miletos in 334 BC: see below with n. 81.

69 The dating “in the third (year) of the polis-god” (for Apollon Delphinios as city god, see Herda 2011; for his eponymy, see Herda 2006, 39-40 n. 175, 409 n. 2904) allows us to date it before the last four preserved eponymic lists of Miletos, which cover the period between 89/88 BC and AD 31/32 (Kawerau & Rehm 1914, 267-75 nos. 125-8), as nowhere in these lists is there a period of three successive years where Apollo Delphinios is eponymous. Two successive years is only attested twice (232/31 BC and 191/90 BC; for the corrected dating see Herrmann 1997, 166-7) in the list presented in Kawerau & Rehm 1914, 264-7 no. 124 (237/6-189/8 BC). Therefore, we have to place the three-year period of Apollo’s eponymy in the missing eponymic list(s) of the years 188/87-90/89 BC.

70 Triantafyllidis 2010, 34-5 figs. 44-5.

71 von Gerkan 1922, 73-80 figs. 88-95, pl. 1; Kleiner 1968, 56, 59-60 figs. 35-6. The inscription is palaeographically dated to the Flavian period (AD 69-96) by Kleiner 1968, 56. A. Rehm in Herrmann 1997, 12 no. 190 dated it to the 1<sup>st</sup> century AD. Herrmann 1997, 198 no. 190 pl. 13, 1 (Herrmann cites Geza Alföldy [personal communication] who identifies Grattius with a Roman senator from Spanish Saguntum and adds that the inscription will have been completed by Grattius’ cognomen and his official title).

72 Kleiner 1968, 54-5 fig. 31; Kleine 1980, 74-5 fig. 30.

73 See Höckmann forthcoming.

74 Tuttahs 1998, 162-3 fig. 116; Tuttahs 2007, 351-2 fig. 382. Much to our regret this admirable engineer and scholar died on 1<sup>st</sup> of January 2013, while this article was in preparation. For shipsheds in the Lion Harbour see also: Greaves 2000a, 42-3, 49 fig. 4.



Fig. 15a-b. Milesian *phrourion* on the island of Tragia, today's Agathonisi: photograph and drawing of roof tile fragment with dating stamp "the third (year) of the city-god, (the year) of the victory of the safe harbour" (ἐπὶ τοῦ τρίτου | θεοῦ πόλεως ἐϋλιμένου νικῆς) (c. 100 BC). Source: Triantafyllidis 2010:37 figs. 44-5.

case, for example, at the harbour of Samos in the time of Polykrates (before 528 BC),<sup>75</sup> or in the 5<sup>th</sup> century BC harbours of Sicilian Naxos and the Zea Harbour of Athens, a quay wall is missing in front of the shipsheds.<sup>76</sup> According to Herodotos (6.8.1), Miletos was able to supply 80 triremes in the battle of Lade in 494 BC, even without following the proposal of Hekataios to make use of the treasures of the

oracular sanctuary in Didyma to enlarge the fleet.<sup>77</sup> But its fleet may originally have reached the size of the largest Greek contingent at Lade, the Chian fleet, which consisted of 100 ships: shortly before the battle of Lade, the Milesian tyrant Aristagoras, organiser of the revolt, led a small Milesian fleet of unknown size to carry settlers to his stronghold Myrkinos in Thrace.<sup>78</sup> There was not enough

75 Cf. Herodotos 3.45; Lehmann-Hartleben 1923, 56-8. For the location of the Samian shipsheds, see Kienast 1978, 38. He thought that the western starting point of the southern mole was in front of the inner harbour wall, where the quay extends to an area of 50 to 80 m, projecting into the sea to the east, see Kienast 1978. "Gesamtplan"; cf. the historical maps of T. Spratt (pl. 3, 1-2; 4, 1) as well as the aerial photograph (pl. 6, 2). But this area alone is too small for the Samian fleet, which consisted of 100 *pentekonteres* and 40 triremes in the time of Polykrates (Herodotos 3.39, 44); this would require c. 910 m of shipsheds (6.5 m for each ship). One should therefore expect that the *neoria* ran along the whole western semicircle of the harbour, and extended to the southern mole, which is now mostly submerged in a depth of 2.75-3.20 m, but was originally c. 75 m broad and more than 300 m long according to the aerial photograph and the maps of Spratt. Herodotos 3.60 mentions that the χῶμα, "mole/pier", was two *stadia* long (c. 360 m) and 20 *orgyiai* (c. 36 m) deep/high, which matches the southern mole best (for the ancient moles see Simossi 1991; 1998; 1999; see also: <http://www2.rgz.de/Navis2/Home/HarbourFullTextOutput.cfm?HarbourNR=Samos> [accessed 13 August 2013]). But even then the space is not sufficient, as it amounts to c. 700 m only. The Archaic Samians may have invented double shipsheds of c. 75 m length, placing them on the southern mole (the reconstructed dimensions deliver sufficient space for c. 90 triremes), long before the Syracusians (Diodoros 14.42; cf. Lehmann-Hartleben 1923, 107 n. 1: Dionysios I, 404 BC) and the Athenians (see next note). This would have made part of the Samian harbour available for commercial use as well.

76 On shipsheds see e.g. Blackman *et al.* 1996; Blackman 2004; Baika 2006; Tuttahs 2007, 348 f. fig. 380, 352 f. fig. 383; Blackman 2010. The 4<sup>th</sup> century BC shipsheds of Oiniadai (Kolonas 1989-90; Vött & Brückner 2006) and the recently excavated 5<sup>th</sup> century shipsheds in Naxos on Sicily also have slipways: Lentini *et al.* 2008; Lentini & Blackman 2009, 41-79 figs. 3, 5, 18-19, 22, 25-37; pp. 80-86 figs. 1-6. On the 5<sup>th</sup>-4<sup>th</sup> century BC shipsheds of the Zea Harbour of Athens see now Lovén & Schaldemose 2012; B. Lovén & M.M. Nielsen in this volume 235-241. In the mid-4<sup>th</sup> century they were extended in length (c. 80 m) to house two ships in a row: see V. Gabrielsen in this volume 37-48. The two recently detected Hellenistic shipsheds of the Milesian *phrourion* in Kastraki on the island of Tragia-Agathonisi most probably had slipways, as they are partly cut into the rocky coast line: Triantafyllidis 2010, 17 fig. 12, pp. 18-9 fig. 13 no. 7 (not mentioned explicitly in the text).

77 Cf. Herodotos 5.36; Hiller von Gaertringen 1932, 1597.

78 Herodotos 5.124, 126. Perhaps the fleet of 100 units with which Histiaios' nephew Aristagoras, at that time tyrant in Miletos, wanted to attack Naxos in the name of the Persian king c. 500 BC (Herodotos 5.31), corresponds to the total number of Milesian warships. On different Milesian ship types see Greaves 2000a, 50 (*pentekonter*, *trireme*, *myparo*, *keles*, *lembos*); on Milesian ship building resources: Greaves 2000a, 49-50, 52; Greaves 2002, 14. On the complex problems with calculating the number of citizens and the total population of Miletos from the number of warships, see Tuttahs 1998, 41-53 tab. 4; Greaves 2000a, 52-3 with fig. 9; Greaves 2002, 100; Greaves 2007, 14-7; Tuttahs 2007, 39-40. A Milesian sailing boat without oars, perhaps a merchant vessel, is depicted on one of the upper limestone column shafts of the Archaic temple in Didyma: Schneider 1996, 80 fig. 4 with comment in n. 9.

space in the Lion Harbour for this number of shipsheds. For 80 shipsheds, O. Höckmann has calculated that at least 528 m shoreline would be required, whereas the eastern fringe of the Lion Harbour offers max. 250 m, enough for 38 shipsheds.<sup>79</sup> We may, therefore, assume that there were additional buildings in the other harbours of the city; first of all in the Theatre Harbour, which was most probably another closable harbour and of similar size as the Lion Harbour (see below, § 4.1).<sup>80</sup>

The Lion Harbour was probably the harbour that Alexander blocked with a few triremes, “at the narrowest part of the harbour entrance”, during his siege of the city in 334 BC.<sup>81</sup> This entrance was protected by two artillery towers or bastions at the adjacent tips of Kale Tepe and

Humei Tepe, at a distance of c. 200 m from each other;<sup>82</sup> it was artificially narrowed to c. 20-40 m by two moles, remnants of which might still be hidden under the fluvial sediments of the Maeander. They may be identified in the geomagnetic anomaly “F” running slightly diagonal to the southern flank of the modern dam (Fig. 16; see below, § 3.3.3).

It is to be expected that the integration of the moles into the defences and the closing of the Lion Harbour occurred in the Archaic age. Moles built of stone were an important feature of the Archaic closable harbour of Samos.<sup>83</sup> The Samians were famous for their building efforts, and the construction of the Samian moles was much more intricate than that of the assumed moles in Miletos.<sup>84</sup> Other closable

79 Höckmann forthcoming (the average measurements for trireme shipsheds are c. 6.5 m width and c. 40 m length). The reconstruction of shipsheds on the western fringe of the Lion Harbour by Tuttahs 2007, 351 fig. 382 is less likely due to the sloped terrain.

80 The reconstruction of shipsheds at the western mouth of the Theatre Harbour by Tuttahs 2007, 351-2 fig. 382 seems less probable as it assumes that the shipsheds were open to the sea and therefore easy to attack. When producing this reconstruction, Tuttahs had no knowledge of how deep the harbour cut into the peninsula in Archaic times.

81 Arrian *Anabasis* 1.19.3: κατὰ τὸ στόμα τοῦ λιμένος ἤπερ τὸ στενώτατον; cf. Mayer 1932, 1602; Kleiner 1968, 17; von Graeve 2000, 125.

82 Cf. Blum 1999, 57 fig. 4, 62-3 with fig. 13 (remains of a tower(?) at the NE corner of Kale Tepe, built of large limestone and mica schist slabs, partly Archaic in workmanship; pottery finds dated to the 6<sup>th</sup> and 5<sup>th</sup> centuries BC; the structure is considered to be an Archaic tower by Kleine 1980, 20 fig. 5); 64-6 with figs. 14, 16-7 (remains of a tower(?) at the NW corner of Humei Tepe, built of large mica schist slabs); 72-3 with fig. 24 (both structures are labelled with “Turm?” in the map); thereafter Tuttahs 2007, 353. According to Blum 1999, 72 the distance of 200 m between the structures argues against the possibility that both artillery positions could protect one another, as well as the harbour entrance. This is true until the first half of the 4<sup>th</sup> century BC; but at least from the mid-4<sup>th</sup> century BC the range of stone and arrow throwing catapults, especially those which were torsion-based, reached 200-300 m and more: Marsden 1969-1971, I 86-98, 142-48 with figs. 6-10; Rihll 2007, 228-31. On early artillery towers, cf. Marsden 1969-1971, I 126-39; Ober 1987; 1992; Milner 1997, 211-2; Rihll 2006; 2007, 51-4. Therefore, the entrance width of the harbours of Alexandria (200 m) and Attaleia (225 m) did not constitute a security problem, especially as they were protected by artillery positions on both sides; this was a frequent feature of Hellenistic harbours; see already Lehmann-Hartleben 1923, 74.

83 Herodotos 3.60.

84 Kienast 2004, 74-6 fig. 7; see above n. 75. The city wall as well as the tunnel of Eupalinos have been archaeologically dated to the middle of the 6<sup>th</sup> century BC at the latest, so that Kienast (2004, 74 n. 19) also considers the harbour moles to be pre-Polykratean. This makes sense because the harbour was part of the defence works and its shipsheds already existed in the time of Polykrates (Herodotos 3.45). Assuming that Polykrates was the builder (e.g. Shipley 1987, 75 referring to Aristotle *Politeia* 1313b Πολυκράτεια ἔργα without specification) is, therefore, misleading. Instead, compare again Herodotos 3.60: he writes about “the Samians” as builders, without naming any individual person. Compare also the portrait statue of Aeakes from Samos, presumably the father of Polykrates, who was in charge of *epistasis* in the harbours of Samos. The statue is dated to c. 550/40 BC: see above § 3.1 with n. 51.

85 Frederiksen 2011, 10 with n. 16, 194-5 fig. 108; Grandjean 2011, 321-47 figs. 330, 335.

86 Frederiksen 2011, 125-6 fig. 16.

87 Frederiksen 2011, 168 fig. 75.

88 von Gerkan 1935, 112-3.

89 The Piraeus harbour is the earliest for which a chain is explicitly attested: Thukydides 2.94.4; cf. Garlan 1974, 388 with further examples and a reconstruction fig. 67.

90 Hoepfner 2000, 137-8 figs. 12-3, 144-5 fig. 26.

91 Müller-Wiener 1994, 4, 12, 24; Anapnotis 2006.

92 von Gerkan (1935, 113-4) envisaged a fitting for the chain, e.g. a ring somewhere at the end of a mole, close to the eastern lion, at sea level height. He doubted its permanence because the harbour would have been closed only very rarely. For the construction of an ancient closing chain, consisting of one horizontal (κλειθρον), and several vertical strings (ἄλυσις) to fix it to the ground, see Garlan 1974, 388 with fig. 67. Vitruvius *De architectura* 5.12.1 states that the chains were tightened with the help of machines, situated in towers on either side of the harbour entrance: *turresque ex utraque parte conlocandae, ex quibus catenae traduci per machinas possint*.

93 For the construction of harbour entrance barriers in antiquity, see 3<sup>rd</sup> century BC author Philon of Byzantion in his *Poliorketika* B 51-55 with the commentary of Garlan 1974, 387-90. Tuttahs 2007, 354, referring to von Gerkan 1935, 114, considers the possibility of a temporary, fixed barrier made of earth or some organic material, without further specification.



**Fig. 16.** Humei Tepe and the Lion Harbour with topographical relief and superimposed magnetic map (dark and light are positive and negative anomalies, respectively). Red: ancient buildings, yellow: assumed course of the sea wall and closing mole at the harbour mouth. Source: modified after Rabbel et al. 2006, 211 fig. 4.

harbours of Archaic times were at Thasos,<sup>85</sup> Aegina,<sup>86</sup> and probably Metymna on Lesbos.<sup>87</sup>

As early as 1935 A. von Gerkan assumed that the Milesian Lion Harbour was locked off in the late Classical and Hellenistic periods with the help of a boom or an iron chain,<sup>88</sup> like in the ancient war harbours of the Piraeus,<sup>89</sup> or that of Rhodes (Mandraki Harbour),<sup>90</sup> or the medieval

Golden Horn Harbour in Byzantion-Konstantinoupolis.<sup>91</sup> However, no installations for such a chain have been identified at Miletos: perhaps because systematic excavation at the harbour entrance is lacking,<sup>92</sup> or perhaps because the harbour entrance was defended with the help of temporary interconnected pontoons (ζεύγματα) or ships.<sup>93</sup> The latter strategy was also used by Alexander's fleet in 334

BC, not to defend the entrance but to block the exiting fleet of the Milesians, and to prevent the Persian ships outside from helping them.

In the late Classical period, possibly shortly after the conquest of Alexander, the two marble lions were installed at the harbour entrance; this was the same period in which the Harbour Hall was built.

Taken together, the construction of the late Classical Harbour Hall and the subsequent erection of the Harbour Monuments may have prompted the mid-1<sup>st</sup> century AD novelist Chariton of Aphrodisias to call the Lion Harbour Δόκιμος, the “Excellent”. He did so in his love novel *Chaireas and Kallirhoë*.<sup>94</sup> The fictional plot is set around 400 BC, a period in which Miletos was dominated by the Persians. The harbour is the setting for the triumphant arrival of the heroine Kallirhoë, daughter of Hermokrates, a famous Syracusan aristocrat and general, who had put down the Athenian attack on Syracuse in 413 BC.<sup>95</sup> She is going to marry one of the first citizens of Miletos, Dionysios. He owns a luxurious house close to the harbour, which also served as the residence of the Persian great king, his friend (φίλος),<sup>96</sup> when he stayed in Miletos.<sup>97</sup> When Kallirhoë lands, the people of Miletos

greet her, suggesting not only an adequate amount of space for crowds of people, but also a prestigious stage. These conditions are best fulfilled by the layout of the Lion Harbour and its surroundings.<sup>98</sup>

C.P. Jones has nonetheless given a much more convincing explanation for the harbour’s name. Instead of understanding Δοκίμου in Chariton’s ambiguous phrasing τοῦ λιμένος τοῦ Δοκίμου λεγομένου as an adjective related to λιμένος (“of the harbour that is called the ‘Excellent’”), he takes it as a personal name, ὁ λιμὴν ὁ Δοκίμου λεγόμενος (“the harbour called that of Dokimos”), and argues that the Lion Harbour received its name from Dokimos, an army general of Antigonos Monophthalmos. This Dokimos had restored Miletos’ autonomy and democracy in 312 BC, having taken the city by force from Asandros, another Macedonian, who had been satrap of Karia since Alexander (c. 324/23 BC). Dokimos attacked Miletos by land, while the admiral of Antigonos, Medios, attacked it by sea. The final battle took place within the city around the fortified acropolis (φρουρουμένη ἄκρα), most likely today’s Theatre Hill (Kale Tepe); it would have been necessary to renovate the nearby harbour and its facilities afterwards.<sup>99</sup> Perhaps the

- 94 *Chaireas and Kallirhoë* 3.2.11: ἐπ’ αὐτοῦ τοῦ λιμένος τοῦ Δοκίμου λεγομένου; for an adjectival understanding of the phrase, cf. Büchner 1903, 1274 “der ‘Gastliche’ (...) Hafen von Miletos”; Plepeltis 1976, 71 “Hafen mit Namen Dokimos”; Ruiz-Montero 1994, 1027-8 with n. 123; von Graeve 2000, 127 n. 33: “Nach allem, was wir bisher über milesische Häfen wissen, gibt es keinen, der durch seine Ausgestaltung ‘ansehnlicher’ gewesen wäre. Damit würden wir zumindest einen der milesischen Häfen mit seinem antiken Namen kennen.” Reardon 2004, 45, 149 “Docimus (*portus Mileti*)”; Meckelnborg & Schäfer 2006, 75, 264 n. 6 “Dokimos-Hafen”. On *Chaireas and Kallirhoë* as the first love novel of Greek literature cf. Tilg 2010, 24-79.
- 95 For Hermokrates as victor over the Athenians in 413 BC, see 1.1.1; 1.11.2; 2.6.3; 5.8.8; 7.2.3; 7.5.8; 8.6.10. Anachronistically, Chariton sometimes mixed together Hellenistic and contemporary elements: Jones 1992; Tilg 2010, 39-59; Trzaskoma 2012.
- 96 Dionysios’ friendship with the Persian king, as well as his dominant role in Ionia, is stressed several times: *Chaireas and Kallirhoë* 1.12.6 Διονύσιον πλοῦτον καὶ γένει καὶ παιδείᾳ τῶν ἄλλων Ἴόνων ὑπερέχοντα, φίλον τοῦ μεγάλου βασιλέως (“Dionysios, who supersedes all other Ionians in richness, ancestry and education, friend of the great king”), 7.5.15. At 8.5.12 he even gets the honorary title “first benefactor of the royal house” (πρῶτος εὐεργέτης εἰς τὸν οἶκον τοῦ βασιλέως) for killing the Egyptian king, but see also 4.6.8 and 6.1.9, 11, where king Artaxerxes, according to the etiquette of the Persian court, addresses Dionysios as his “slave” (δοῦλος). Dionysios is otherwise labelled as “first of the Ionians in virtue and fame, admired by satraps, kings and cities” (2.4.4. ἀνὴρ ὁ πρῶτος τῆς Ἰωνίας ἔνεκεν ἀρετῆς τε καὶ δόξης, ὃν θαυμάζουσι σατράπαι καὶ βασιλεῖς καὶ πόλεις), cf. 2.1.5; 2.5.4; 3.6.5; 4.4.3; 4.6.4; 8.7.9. Elsewhere the Persian satrap Mithridates compares him to a tyrant (4.4.4). Once (2.1.5) he is said to stem from a “royal”, βασιλικός, house; taken together, one may suppose from this information that Dionysios belonged to one of the families of the Ionian founders, most probably the Neleidai, who also served as the Milesian “kings” (σκηπτοῦχοι βασιλεῖς) at the common assemblies of the Ionian League in the Panionion sanctuary at Mykale Mountain: Herda 2009, 40 n. 83, 59 n. 168. The Ionian League (κοινὸν τῶν Ἴόνων) still existed in the time of Chariton, and into late Roman times.
- 97 Cf. *Chaireas and Kallirhoë* 1.13.1. Ἐπεὶ δὲ ἦκον εἰς τὴν οἰκίαν, ὁ μὲν Θήρων ἐθαύμαζε τὸ μέγεθος καὶ τὴν πολυτέλειαν ἣν γὰρ εἰς ὑποδοχὴν τοῦ Περσῶν βασιλέως παρεσκευασμένη. (“When they arrived in the house, Theron gazed at its size and splendour, because it was prepared to be the residence of the Persian king.”). For the house’s location directly on the harbour of Dokimos, cf. 3.2.11.
- 98 *Chaireas and Kallirhoë* 3.2.10-17. It is not clear which of Miletos’ harbours is meant by Chariton, but the Lion Harbour is undoubtedly the first candidate from the late Classical period on (cf. also Jones 1992, 101); especially as the other strong candidate, the Theatre Harbour, was no longer a closable harbour in the 4<sup>th</sup> century BC and later, cf. below § 4.1. Chariton mentions the harbours of Miletos on a number of occasions (2.1.6 τοὺς Μιλησίων λιμένας ἅπαντας, “all harbours of the Milesians”; 4.1.5 καλοὶ δὲ Μιλησίων εἰσὶ λιμένες, “but beautiful are the harbours of the Milesians”; 4.7.8 τοὺς Μιλησίων λιμένας), but the “Harbour of Dokimos” is the only one he explicitly names. On the ancient practice of naming harbours, see Lehmann-Hartleben 1923, 289-97.

two lion statues flanking the harbour entrance stem from this rebuilding project, as well as the first building phase of the Harbour Hall. We may further suppose that the prominent so-called Heroon I, an intramural Macedonian chamber tomb located on the southeastern slope of Kale Tepe, and commanding the southern part of the Lion Harbour (Figs. 3.9, 13 & 27), is the grave of Dokimos, built by the city to honour its liberator and benefactor close to the place where he fought the decisive combat.<sup>100</sup>

The assumed *phourion* on top of Kale Tepe, still in use in Byzantine times (and responsible for the later name of Miletos, Palatia-Balat (see above, n. 26), is likely to be the one built by the Persian satrap of Lydia and supreme commander (*karanos*) of Asia Minor, Tissaphernes, in 412/11 BC. It served as a stronghold of the Persian garrison and protected the Persian fleet stationed in the Lion and Theatre Harbours in Classical times.<sup>101</sup> This *phourion* was taken by Milesian and Spartan troops shortly afterwards, in the summer of 411, when Tissaphernes started to negotiate with the Athenians in Samos. One of the Spartan allies involved in this action was Hermokrates of Syracuse; he is explicitly mentioned by Thukydides.<sup>102</sup> One wonders if Chariton is alluding to this event when he lets his heroine Kallirhoë, the fictional daughter of this same Hermokrates, arrive in the Harbour of Doki-

mos: both generals, Hermokrates and Dokimos, may have captured the same strategically important castle on top of Kale Tepe above the Lion Harbour.<sup>103</sup>

The high status of the Lion Harbour in Miletos is due to its central position within the topography of the Archaic/Classical city: with the design of the *insula* street grid in the 6<sup>th</sup> century BC it became a substantial part of the new city centre around the agora and the main sanctuary of the city, the Delphinion (Fig. 10).

It also played a significant role in Miletos' foundation myth: according to one version, Apollo Delphinios swam, as a dolphin or sitting on a dolphin, from Crete via Delos to Asia Minor.<sup>104</sup> At the place where he landed on the beach he founded a sanctuary for himself, the Delphinion, as the "holy nucleus" of the later city of Miletos (Figs. 3.6, 13 & 14). When Ionian Greeks from Athens migrated to Miletos in the early Iron Age, they brought with them a sacred flame from the hearth of the Athenian *prytaneion* (city hall), which lit the sacred hearth of their own city hall.<sup>105</sup> They installed the flame right beside Apollo's altar in the Delphinion. It is interesting to note that both the Archaic and the later sanctuary, with its central altar, were based on the marine sediments of a former southeastern extension of the Lion Harbour embayment; it was literally erected "on the beach" of the Lion Harbour.<sup>106</sup>

- 99 The liberation of Miletos in 312/11 BC is explicitly mentioned in the opening lines of the second preserved list of the eponymous *aisymnetai-stephanephoroi*: A. Rehm in Kawerau & Rehm 1914, 258-64 no. 123.2-4: Ἰππόμαχος Θηρώνος ἐπὶ τούτου ἡ πόλις ἔλευθέρη καὶ αὐτόνομος ἐγένετο ὑπὸ Ἀντιγόμου καὶ ἡ δημοκρατία ἀπεδόθη ("Hippomachos, son of Theron: during whose [eponymous] office the city became free and autonomous under Antigonos, and the democracy was restored"); for the corrected absolute dating of the list cf. Herrmann 1997, 166 pl. 6.1; compare Diodorus Siculus 19.75.4 (Medios and Dokimos free Miletos for Antigonos "after taking by storm the fortified acropolis"); A. Rehm in Kawerau & Rehm 1914, 241 and Kleiner 1968, 17, 27, 129 have convincingly identified the mentioned acropolis (φρουρουμένη ἄκρα) with the Theatre Hill. On the whole matter cf. Jones 1992; followed by: Ehrhardt 2000, 519.
- 100 On the grave, see Kleiner 1968, 129-31 figs. 96-8; Kleine 1980, 51-4 figs. 20-1; von Mangoldt 2012, 357-9 pl. 138, 6-8 ("B190. Milet I"). On Heroon I as the possible grave of Dokimos and his family, cf. Herda 2013, 71-76 figs. 3-5, 11. Kleiner 1968, 129 saw a connection between the heroon and the *phourion*, but he considered Asandros as the possible owner.
- 101 For the *phourion* see Thukydides 8.84.4; 8.85.2; 8.109.1; cf. Cobet 1997, 266-7; for its assumed location on Kale Tepe: Mayer 1932, 1629; Kleiner 1968, 16; von Graeve 2000, 115 n. 6 against Cobet 1997, 280, who thinks of Kalabak Tepe instead. In 494/93 BC the Persian-Phoenician fleet wintered in Miletos (Herodotos 6.31), implying a Persian *phourion* in the city, cf. Cobet 1997, 263. Again, Kale Tepe is the best candidate.
- 102 Thukydides 8.84-5.
- 103 Chariton further constructs an especially subtle example of the irony of history: Hermokrates' admiral's ship of 413 (cf. 3.5.3 ἐκέειν τὴν τριήρη τὴν στρατηγικὴν ἔχουσαν ἔτι τὰ σημεῖα τῆς νίκης, "that triere of the *strategos* that still carried the signs of victory", 4.4.7 τριήρη τὴν καλὴν, τὴν στρατηγικὴν; throughout the story, the ship of Hermokrates is frequently mentioned, cf. 3.9.9-11; 3.10.8; 4.1.1; 4.3.3, etc.), with which Chaireas, the novel's leading male character and true husband of Kallirhoë, has come to Miletos to pick up his wife, is burnt by Persian troops, stationed in "a *phourion* of the barbarians" (*Chaireas and Kallirhoë* 3.7.2: εἰς τι φρούριον βαρβάρων). This *phourion*, where the Persians afterwards brought their captives to sell them as slaves to the satrap of Karia (3.7.3), is most likely the one of Tissaphernes on Kale Tepe.
- 104 Kallimachos *Branchos* fr. 229.12-3. I reconstruct the continuation of the myth with the help of the *Homeric Hymn to Apollo*, ll. 388-546: Herda 2006, 35-37, 273-7; Herda 2008, 15-8, 51-5, 63-4; Herda 2011, 75-81; Herda forthcoming, § 2.7.
- 105 Herodotos 1.146.
- 106 Herda 2005, 288-91; Brückner *et al.* 2006, 73-4; Herda 2008, 51-5; Herda 2011, 81; Herda forthcoming, § 2.7.

The flame of the hearth-altar in the Milesian Delphinion was sacred to the goddess Hestia. Milesian colonists departed from here under the protection of the oracle in Didyma, to found the many colonies that the Ionian metropolis was so famous for. They did so by taking with them flames from the hearth, to establish new hearths and cults of Hestia in each colony. In many cases, including at Sinope, Olbie Polis, Odessos, and Hermonassa, the cult of Apollo Delphinios was installed as well. Figuring as a dolphin-god, Apollo entered the ships together with the future colonisers.<sup>107</sup> On the journey he protected them from all dangers, as Apollo Delphinios did with the Kretans in the famous Archaic *Homeric Hymn to Apollo*.<sup>108</sup> In Archaic times the first step of departure for the Milesian colonists took place in the Delphinion. After sacrificing to Apollo Delphinios and the other gods, they took the hearth fire of Hestia Koine and moved to their ships on the quay of the Lion Harbour close by.

Another important event in the Lion Harbour would have been the *embateria* rites, the ritual with which the seafaring season was initiated in spring every year. It was also closely connected to the cult of Apollo Delphinios, who acted as protector of the seafarers.<sup>109</sup> The rite was probably integrated into the New Year festival, taking place in the Milesian month *Taureon*, our March–April, and devoted to Apollo Delphinios.<sup>110</sup> Did the *Aeinautai*, the “perpetual sailors”, attested as officers for Archaic Mi-

letos, also depart from here; and did they perform the *embateria* rites?<sup>111</sup>

Finally, the Lion Harbour should be considered as the place where foreign diplomatic missions, approaching by boat, landed and were officially welcomed. From here they could easily access the Delphinion, which incorporated the “*Molpon*”. This club house of the Molpoi, the cult association of Apollo Delphinios, served as prytaneion of the city state of Miletos. It incorporated the κοινή ἐστία, the “common hearth”, lit with the sacred flame from the hearth of Miletos’ mothercity Athens. In the *Molpon* the Milesian *prytanes* assembled, and diplomatic receptions (δίκη τῆς ξενίας) took place there.<sup>112</sup>

We can conclude that the Lion Harbour was essential for Miletos’ past and future as a “gate for gods and people”. It was not only of strategic and commercial importance, but also of the highest political and religious value to the city.

The prestigious outfit of the Lion Harbour as well as its usability was ruined when the Goths invaded Asia Minor around AD 262. Miletos’ city walls had to be restored,<sup>113</sup> and in the course of the construction works the inner fringe of the Lion Harbour was fortified for the first time, closing the front of the Harbour Hall and dismantling the large Harbour Monument.<sup>114</sup> This may be a sign that the locking of the harbour against enemies was no longer working effectively.<sup>115</sup>

107 Compare his common epithets *Embasion*, “the one who enters (the ship)”, and *Embaterios*, “the one to whom are devoted the *embateria* rites”, as well as the opposite *Ekbaterios/Ekbaterios* and *Epibasion/Epibaterios*: Herda 2008, 53 with n. 310.

108 *Homeric Hymn to Apollo* 338–546; cf. Herda 2008; Herda 2011, 74–81.

109 Bourboulis 1949, 52–69; Robertson 1987, 383. However, new studies like that of Beresford 2013 show that the idea of a *mare clausum* during winter season is a modern construct.

110 Herda 2008, 51–6.

111 The *Aeinautai*, a faction of rich aristocrats (and merchants?), are an enigma of Archaic Milesian history. Their office is mentioned by Hesychios (s.v. ἀειναῦται: ἀρχῆς ὄνομα παρὰ Μιλησίοις) and Plutarchos *Quaestiones Graecae* 32 p. 293c–d in connection with a period of civil strife which led to the overthrow of the tyrants Thoas and Damasenor: ἐβουλεύοντο περὶ τῶν μεγίστων ἐμβαινόντες εἰς τὰ πλοῖα καὶ πόρρω τῆς γῆς ἐπανάγοντες κυρώσαντες δὲ πῆν γνώμην κατέπλεον, καὶ διὰ ἀειναῦται προσηγορεύθησαν (“They were accustomed to deliberating about matters of the greatest importance by going aboard ships and putting out to sea far away from the land. When they made their decision, they sailed back, and on account of this they are called ‘perpetual sailors.’” Translation by Gorman 2001, 108). The story is put together with Herodotos 5.28–30 and dated to the years before 560 BC: Hiller von Gaetringen 1932, 1594; Robertson 1987, 381–384; Gorman 2001, 108–10; Talamo 2004, 18–31; Herda 2005, 292 with n. 239; Herda 2006, 18 n. 59. *Aeinautai* are also attested in Chalkis and Eretria (6<sup>th</sup>–3<sup>rd</sup> centuries BC): Robertson 1987, 382–3, 384; Scott 2000, 107–8; Gorman 2001, 109–10; Walker 2004, 23, 123–4, 134, 138. That the *Aeinautai* performed the *embateria* rites was assumed by Robertson 1987, 383.

112 Cf. Herda 2011, 63, 67–8 on the Μολπών as it is called in a sacred law of the Molpoi: Herda 2011, 83 lines 11–2, 17, 20. “*Molpon*” is a contracted Ionian dialectal form of Μολπεῖον, the “[club house] of the Molpoi”: Herda 2006, 78–80 with n. 473; Herda 2011, 63 with n. 36.

113 Cobet 1997, 273–4.

114 Niewöhner 2008, 181–6 fig. 1 red marking, 188 fig. 3.

115 But see § 3.3.3 on the late wall “E” at the harbour mouth, which might be part of the “Gotenmauer” (“Wall against the Goths”) which was then also closing the harbour entrance.

During the relative peace of the centuries that followed, the defence works of Miletos were gradually demolished. However, in AD 538, in the twelfth year of Justinian's reign, a new city wall was built, and Humei Tepe as well as the northern parts of Kale Tepe were now excluded from the fortified areas. The wall ran along the southern fringe of the Lion Harbour only, which was no longer a closable harbour.<sup>116</sup> The good accessibility from the open sea made it necessary to restore the city wall from the late 7<sup>th</sup> century AD onwards, in order to defend against Arab pirates who raided the Aegean Sea.

### 3.2 Geophysical data (W.R. & H.S.)

Between 1993 and 2004 the area of the Lion Harbour was investigated thoroughly with different geophysical methods.<sup>117</sup> The objectives of this research were (i) to search for traces of possible harbour constructions, and (ii) to determine the shape of the former harbour basin, from which further hints regarding its use and role in the more general context of city construction might be inferred.

A major result of magnetic mapping was the detection of two 50 m long, 5-10 m wide magnetic anomalies in the silted-up basin area (A and B in Figs. 16-18, 22). The anomalies are spaced 100 m apart and located close to the eastern and western harbour boundaries (Figs. 16, 18 & 22). They lead from the city centre to the two lion monuments. Geometrically, the magnetic anomalies can be thought of as forming two parallel sides of a rectangle spanning the northern part of the harbour, with the lion monuments placed at its northern corners. The relation of the suspected harbour constructions to the street system was investigated by extending the magnetic surveys from the city centre to Humei Tepe, representing the northern part of the peninsula of Miletos.<sup>118</sup> These surveys, together with the micro-topography, show that part of the magnetic structures A and B found at the harbour deviate

10° from the orientation of the Hippodamian grid system (Fig. 16; see § 3.3.2).

Magnetic measurements do not provide reliable information about the depth of the causative archaeological or geological structure. The elongated anomalies A and B found in the Lion Harbour could be caused, for example, by a near surface structure with a width comparable to that of the anomalies (5 to 10 m), or by a narrow but more strongly magnetized structure at a maximum depth of 5 to 6 m. A magnetic source deeper than 5-6 m would have created a wider anomaly than that observed.

The magnetic anomalies C-F (Figs. 16, 22) are located near the modern dam that closes the bay of the Lion Harbour towards the Maeander plain. They include a weak magnetic lineament F, oriented parallel to the dam (Figs. 2 left; 3, 3; 17 background left). This anomaly shows up somewhat stronger in the west (C in Fig. 16) than in the east. Its origin has not yet been investigated. It may be caused by the modern dam, but it could also indicate anomalies of an archaeological structure, such as an assumed west-east oriented mole. Anomaly D is a strongly magnetized spot of unknown origin. Anomaly E is caused by remnants of a late Roman or Byzantine wall (Fig. 17 background right). F is related to the western Lion sculpture and the remnants of excavation work around it (Fig. 17 foreground).

In addition to the geomagnetic studies, DC-geoelectric and seismic refraction measurements (Fig. 17) were carried out in order to determine the geological boundary conditions of the harbour setting, in particular the depth contours of the basin. The northern harbour area was covered with 19 parallel seismic refraction profiles with 8 m spacing. The profiles were 144 m long with a sensor spacing of 1 m. In addition, two 3D seismic surveys were carried out on areas of 48x48 m<sup>2</sup> and 40x80 m<sup>2</sup>, with 1 m grid spacing, in order to investigate the seismic basement beneath the magnetic anomalies A and B in closer detail.

<sup>116</sup> Tuttahs 2007, 367-8 figs. 391-2; Niewöhner 2008, 108 fig. 1 green marking; Niewöhner 2009, 62 fig. 2 pink marking. The dating of the early Byzantine city wall is disputed, depending on the attribution of a Justinian building inscription of AD 538 on a lintel block to the famous Market Gate. Niewöhner (2008; 2009; 2010, 240 with n. 4-5, pp. 257-8) believes the lintel to be re-used in the gate in the 7<sup>th</sup>/8<sup>th</sup> centuries AD, when the wall could have been built against the Persian and Arab invasions into Western Asia Minor. Kästner (2009) on the contrary argues more convincingly for its original use at the gate; he therefore dates the rebuilding of the Market Gate as well as the city wall to Justinian times, AD 538 (see already von Gerkan 1935, 114-7).

<sup>117</sup> Stümpel *et al.* 1995, 1997, 1999; Wölz 2003; Rabbel *et al.* 2004.

<sup>118</sup> Stümpel 2001.



Fig. 17. Seismic measurements at the western Harbour Lion. In the background at the top: modern earth dam (left) and late Roman/early Byzantine (?) wall "E" (right). Photograph: W. Rabbel.

The seismic measurements show that the harbour basin reaches a maximum depth of 22 m between the magnetic anomalies. The dip of the basin flanks is of the order of 30°. The seismically determined depth contours of the harbour basin were verified by drilling at many places (Tab. 2; see below, § 3.3.2).

Both the seismic and geoelectric measurements (Fig. 18) show that the western magnetic anomaly A is underlain by a rock plateau at c. 5 m depth.<sup>119</sup> It is part of a ridge that closes the harbour basin towards the Maeander plain, i.e. towards the sea in ancient times. The ridge shows a 10 to 20 m wide opening, which probably represents the ancient harbour entrance. It is located c. 5 m east of the western lion monument. The geoelectric profile shows a depth section in terms of specific electric resistivity leading from the plateau into the harbour basin somewhat south of the ridge. Resistivity values of >6 Wm indicate the consolidated basement of the plateau and the harbour basin. The basin fill shows resistivity values as low as 1 Wm caused by water saturation and high porosity. The basin depths found by geoelectrics and seismics are in agreement with the limits of measurement accuracy.

Beneath the eastern magnetic anomaly B solid ground is found at a depth of 5 to 7 m. A careful tomographic investigation of this site shows that this solid ground most

likely represents a debris layer overlaying soft sediments.<sup>120</sup> The limestone basement is found beneath these sediments at a depth of 10 to 12 m. The eastern magnetic anomaly B follows the 10 m depth contour of the seismic basement. However, as in the case of the western magnetic anomaly A, the maximum possible depth of the causative magnetic structure is of the order of 5 m.

### 3.3 Data and evidence from corings (H.B., A.H. & M.M.)

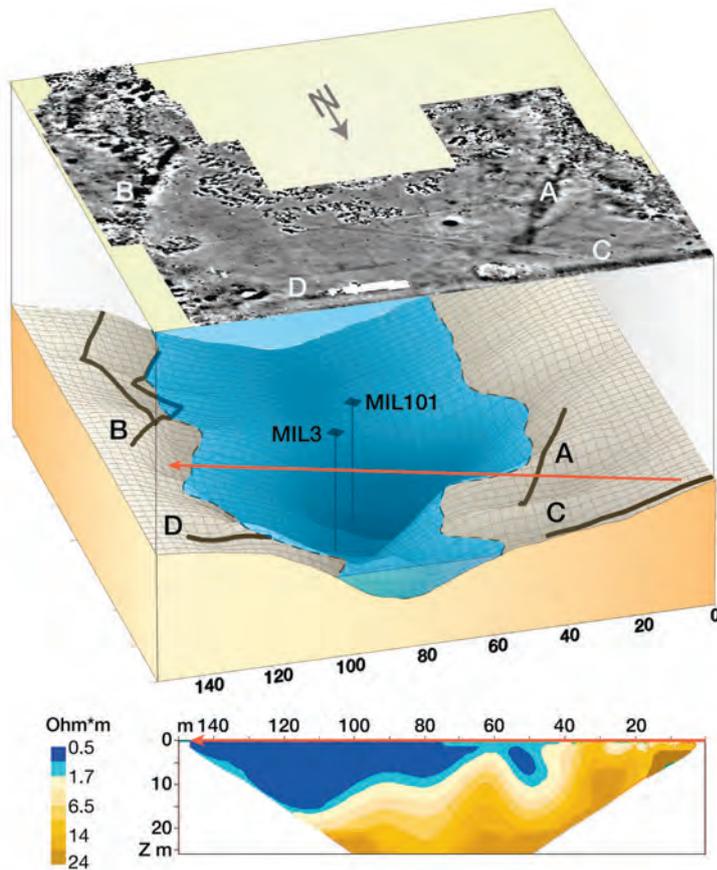
#### 3.3.1 Sediment profile at the entrance of the Lion Harbour

The coring Mil 3 was sunk into the ground at the entrance of the Lion Harbour, between the present positions of the two lion sculptures and south of a still visible later wall (E in Figs. 16-18). It displays the typical stratigraphy of the Maeander alluvial plain. In addition, it reveals the gradual siltation of the harbour basin (Fig. 19).

Slope debris, most probably of Pleistocene age, is reached at a depth of 12.75 m bsl (below present sea level). It is topped by littoral facies with small pebbles in a sandy matrix, which are sedimentary proof of the marine transgression. With the rising water table the former beach area turned into a shallow marine embayment, as evidenced by rich marine fauna and sea grass (*Posidonia* sp.). The radiocarbon age of a specimen of the marine-brackish bivalve cockle *Cerastoderma glaucum* dates the onset of this phase to 3960-3790 cal. BC. The sediment is clayey because of the sheltered leeward position behind the Kale Tepe hill. Around 8.50 m bsl, the clay turns into silt, indicating increased sediment input from the adjacent terrain rather than higher wave energy; this had already started before the 1<sup>st</sup> century BC. The upper part of the harbour sediments (c. 2.25-0.25 m bsl) is rich in closed specimens of *Cerastoderma glaucum*, together with *Posidonia* sp., both indicating a low-energy, brackish environment. Several finds of diagnostic ceramic fragments date this stratum to the early Byzantine period. The top layer consists of alluvium from the Maeander river, continuously deposited when the river flooded the area during winter seasons before the earth dam was built in 1984/85.

<sup>119</sup> Woelz & Rabbel 2005.

<sup>120</sup> Woelz *et al.* 2009.



**Fig. 18.** Magnetic, seismic, and electric investigations of the Lion Harbour. View from southwest. Top: model of the harbour basin based on 2D and 3D refraction seismic interpretation, superimposed with a gray-scaled plot of magnetic anomalies (dark and light are positive and negative anomalies, respectively). Middle part: the bluish plain shows a depth of 6 m below today's earth surface. The maximum depth of the harbour basin of c. 22 m was verified by drilling (Mil 101). Bottom: electrical resistivity cross-section acquired near the modern earth dam, erected at the entrance of the former harbour. The geoelectric profile follows the red line in the middle figure. Source: Stümpel et al. 1999, 93, and Wölz 2003, 19.

The chronostratigraphy of the sedimentation process, based on several  $^{14}\text{C}$  age estimates and diagnostic ceramic fragments, reveals considerable morphodynamic changes. The very low sedimentation rate between 3960-3790 BC and 510-390 BC, i.e. from the Neolithic/ Chalcolithic until the Archaic periods, of only 0.6 mm/a, is evidence of a still intact ecosystem with a low sediment flux in the environs of the Lion Harbour. Thereafter, the sedimentation rate increases to 6.3 mm/a between 510-390 BC and 100-50 BC, i.e. during the Classical and Hellenistic periods, which documents the mobilisation of sediments from the adjacent slopes. The highest sedimentation rate is reached in Roman and early Byzantine times: 12.2 mm/a between 100-50 BC and c. AD 400. This can be explained by the increased human impact on the ecosystem in Roman times.<sup>121</sup> The same holds true for Lake

Bafa, where the sedimentation rate is also highest during the Roman period.<sup>122</sup> In the case of the Lion Harbour another factor has to be added: in later Roman Imperial times, the Maeander delta front is close to the Milesian Peninsula, thus contributing considerably to the siltation of the harbour (Fig. 11).<sup>123</sup>

### 3.3.2 Coring adds to the interpretation of geophysical data

Wherever possible, the best geoaerchaeological approach for the study of a given area is to carry out geophysical (georadar, geoelectric, geomagnetic) research as a first step; it is the best means of acquiring areal information about the subsurface strata, including the potential occurrence of building structures, artefacts, finds, etc., relatively

121 Brückner et al. 2006, 76-7.

122 Müllenhoff 2005, 230-3; Knipping et al. 2008.

123 Müllenhoff 2005, 201 fig. 52.

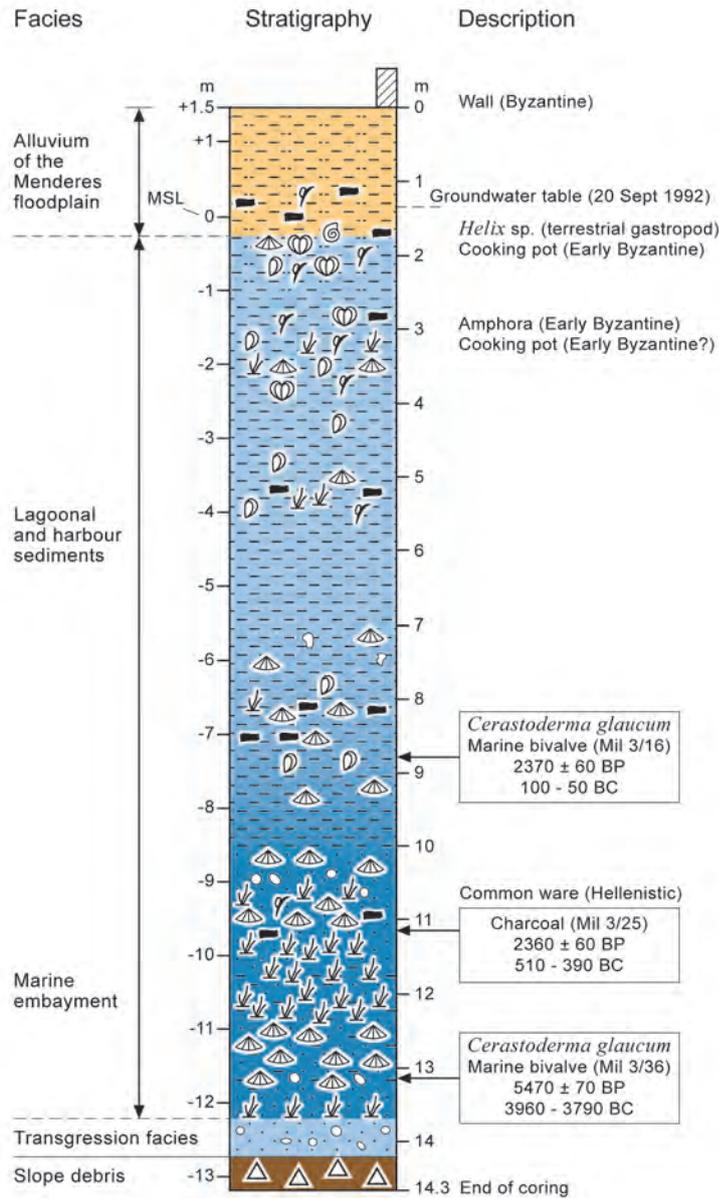
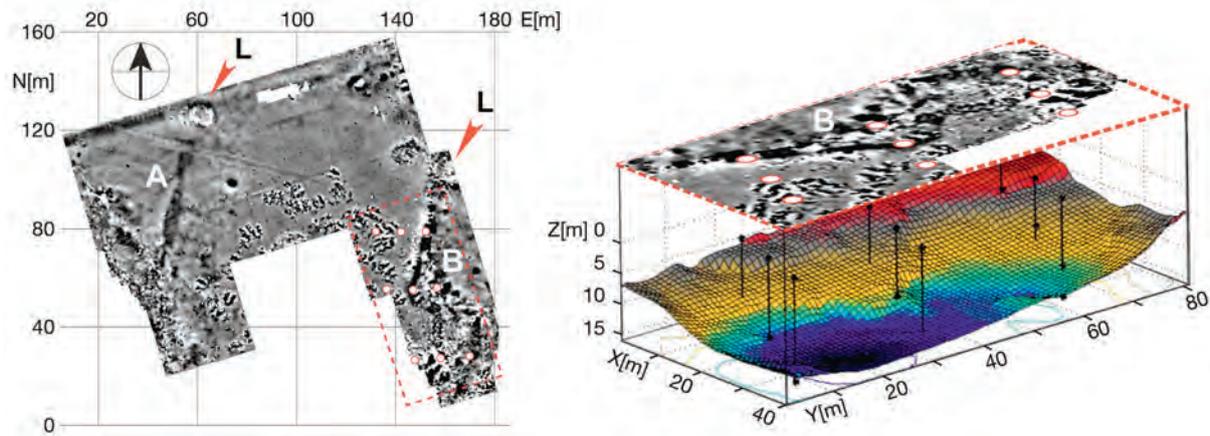


Fig. 19. Coring profile Mil 3 at the entrance of the Lion Harbour (see fig. 14). Source: modified after Brückner 1996, 571.

quickly. The processed data and any kind of anomalies have to be interpreted. The second step is to verify or falsify these interpretations. In many cases this can be done by coring, which is a relatively quick and inexpensive method, causing nearly no damage to the subterranean structures; it is a kind of “minimally invasive” archaeology. The third step is to carry out excavations – the most precise method, but also the most costly and time consuming one; in areas where the groundwater table is high, e.g. in coastal or alluvial archives, excavation is only possible with an expensive well-point system.

At the Lion Harbour, several cross-checks were carried out between geophysical and coring data. A basic question was the sediment thickness of the silted-up harbour basin. With geoelectric and seismic measurements it is relatively easy to detect the contact between hard rock (pre-Holocene bedrock) and soft rock (harbour fill). In one section of the harbour this data was compared with the results from nine corings (Fig. 20 right, Tab. 2). The refractor model and the cored bedrock depths are in good agreement, although the refractor depth is slightly underestimated in the northernmost part. The average difference between migrated



**Fig. 20.** Magnetic, seismic, and geoarchaeological investigation in the Lion Harbour. Left: magnetic map of northern harbour basin. L = present-day position of the lion statues. Dashed red frame = area of 3D seismic measurements; red circles: locations of nine corings for ground truthing of the seismic measurements (cf. Tab. 2). Right: in colour: final topographic model of the basement derived from 3D seismic refraction data (view from NW); black vertical lines: coring hole positions, diamond markers indicate the surface and cored bedrock depths, respectively; grey scale map on top: cut-out from the magnetic map. The dashed red frames and red circles of the left and right figures correspond to each other. Source: modified after Woelz et al. 2009, fig. 5.20.

Coring site	1	2	3	4	5	6	7	8	9
Migrated depth (m)	14.01	13.26	9.57	13.67	11.55	8.95	11.55	9.96	5.91
Drilled depth (m)	17.00	13.05	11.35	14.15	11.20	10.75	11.00	7.73	5.46
Difference (m)	-2.99	0.21	-1.78	-0.48	0.35	-1.80	0.55	2.23	0.45
Difference (%)	-17.59	1.61	-15.68	-3.39	3.13	-16.74	5.00	28.84	8.24

**Table 2.** Depth of the soft rock/hard rock contact based on geophysical data (“migrated depth”) and coring evidence (“drilled depth”) from nine coring sites of the Lion Harbour. For the coring sites, see Fig. 20.

depths and drilling depths is 1.20 m; in reference to the drilling depths this is equivalent to an average difference of 11% (Tab. 2). The probable reason for this is that between the solid bedrock and the soft sediments of the harbour basin is an intermediate zone of weathered bedrock and (Pleistocene?) slope debris. Therefore, in some places the hardrock/softrock contact is not very sharp.

The greyscaled magnetic map (Figs. 16, 18, 20 left) shows two strong linear anomalies, A and B, running for 50 m from the present position of the lion sculptures to the southwest, at a distance of c. 100 m from each other. These anomalies were thought to be quay walls or mole foundations.<sup>124</sup> However, several corings (Mil 142, 145, 171, 212) directly on these anomalies clearly reveal only

124 Blum 1999, 72-4 fig. 24; Stümpel et al. 1999, 89, 91-4; Wölz 2003, 20; Stümpel et al. 2005, 192; Rabbel et al. 2006, 207; Tuttahs 2007, 352.

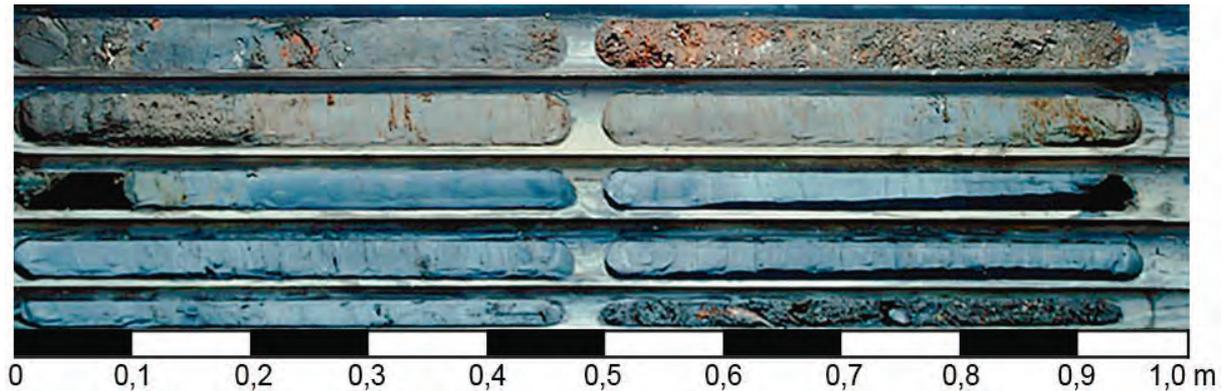


Fig. 21. Coring Mil 145, directly on the geomagnetic anomaly running south from the eastern harbour lion (see Fig. 17, anomaly B). The surface of the silted up harbour is in the upper left corner. Total coring depth: 5 m, diameter of open auger heads: 6 cm Ø (0-2 m), 5 cm Ø (2-4 m), 3.6 cm Ø (4-5 m). Note the red brick layer at 0.45-0.63 m below surface. Photograph: H. Brückner (September 2001)

soft sediments. Figure 21 shows a typical profile in coring Mil 145, placed directly in anomaly B: 0-0.45 m below surface (b.s.): silts, partly sandy, disturbed; 0.45-0.63 m b.s.: pieces of bricks in silty sand; 0.63-1.20 m b.s.: silty sand; 1.20-4.45 m b.s.: silt, partly clayey; 4.45-5 m b.s.: seagrass with marine bivalves and gastropods. This result is confirmed by a more recent analysis of the seismic measurements, indicating only a plateau near to 5 m in depth (see above, § 3.2, Fig. 18).<sup>125</sup> Stone material which would be needed to construct a steady quay or a mole has not been encountered in any of the corings. How then can the anomalies be explained?

The bricks at a depth of 0.45-0.63 m b.s. are likely to be the reason for the anomalies A and B featured in the geomagnetic image, since in all of the corings the bricks are the only material that would give such a strong magnetic signal.

These brick layers miss every kind of solid foundation on the bedrock, which is at a depth of 8-11 m under anomaly B and c. 5 m under anomaly A.<sup>126</sup> This evidence seems to indicate paved paths, which might, for instance, have provided access to the lion statues when the harbour

was partly silted up. At the most, the brick layers might be foundations of rather weak walls, whose upper parts, built with bricks or stones, were later removed. They may have formed the harbour limits in the late Roman/early Byzantine periods, when the Lion Harbour had started to silt up (see below, § 3.4). This would also explain the irregularity of anomaly B, which indicates a double course in its southern part (Figs. 18, 22)<sup>127</sup>: the eastern line with its zigzag curved course in the middle part is most probably an older attempt to define the eastern harbour fringe in this area. When the siltation progressed, it was relocated further to the west.

In the context of their interpretation as quay walls or moles, anomalies A and B were formerly believed to follow the 22° clockwise inclination from geographical north of the so-called Hippodamian *insula* street grid system in this area.<sup>128</sup> But this is not correct: anomaly A has only an inclination of 10° clockwise, while the course of anomaly B is difficult to determine. At least in the northern part, anomaly B shows an inclination of 10.5° clockwise. The orientation of the anomalies therefore has no direct chronological implication in the sense that

<sup>125</sup> Woelz & Rabbel 2005.

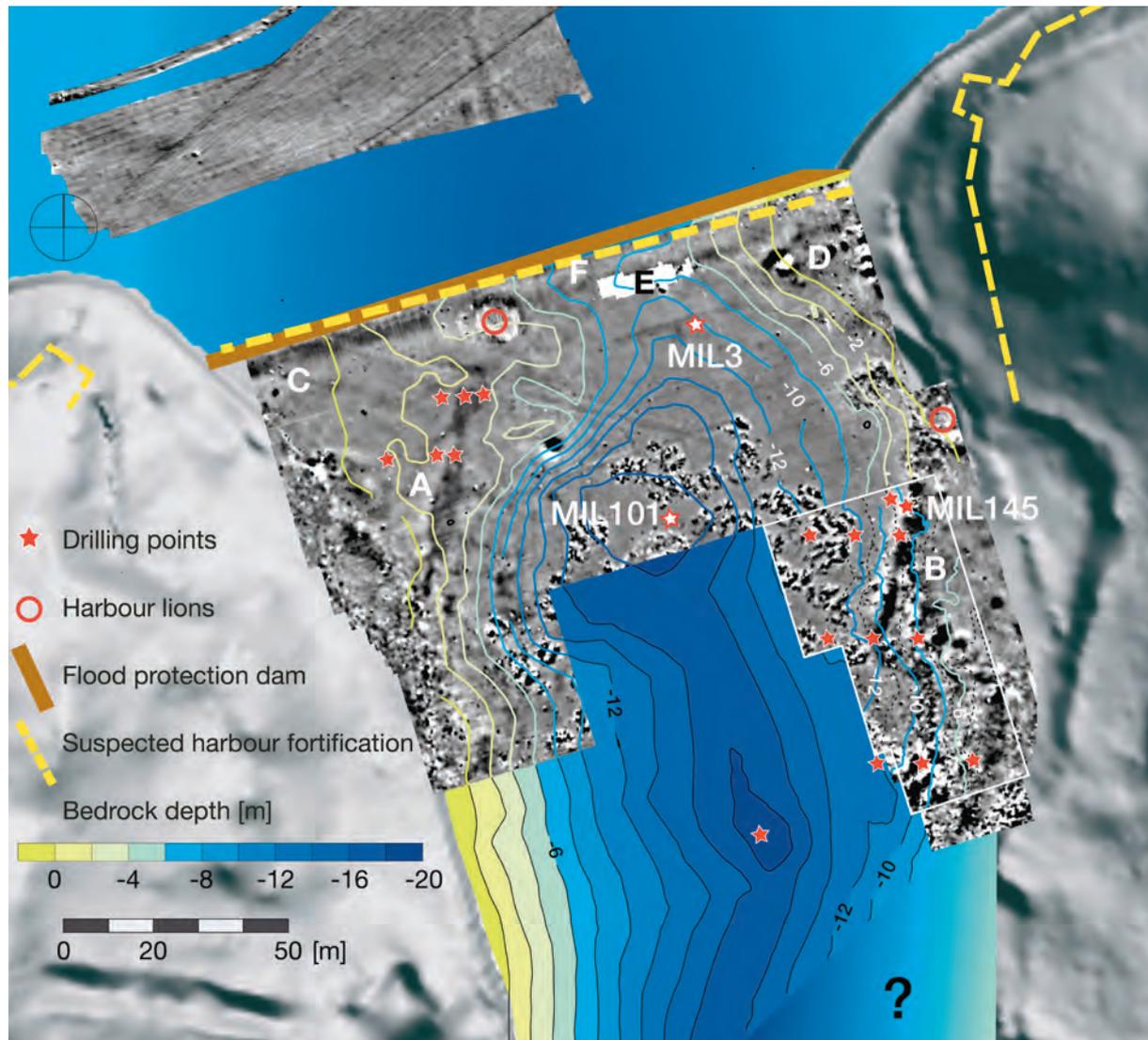
<sup>126</sup> Stümpel *et al.* 2005, 190-2 figs. 6-7; see § 3.2.

<sup>127</sup> Stümpel *et al.* 1999, 91 fig. 2, 93 fig. 4; Stümpel *et al.* 2005, 192 fig. 7.

<sup>128</sup> Rabbel *et al.* 2006, 207.

<sup>129</sup> This was the case until middle Byzantine times, 8<sup>th</sup> to early 11<sup>th</sup> centuries AD (K. Wulzinger in Wulzinger *et al.* 1935, 11, 56).

<sup>130</sup> Stümpel *et al.* 1999, 93 fig. 4; Stümpel *et al.* 2005, 192 fig. 7; Rabbel *et al.* 2006, 207 fig. 5.



**Fig. 22.** Magnetic and seismic investigation in the Lion Harbour. Dark grey are positive, light grey are negative anomalies. The thickness of the Holocene filling of the harbour basin is based on 2D and 3D seismic refraction data; drilling locations indicated by stars. 3D data was acquired in the framed area around anomaly B. Note that the absolute depths of the 2D and 3D measurements deviate from each other at the frame. Anomaly “F” marks assumed ancient mole to close the harbour. Anomalies “A” and “B” most probably belong to the early Byzantine brick constructions, anomalies “C” – “E” probably to the so-called *Gotenmauer* (wall built against the invasion of the Goths in c. AD 262). Source: compiled after Stümpel et al. 1999, 91 fig. 2, Woelz 2003, 20, and Woelz et al. 2009.

they were built when the Archaic-Classical grid system was still in use.<sup>129</sup> Instead, the orientation is subject to the natural conditions of the harbour basin, e.g. the underground topography as detected by seismic studies (Fig. 18).<sup>130</sup>

### 3.3.3 A new reconstruction of the Lion Harbour entrance

The new interpretation of anomalies A and B requires a review of the situation at the harbour entrance. A detailed plan of all anomalies in this area will help to solve the puzzle (Fig. 22).

First the lions: as the eastern lion (Fig. 7) stands at the northern end of the late Roman-early Byzantine anomaly B, 100 m to the southeast of the western lion, this position can hardly be original. Instead, the late Hellenistic inscription on its breast, addressing the incoming ships (see above, § 1.1), suggests an installation at the harbour entrance. A secondary placement is also likely because the sculpture of 23 tons currently stands directly on sand, without any foundation.<sup>131</sup>

The western lion (Figs. 6, 17), in contrast, is located close to its original position, marking the terminal points of anomalies A as well as C.<sup>132</sup> The lion later broke into two pieces, and the hind part was turned around, obviously during a futile attempt to carry it away.<sup>133</sup>

Anomaly C could be interpreted as a quay or, more probably, a mole forming the western side of the harbour entrance. Anomaly D on the opposite side of the entrance represents a very strong but nevertheless only punctiform signal.<sup>134</sup> Its western endpoint, which is unfortunately not very clear in the geomagnetic image (Figs. 16, 22),<sup>135</sup> has to be taken as the approximate original position of the eastern lion. The c. 50 m broad passage between anomalies C and D transformed the harbour into a “closable” one – the κλειστός λιμὴν mentioned in the inscription of the *epistates* Biare (see above, § 3.1). As the seismics have shown, anomalies C and D are situated over a ridge in the bedrock, separating the max. 22 m deep harbour basin from the open sea. The harbour entrance crossed

this ridge with a max. depth of c. 8-10 m and a width of c. 30-40 m (see § 3.2, Figs. 18, 22).

The strong geomagnetic signal of anomalies C and D can be explained: between both anomalies a section of a later wall E is preserved, still visible today (Figs. 2 left, 17). It consists of stones and bricks in mortar, and forms an exact line with anomalies C and D (Figs. 16, 22).<sup>136</sup> We may, therefore, postulate that the latter are part of this later wall, which might stand on the ancient moles.

These moles could be identical with another anomaly, running parallel under anomalies C and D and the visible wall E. This anomaly F is slightly broader and its western end is partly hidden under the modern earth dam that forms the northern limitation of the area surveyed by geophysics (Fig. 22). The anomaly is a negative one, recognisable from its grey colour, which indicates non-magnetic material like limestone, mica schist, or marble ashlar blocks – materials that were also used in the city walls of Miletos.<sup>137</sup> Its course, following the natural ridge between the harbour basin and the open sea (Fig. 18), is as straight as that of the other anomalies A to D, but shows interruption. It does not run exactly parallel with the modern earth dam; instead its western end disappears under the dam. This can be taken as an argument that anomaly F forms its own structure, so far unrecognised.

One may assume an anthropogenic origin, and identify this grey anomaly F with the structures of the ancient moles, closing the mouth of the Lion Harbour at

131 von Graeve 1996, 321 n. 15; contra: von Gerkan 1935, 113-4; Stümpel *et al.* 1995, 241; Stümpel 1999, 94; von Graeve 2000, 127; Wölz 2003, 20; Tuttahs 2007, 352. Von Graeve (1996, 321 n. 15) adds that a row of stone blocks of mica schist, marble and poros, built in header-stretcher technique, was partly uncovered, aligning the eastern backside of the lion (see in Fig. 7 the stones to the left of the lion). He could not give an explanation for this, but compared it to the construction of the harbour wall described by von Gerkan (1922, 82-3, 86-7; 1935, 110-2), and assumed that the lion had originally stood on this part of the harbour wall before it was taken down on the sand in front of the wall to move it away (see also Blum 1999, 73). In contrast, von Gerkan (1935, 113-4) reports that the lion was situated with its forepart and back, not its middle part (!), on a “postament” which he could not examine more accurately because of the high groundwater table. This contradicting information requires further investigation.

132 Stümpel *et al.* 1999, 92, 94.

133 von Graeve 1996, 321-2 with n. 15 fig. 8. On the contrary, von Gerkan (1935, 112-4) believed the western lion to be in a secondary position and the eastern lion to be in its original place (cf. also Kleine 1980, 61). He therefore reconstructed the Hellenistic harbour closure between the eastern lion and a place somewhere around the southern end of the geomagnetic anomaly A (Blum 1999, 73 fig. 24 “hell. Hafensperre (v. Gerkan)”). Blum (1999, fig. 24 “hell. Hafensperre (hypoth.)”) reconstructed the Hellenistic closure between the present positions of the lions, assuming that the eastern lion is close to its original place (followed by Tuttahs 2007, 351-2 with fig. 382). But she is astonished that the closure did not use the shorter and from a strategical point of view more suitable distance between the western lion and the western end of anomaly D (Blum 1999, fig. 24 “Variante?”).

134 W. Rabbel (personal correspondence in February 2012) assumes a heap of bricks or discarded metal.

135 Stümpel *et al.* 1999, 89-93 figs. 1, 2, 4.

136 Stümpel *et al.* 1999, 89-91 fig. 2. The in-line position of the visible wall in relation to anomalies C and D is not correctly displayed by Blum (1999, 73 fig. 24) and – based on Blum – by Tuttahs (2007, 351 fig. 382).

137 The stones that were used as building material in Miletos are limestone, poros, mica schist, and marble. They are all non-magnetic. A magnetic stone could be volcanic andesite, which is unknown in Miletos.

its narrowest part. From a strategic perspective this is the perfect place for these moles (see above, § 3.1 on the siege of Alexander), and the position of the western lion seems to support this assumption.

The (anti-)magnetic anomaly F has to be located at a maximum depth of 5 to 6 m, in accordance with the fact that it would otherwise have created a wider spreading of the signal with less clear borders (see above, § 3.2). Taking into account the fact that the bedrock at the harbour entrance is at a depth of max. 8-10 m (Figs. 18, 22), the moles are expected to have a maximum height of at least c. 10 m at their deepest point, close to the entrance. This calculation includes the current reconstruction of the sea level in Archaic times, which was c. 1 m lower than today.<sup>138</sup> Just to give a comparison, the larger of the two Archaic moles in Samos, the one to the south of the harbour, was max. 15 m deep and at its foot 10 m broad.<sup>139</sup>

As the signal of anomaly F runs over the whole extension of the harbour entrance (c. 130-140 m), we have to expect an unbroken course of the mole in its lower part. In the middle, between the original positions of the two harbour lions, the upper layers of the masonry were presumably left out to form an easily closable gap of c. 20-30 m breadth and c. 5 m depth for the incoming ships.<sup>140</sup>

However, this reconstruction remains hypothetical and its validity has to be verified by an excavation, or at least – regarding the high groundwater table – further coring.

Finally, returning to the later wall E between anomalies C and D, we would like to add an important observation: Tuttahs notes that the visible wall is not strong enough to function as a protective barrier against floods of the Maeander or as a fortification. Nevertheless, he assumes that the wall, which he thought “clearly younger” than Byzantine, served as protection against “marauding soldateska” in the 16<sup>th</sup> and 17<sup>th</sup> centuries.<sup>141</sup> But, as can be seen in Figure 17, the wall is at least 2 m thick and consists of reused stone and brick material, held together by mortar. This is exactly the way in which the “Gotenmauer” of c. AD 262 was built, which followed the course of the older, partly demolished Hellenistic city wall around Humei Tepe and Kale Tepe.<sup>142</sup> Therefore, we propose to identify the late wall E as part of the Gotenmauer, which then not only surrounded the inner fringe of the Lion Harbour, but also protected its mouth, grounded on the Hellenistic moles. This perhaps also affected the lions at their terminal points, which then had to be removed. The re-installation of the eastern lion some 80 m to the southeast of its former position was not

138 For the tectonically corrected reconstruction of the sea level curve for the Maeander delta in Archaic times, see Müllenhoff 2005, 185 fig. 47 (dotted line). Fortifications built on top of the mole would have increased its height respectively.

139 Kienast 2004, 75-6. But see above n. 75: the southern mole in Samos seems to have been c. 75 m broad in its western part.

140 Warships had a draught of max. 1.20-1.50 m, transport vessels of up to 3-4 m; information kindly provided by O. Höckmann. The width of a trireme was c. 10 m with oars. The width of the harbour entrance should therefore be at least c. 11-12 m for one or 22-24 m for two warships. See, e.g., the entrance to the war harbour of Hellenistic Rhodes, which had a width of less than 20 m, and the inner basin of the commercial harbour 13 m: Lehmann-Hartleben 1923, 129. The entrance of the port of Boeotian Larymna was 13 m wide; that of Elaia, the port of Pergamon, 45 m: Lehmann-Hartleben 1923 74.

In Roman times, with the introduction of opus caementitium, it was possible to build moles on single standing “*pilae*”, “pillars”, connected via arches, so that the water could constantly flow through below, preventing harbours with two entrances from silting up: Feuser 2009, 107 fig. 28, 111-3 (e.g. Alexandria Troas, Puteoli, Misenum). It remains unclear why in the case of the Lion Harbour the foundation of the mole seems to run through the whole course and is not interrupted. Was this to keep siltation out of a harbour with only one entrance, or was it due to the state-of-the-art of hydraulic engineering in Archaic times, in which the foundations of a fortified mole had to be made as steady as possible, lacking opus caementitium suitable for underwater constructions? There are several harbours detected where moles with continuing foundations are interrupted by small water channels: Feuser 2009, 113-6 (northern harbour of Mytilene, Paphos, Caesarea Maritima, northern harbour of Side). The mole of the northern harbour of Mytilene, built with hydraulic mortar, may predate Roman times: Lehmann-Hartleben 1923, 104-5 with fig. 4. For hydraulic mortar of harbour constructions, made of *puzzolana*, see Vitruvius *De architectura* 5.12.2-3.

141 Tuttahs 2007, 352.

142 von Gerkan 1935, 81-4 figs. 47-52, p. 114-5, 126-7; Niewöhner 2008, 183-6 figs. 1-2. Von Gerkan 1935, 82 characterises it as follows: 1.50 to 3 m thick, consisting of an outer coating built of large re-used ashlar blocks of different material, including sculptures, while the inner coating is made of careless mortar-masonry with rubble stones or sometimes also bricks. The wall is dated by coins found in the mortar of the filling, dating to the time of the emperors Gallienus (253-268 AD), Galerius (293-311 AD), Maximian (286-305 AD), and Licinius (308-324 AD). A terminus ante quem is given by a small hoard with coins of Constantin I (306-337 AD) and Theodosius I (379-395 AD) outside the wall (von Gerkan 1935, 83). Part of the “Gotenmauer” around eastern Humei Tepe, with a gate to the “Humei Tepe Harbour” (see below, § 4.3), was detected only in 2011: Bumke & Tannöver 2012, 77-8 figs. 76, 1, 3, 77-8.

an inconsiderable effort, since it weighs some 23 tons;<sup>143</sup> this signals its continued symbolic worth to the city.

### 3.3.4 *Sediment profiles at the southern fringe of the Lion Harbour embayment*

A large area of the southern part of the Lion Harbour is filled with excavation debris, which reduces the opportunity for geophysical surveying. Nevertheless, seismic and geoelectrical measurements revealed the subsurface topography of the harbour basin and several sedimentary strata of the filling.<sup>144</sup> In order to decipher the palaeogeographical evolution in this area, a north–south trending transect was cored (Figs. 23–4). It connects the southern harbour basin (Mil 227, Mil 8) with the area of the Harbour Hall (Mil 261) and the North Market.<sup>145</sup>

All corings penetrate marine sediments above bedrock. The transgression peak can be reconstructed near coring Mil 241 (see below, Fig. 23) which shows only about 30 cm of littoral sands. According to a radiocarbon age in the upper part of this section, aggradation in this southernmost area of the Lion Harbour embayment occurred in the late Bronze Age (1413–1312 cal BC; sample Mil 241/14H, 1.00 m b.s.l.).

In Mil 227 and Mil 8, located within the southern port basin of the Lion Harbour, the transgressive unit is covered by thick shallow marine silts and sands, followed by clayey silts with reed and several cultural remains (ceramic fragments, olive stones, and grape seeds), best interpreted as coastal harbour sediments. They date from the Archaic period until late Roman Imperial times (3<sup>rd</sup> century AD; Mil 227/9HK, 1.87 m b.s.l.). Soon after, cultural debris and alluvial sediments mark the anthropogenic infill of the southernmost port basin, followed by the final siltation. On top of these sediments, 1.70 m of cultural debris represents late Medieval and later settlement activities, as well as the spoil of old excavations.<sup>146</sup>

Corings Mil 262, 260, and 241 are located south of the assumed Archaic/Classical quay wall; therefore, harbour sediments are missing. Littoral (Mil 260, 241) and shallow marine (Mil 262) sediments are directly covered by anthropogenic deposits (layers with stones and tile and ceramic fragments), indicating the man-made infill of this area in Archaic times (c. mid-6<sup>th</sup> century BC), most probably for an extension of the city centre to the north. We assume that this extension formed part of a reorganisation of the city centre around the agora according to the new, so-called Hippodamian *insula* street grid.<sup>147</sup>

In Mil 262, the first anthropogenic debris between 1.95–1.38 m b.s.l. delivers a <sup>14</sup>C age of 733–406 BC (Mil 262/15 SK, 1.63–1.38 m b.s.l.). The layer is topped by 45 cm of sand with marine fossils and artefacts, probably piled up intentionally in order to drain the area. According to diagnostic ceramic finds, the deposits date to the 6<sup>th</sup>/5<sup>th</sup> century BC. It was not until then that this area was definitely reclaimed and consolidated by man-made infill, which served as groundings for the erection of the southern and southwestern quay and the monumental late Classical Harbour Hall (Fig. 13).<sup>148</sup>

### 3.4 *The effect of the siltation process on the uses of the harbour (A.H., H.B & M.M.)*

All of the ancient harbour cities bordering the former marine embayment, such as Myous, Priene, Herakleia, Miletos etc., lost the basis of their existence when they became landlocked due to the bypassing of the delta front.<sup>149</sup> In the 2<sup>nd</sup> century AD, Pausanias describes this fate for Myous:<sup>150</sup>

The Ionians who settled at Myous and Priene, they too took the cities from Karians. (...) The people of Myous left their city on account of the following accident. A small inlet (κόλπος) of the

<sup>143</sup> See above n. 11.

<sup>144</sup> Rabbel *et al.* 2004; Rabbel *et al.* 2006; Stümpel *et al.* 2005; Wölz 2003; Woelz & Rabbel 2005; Woelz *et al.* 2009. The final publication of these results by W. Rabbel, H. Stümpel & S. Wölz is in preparation.

<sup>145</sup> Müllenhoff *et al.* 2009a, 99–103 figs. 2–5.

<sup>146</sup> See also Schröder *et al.* 1995, 241–2 fig. 43.

<sup>147</sup> Herda 2005; Müllenhoff *et al.* 2009a.

<sup>148</sup> von Gerkan 1922, 89–91; von Gerkan 1935, 110–4.

<sup>149</sup> Müllenhoff 2005, 187–215.

<sup>150</sup> Pausanias 7.2.10–11.

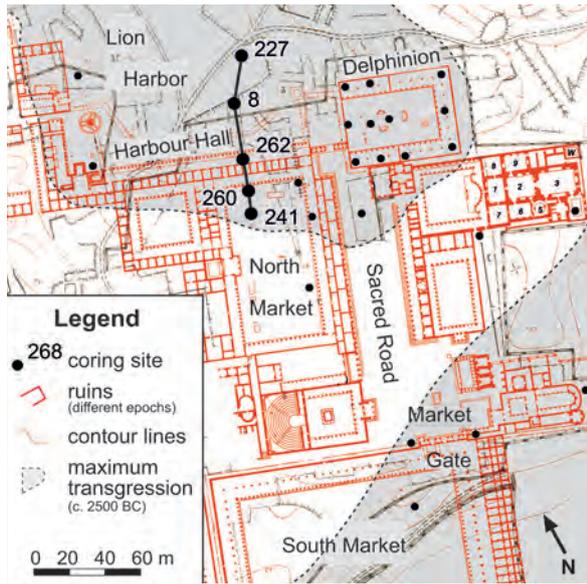


Fig. 23. Location of corings and geological cross-section in the city centre of Miletos (see Fig. 24). The areas coloured in grey were submerged by the sea during the time of the maximum marine transgression c. 2500 BC. Source: modified after Müllenhoff et al. 2009a, 99 fig. 2.

sea used to run into their land. This inlet the river Maeander turned into a lake (λίμνη), by blocking up the entrance with mud. When the water, ceasing to be sea, became fresh, gnats in vast swarms bred in the lake until the inhabitants were forced to leave the city. They departed for Miletos, taking with them the images of the gods and their other movables; and on my visit I found nothing in Myous except a white marble temple of Dionysos.<sup>151</sup>

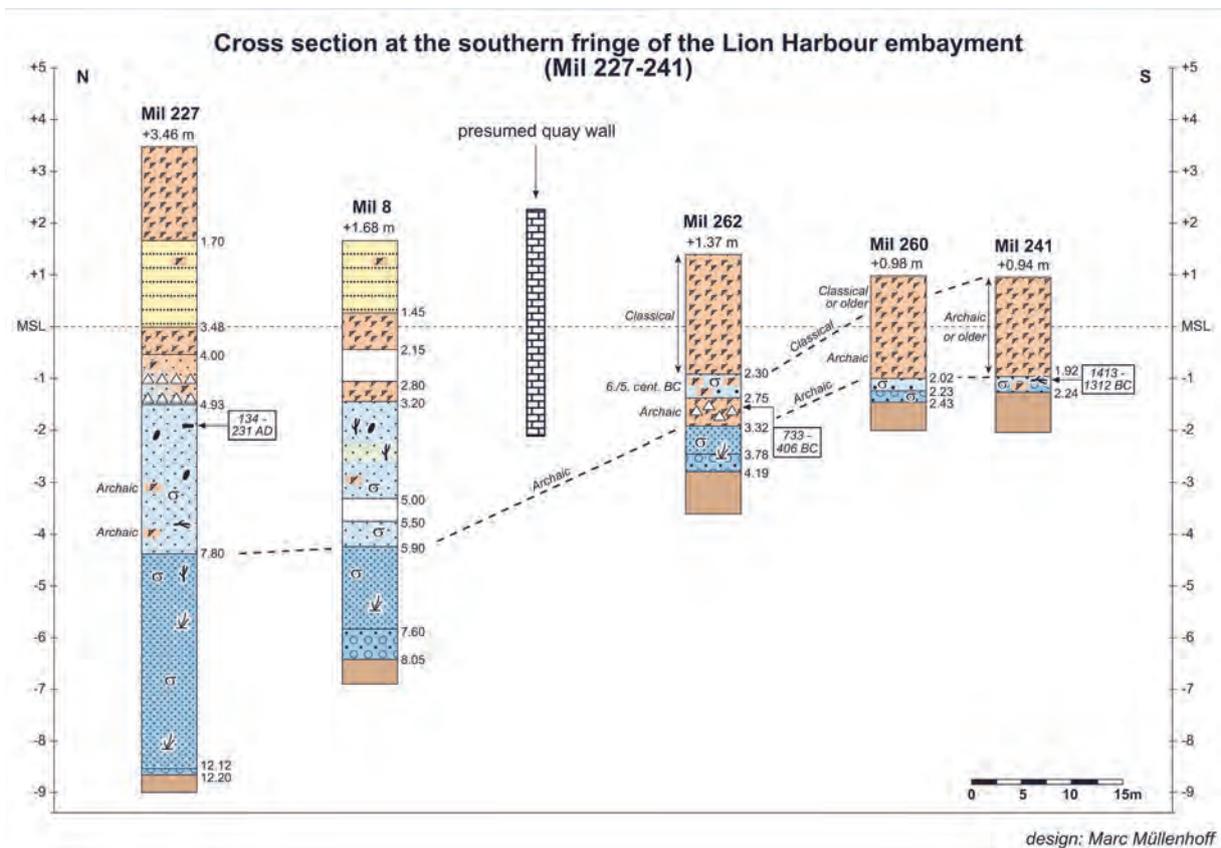


Fig. 24. Cross-section at the southern fringe of the Lion Harbour embayment (see Fig. 23 for location). Source: modified after Müllenhoff et al. 2009a, 101 fig. 3.

<sup>151</sup> Translation by W.H.S. Jones.

Pausanias believed that intensive arable farming further upstream was the reason behind the rapid growth of the Maeander delta plain:<sup>152</sup>

My reasoning is confirmed by the fact that the Maeander, flowing through the land of the Phrygians and Karians, which is ploughed up each year, has turned in a short time the sea between Priene and Myous into solid land.

Here he is obviously following an observation by Platon, who already dealt with the problem of soil erosion in Attica due to deforestation, thus delivering the first known accurate “geoarchaeological” explanation of this phenomenon.<sup>153</sup>

As long as Miletos was not cut off from the open sea, it profited from the delta growth of the Maeander: in the late 1<sup>st</sup> century BC or early 1<sup>st</sup> century AD, a certain C. Iulius Epikrates gained permission from emperor Augustus to take possession of “the land newly turned to earth by the Maeander, and the sandbanks”:<sup>154</sup>

Step by step the westbound delta growth landlocked the former islands of Hybanda (modern Özbaşı) north of Myous, and Lade (modern Batmaz Tepeleri, the “unsinkable Hills”) northwest of Miletos,<sup>155</sup> and separated the Latmian Gulf (Λάτμικος κόλπος)<sup>156</sup> from the open sea, leading to the evolution of the still brackish Lake Bafa (Fig. 11). Late Byzantine texts of the 13<sup>th</sup> century AD call it the “Milesian Lake”, as it originally extended from Miletos to Herakleia and Ioniapolis.<sup>157</sup> The present shoreline is nearly 8 km to the west of Miletos.<sup>158</sup> Many other cities along the west coast of Turkey experienced comparable landscape transformations,<sup>159</sup> the most prominent examples being Ephesos<sup>160</sup> and Troy.<sup>161</sup>

Geoarchaeological evidence, based on many corings, shows that the delta front approached Miletos from the north in Roman Imperial times. In the following centuries, sedimentation rates in the Lion Harbour increased and shipping was more and more constricted.<sup>162</sup> The harbour may have been kept free from sediments by dredging the basin from time to time,<sup>163</sup> as has been assumed for

152 Pausanias 8.24.11; cf. Thonemann 2011, 295-6, 306-7; for the English translation see Thonemann 2011, 306.

153 Platon, *Critias* 110C-112E; cf. Hughes & Thirgood 1982, 67. Rackham & Moody (1996), 18 instead believe that Platon was referring not to erosion as consequence of anthropogenic deforestation, but to Pleistocene erosion taking place in Attica 9000 years before his time. Actually Platon may be comparing both, as their effect is the same: Thommen 2009, 43-44.

154 Herrmann 1994, 122-3; Herrmann 1996, 6-7; P. Herrmann in Herrmann *et al.* 2006, 82-5 esp. 84 on no. 1131.6-7: τὴν ἀπ[ο]γαί[ου]μένην χώραν ὑπὸ τοῦ Μαϊάνδρου | καὶ τοῦς γαιεῶνας; cf. Günther 2006, 170-1 fig. 2; Thonemann 2011, 322-3, 334.

155 In 494 BC, the island of Lade was the site of the naval battle between the Persian and the Greek-Ionian fleets, which ended in the total defeat of the Greeks and the destruction of Miletos (Herodotos 6.13-17). On Lade’s strategic role for controlling Miletos and her harbours cf. Greaves 2000a, 40, 42 fig. 3. Lade is still known as a location in a Byzantine dossier regarding the new estates of Andronikos Doukas in the Maeander valley in AD 1073. At that time a village called Galaidai was located on Lade (Thonemann 2011, 259-65 figs. 11-2). The Turkish name “Batmaz” (“that which cannot sink”) originates from the name of the Byzantine monastery island Patmos, named *Batnos* by the Turks (see e.g. Piri Re’is, *Kitab-I Bahriye*, AD 1521: Thonemann 2011, 290 f., 329), which had been in possession of Lade since AD 1216, then called τὸ Πατμιότυκο, until the Turkish conquest in the early 14<sup>th</sup> century AD (Wiegand 1929, 15). In the late 16<sup>th</sup> century, the salines around lade-*Patmiotiko* were property of the Ottoman state, but still kept the name of the old owner, “*Batnos* salt pans”: Thonemann 2011, 328 f. Nevertheless the Turkish name *Batmaz Tepeleri* does retain, by giving a ‘folk etymology’, a recollection of the former island (Kleiner 1968, 6), especially since Lade became an island again during the winter floodings of the Maeander, before modern irrigation measures were installed after World War II (Wiegand & Schrader 1904, 12; translated into English in Thonemann 2011, 299). Thonemann (2011, 264 n. 66) instead thinks that *Batmaz Tepeleri* is “a toponym unparalleled in Turkey: this is simply *Batnos*/*Patmos* with a more convincingly ‘Turkic’ termination”.

156 Cf. Herda 2009, 44 n. 106, 45 fig. 3.

157 Maximus Planudes *Epistulae* 119; cf. Müllenhoff 2005, 202-206 fig. 53; Lohmann 2006, 221 f. s.v. Milesie limne (Μιλησιή λίμνη).

158 While the delta progradation has stopped, erosion of the delta front and a landward shift in the shoreline are taking place. The major reasons are the transformation of the former lower floodplain into irrigated fields in the 1950s, which led to a reduction in the water and sediment fluxes to the sea, and the rise in the global sea level.

159 Brückner *et al.* 2004; Brückner *et al.* 2006.

160 Brückner 2005; Kraft *et al.* 2007; Kraft *et al.* 2011.

161 Kraft *et al.* 2003a; Kraft *et al.* 2003b.

162 Brückner 2003, 135; Tuttahs 1998, 167.

163 Kindly remarked by O. Höckmann (letter dated 12 February 2012). The unbroken course of anomaly F, the assumed foundation of the harbour’s mole, may have prevented siltation from entering the Lion Harbour through its single entrance; see above, n. 140.

164 Höckmann 2007, 336 fig. 1.1; Feuser 2009, 115.

the Theatre Harbour (see below, § 4.1). In the Roman period, special vessels with buckets for dredging were in widespread use.<sup>164</sup> The harbour of Ephesos, for example, was heavily affected by siltation from the river Cayster,<sup>165</sup> as well as by the careless dumping of waste, which led to the introduction of fines against dumping in AD 146/7.<sup>166</sup> Several texts and inscriptions attest to the dredging of the harbour, for example in the mid-1<sup>st</sup> century AD,<sup>167</sup> twice at the beginning of the 2<sup>nd</sup> century AD,<sup>168</sup> in AD 129 by the emperor Hadrian,<sup>169</sup> and again in the 3<sup>rd</sup> century AD, when Marcus Aurelius Artemidorus spent 20,000 denarii for cleaning the harbour.<sup>170</sup>

In the 4<sup>th</sup> century AD, the river mouth of the Maeander was already located west of Miletos, between the (former) Island of Lade and the southern mainland. Nevertheless, the city could still be approached by ships via marine-brackish waters. But this was only possible with the help of hydraulic engineering: the orator Himerius (*Orationes* 25.73-95) testifies that the *vicarius Asiae* (governor of the diocese of Asia) of AD 343, Skylakios, built a “canal through the plain” (διώρυγι κατὰ τὸ πεδῖον), “turned the Maeander back into a natural course” (ἦ ποταμῷ φύσις κομίζεσθαι), and “restored the harbours to the city” (τῇ πόλει δὲ ἀπέδωκε τὸς λιμένας). This implies that he at least in part dredged them.<sup>171</sup>

But the functionality of the Lion Harbour was reduced since its inner fringes, and probably also its entrance, had been fortified against the Goths c. AD 262 (see § 3.3.3).

These walls may have been partly demolished in the following relatively peaceful centuries to restore the harbour's capacity. When, however, the city wall was re-built in AD 538, the harbour as well as some of the houses and churches were situated outside the fortifications (see § 3.1).

Miletos was still an important Byzantine harbour in the 11<sup>th</sup> century AD.<sup>172</sup> Since AD 1293 the city had paid tribute to the Turkish tribes controlling the Maiandros plain,<sup>173</sup> and it was finally lost to Turkish invaders of the emirate of Menteşe in the early 14<sup>th</sup> century AD. After signing a treaty with the new lords in AD 1331, Venetian-Kretan merchants settled within fortified Miletos, now called “Palatia” or “Balat”,<sup>174</sup> although Venice had already opened a consulate before 1331.<sup>175</sup> The emirs of Menteşe İli acted as pirates in the eastern Aegean, with their headquarters in Ayasuluk-Selçuk, former Ephesos-Theologo.<sup>176</sup> At that time parts of the antique harbours of Palatia-Balat were still in use. In 1350 they served to gather a Turkish fleet to attack Christian Smyrna.<sup>177</sup> In 1351/52, part of the Venetian fleet spent the winter in the city.<sup>178</sup> During the same period, Palatia-Balat formed a terminal point on one of the branches of the Silk Road, traversing the Maeander Valley in the western direction.<sup>179</sup> This is well demonstrated by finds of Chinese celadon-porcelain with the typical pale jade-green glaze, and its local imitations.<sup>180</sup> But Palatia-Balat was also an important harbour for the product exchange between the Genoese and Venetians on the one side, and the emirates of Menteşe and Aydın on the other.<sup>181</sup> When the Otto-

165 Strabon 14.1.24, p. 641.

166 Wankel 1979, 140-3 no. 23.

167 Tacitus *Annales* 16.23.1.

168 Meriç *et al.* 1981, 65-6 no. 3066; Merkelbach & Nollé 1980, 44-7 no. 2061 II.14-6.

169 Börker & Merkelbach 1979, 71-2 no. 274.13-6; Thonemann 2011, 319 n. 55.

170 Meriç *et al.* 1981, 72-4 no. 3071. 11-3; Feuser 2009, 115 with n. 285.

171 Thonemann 2011, 318-9.

172 Kleiner 1968, 21.

173 Zachariadou 1983, 23 with n. 85, 105-6.

174 On the naming, see above n. 26.

175 Zachariadou 1983, 18-20, 130-1, 137.

176 The headquarters of the Menteşe in Ayasuluk were conquered by the Ottomans in 1425: Wittek 1934, 103; Kahane & Tietze 1958, 12 f. (they give 1421 erroneously).

177 Wittek 1934, 71; Zachariadou 1983, 114.

178 P. Wittek in Wulzinger *et al.* 1935, 3-10.

179 P. Wittek in Wulzinger *et al.* 1935, 3-10.

180 P. Wittek in Wulzinger *et al.* 1935, 80-1; Greaves 2002, 147-8 (“Miletos-ware”). Both only mention imitations of celadon-ware, but A. Herda identified fragments of original Chinese vessels in the excavation depot (unpublished), which are comparable to the ware of the famous celadon collection of the Ottoman sultans in the Topkapı Museum in Istanbul.

181 Cf. Wittek 1934, 123 f.; Zachariadou 1983, 261 index s.v. Palatia; Fleet 1999, 198 index s.v. Balat; Greaves 2002, 144 (Italian: soap, mastic, jewels, glass, clothes, lead, tin; Turkish: spices, tanned leather, fish, wine, grape must [*pekmez*], alum, grain, wax, cotton, wool, carpets, clothes, slaves). One also has to add salt, which was produced in salines at the Maeander mouth from antiquity up to the 16<sup>th</sup> century AD: Thonemann 2011, 327-332.

man sultan Bayezid I conquered the region in AD 1389/90, the Venetians quickly managed to secure their commercial privileges in Palatia-Balat and Ephesos-Theologos. They did so again in 1403, when Menteşe briefly regained power after the Mongol Khan Timur had defeated Bayezid, and after 1425, when Murad II restored the Ottoman rule.<sup>182</sup>

The results of our corings (e.g. Mil 3, Fig. 19; Mil 227, Figs. 23-24) point to the fact that the Lion Harbour was at least partly silted up during early Byzantine times (5<sup>th</sup>–7<sup>th</sup> centuries AD). The two 50 m long structures, detected by geophysics at the harbour entrance as anomalies A and B, may have functioned as new harbour limitations, which became necessary because of the ongoing siltation process. This assumption is reinforced by the re-installation of the eastern harbour lion at the northern terminal point of anomaly B (Figs. 7, 16, 22; see § 3.3.3).

K. Wulzinger<sup>183</sup> and G. Tuttahs<sup>184</sup> assume a harbour basin of reduced size, connected with the Maeander by a channel, until the 16<sup>th</sup> century AD.<sup>185</sup> Some harbours of Miletos (see § 4), were also still functioning;<sup>186</sup> one may think of the Eastern Harbour and the Humei Tepe Harbour, which were accessible from the open sea.<sup>187</sup> The remaining parts of the Theatre Harbour may also be taken into account.

Balat kept its harbour function at least until the end of the 17<sup>th</sup> century AD, when the Turkish traveller Evliya Celebi visited it and witnessed *qaiqs* (caïques) from Gallipoli (Dardanelles) and İstanköy (Kos), frigates from Syme and Anabolu (Nauplio), as well as ships called *Zarbuna* and *Shaiqa*, loading wheat, barley, cotton, and especially liquorice (*beyân kökü*).<sup>188</sup> Ship-graffiti dated to the 16<sup>th</sup>–18<sup>th</sup>/19<sup>th</sup> centuries, scratched into the wall plaster of the so-called Selçuk Bath directly south of the Delphinion, offer a lively picture of the ships heading to Palatia-Balat (Fig. 25).<sup>189</sup> At that time they had to sail upstream along the Maeander River, because the siltation had cut the city off from the open sea around AD 1500.<sup>190</sup> By then, the front of the southern branch of the Maeander reached the city and took its course around the peninsula. Most probably, the Eastern Harbour and the Humei Tepe Harbour were the first Milesian harbours which lost their function; otherwise they would have had to be transformed into river ports.<sup>191</sup> Some scholars, therefore, postulate a larger “out-port” at the Maeander mouth some 6 km southwest of Palatia-Balat, where the bigger ships could debark. The place was called η Βίγλα, the “watch”/“look-out point”;<sup>192</sup> by the 19<sup>th</sup>-century Greeks. A small hill at the northern end of the large

182 Wittek 1934, 103; Zachariadou 1983, 76-89.

183 In Wulzinger *et al.* 1935, 58.

184 Tuttahs 2007, 440-2 fig. 477.

185 K. Wulzinger (in Wulzinger *et al.* 1935, 4) and G. Tuttahs argue from the existence of the 15<sup>th</sup>-century AD *Han* (caravanserai), as well as a *Tekke* (Derwish cloister) in the southeastern area of the harbour, and the so-called Selçuk Bath south of the Delphinion (Figs. 3, 7, 11, 13). Additionally, K. Wulzinger (in Wulzinger *et al.* 1935, 58) pointed to a powder magazine of a 15<sup>th</sup>-century AD ship cannon, found in the Lion Harbour (cf. Tuttahs 2007, 431, 440-1).

186 Brückner 2003, Brückner *et al.* 2002, Müllenhoff 2005, 205.

187 Müllenhoff 2005, 199-206 figs. 52-3.

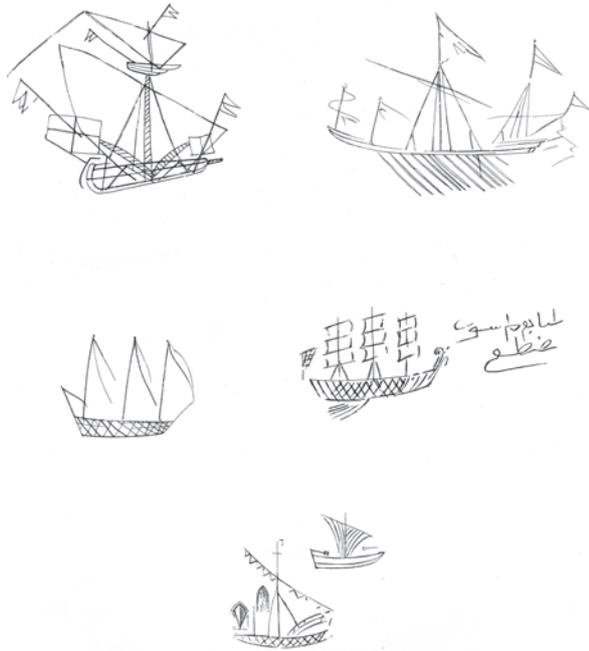
188 Evliya Celebi visited Balat in c. AD 1670. His description is cited in the Ottoman Turkish original and in German translation by P. Wittek in Wulzinger *et al.* 1935, 8-9; Wittek 1934, 131-133. On ship types in Ottoman times, see Müller-Wiener 1994, 39-41, 61-4. The *Shaika* (*şayka*, *saique*) was a small vessel for sailing on rivers and along the coast: Wittek 1934, 132 with n. 3 (Slavic word for Danube boat without prow); Müller-Wiener 1994, 48, 52-3, 63. *Zarbuna* may designate a slow heavy sailer, as the Adriatic (Venetian?) loanword of Byzantine σαβούρα, \**Saburna*, means “ballast”: Kahane & Tietze 1958, 561-3 no. 837 σαβούρα. In modern Maltese *zarbuna* means “shoe”, perhaps referring to this type of ship.

189 K. Wulzinger in Wulzinger *et al.* 1935, 52-53 pl. 46; Greaves 2000a, 58 fig. 13; Tuttahs 2007, 430-1 fig. 460. At least the large three-masters should be dated to the 18<sup>th</sup> or 19<sup>th</sup> century AD; they therefore postdate the time when the harbours of Palatia-Balat could be reached by such large ships (O. Höckmann, letter of 7 December 2012).

190 Müllenhoff 2005, 206-8 fig. 54.

191 Probably in the 15<sup>th</sup> century AD, a bridge was built over the Maeander between the East Harbour and the Humei Tepe Harbour, which belonged to a 8.5 km long stone paved dam through the marshes (named Kız Döşemesi, “Girls Paving”). It led to the village of Sankemer in the northeast (Philippson 1936, 6-7; Tuttahs 2007, 420-4 figs. 450-5). At that time the East Harbour was definitely out of function even as a river port reachable from the open sea, because the bridge would have made access by ship impossible. For the detection of an ancient river port, see recently Martini *et al.* 2008 on Perge in Pamphylia.

192 The Byzantine military term of Latin origin, βίγλα, “watch”, was taken over by the Ottomans as “vigla”, “vikla”, “vigle”, etc.: Kahane & Tietze 1958, 489-90 no. 745 βίγλα. The 48 m high hill with a lighthouse on its top (see next footnote) was a good point from which to look out for enemies coming by boat.



**Fig. 25.** Ship graffiti scratched into the wall plaster of the “Selçuk Bath” south of the Delphinion, c. 16<sup>th</sup>-18<sup>th</sup>/19<sup>th</sup> centuries AD. Upper row, Turkish war galleon (*kalyon*) to the left, Turkish war galley (*pergende?*) with two masts and ‘Lateen sail’ to the right (16<sup>th</sup>/17<sup>th</sup> century AD). Middle row: two large merchant(?) ships with three masts (18<sup>th</sup>/19<sup>th</sup> century AD). Lowermost row: two smaller sailing boats with Lateen sail (left) and Lugger sail(?) (right) (16<sup>th</sup>-17<sup>th</sup> centuries AD). Source: Wulzinger et al. 1935, pl. 46.

bay bears the name Τὸ Φανάρι, Turkish *Fener Tepe*, in recollection of a former “lighthouse”.<sup>193</sup>

#### 4. The other harbours of Miletos (A.H., M.M & H.B.)

Strabon states in his *Geographica* (14.1.6) that the city of Miletos had four harbours (see § 3.1).<sup>194</sup> The position of two of them was well known: the Lion Harbour between Kale Tepe and Humei Tepe, and the Theatre Harbour west of Kale Tepe at the foot of the Hellenistic-Roman Theatre. The positions of the third and fourth harbours have been recently detected by geoarchaeological, geophysical, and, since 2011, archaeological investigations (Fig. 10). They are located at the eastern flank of the Milesian Peninsula in a protected leeward position from the western winds (*Imbat*).<sup>195</sup> Two other harbours of minor importance are also taken into consideration here: the so-called Athena Harbour and the Kalabak Tepe Harbour.<sup>196</sup>

##### 4.1 The Theatre Harbour

Our recent research reveals that until the early Classical period the Theatre Harbour cut much deeper into the city peninsula than has been reconstructed in Figure 10.<sup>197</sup> It was created after the time of the maximum transgression in the early Bronze Age, c. 2500 BC, when the archipelago consisting of the main islands of the later Athena Temple area and the Kale/Humei Tepe was gradually connected to the mainland via sandbars (*tomboli*). The island around the later Athena Temple was landlocked before c. 1500 BC. While the Minoans (Miletos III-IV, c. 1900-1450 BC, see Tab. 1) were still able to sail through the passage between the southern limits of the archipelago and the mainland, the Mycenaeans (Miletos V-VI, c. 1450-1220 BC) were able to profit from the new *tombolo*. The beaches created a perfect landing situation for ships on both sides. The area east of the new peninsula was transformed into a closable

193 Philippson 1936, 11; Tuttahs 2007, 429-38 figs. 465-9. H. Lohmann located a Byzantine and late Byzantine settlement here (Lohmann 1995, 325 fig. 111; Günther 1999, 475 n. 2). Two small settlements and a Medieval lighthouse (“To Fanari”) are already marked in the archaeological map of Wilski 1906, B/C 5, C/6 at a place called “Kamares” (cf. Tuttahs 2007, 430 fig. 459). Th. Wiegand, A. Philippson, and G. Tuttahs believe this place to be the Karaağaç Limanı (“Ulmenhafen”) suitable for larger war ships, mentioned by the Ottoman admiral Piri Re’is in his portolan of AD 1521 (Kitab-ı Bahriye) (Wiegand 1929, 16; Philippson 1936, 11; Tuttahs 2007, 432-3 figs. 463 a-b).

194 We can only give a short overview here and will deal further with the harbours in our final publication on the geoarchaeology of the Milesian city peninsula (Herda et al. forthcoming, see above, n. 25). On the other harbours in the mainland territory of Miletos, the Milesian peninsula, as well as the Milesian islands, see Greaves 2000a, 42-6 figs. 5-7 (Panormos near Didyma, Ioniapolis in the Latmian Gulf, Teichiussa, Leros, Patmos, Pharmakoussa, Lepsia, Ikaros); for the *phrourion* with two shipsheds on the island of Tragia/Agathonisi see n. 76.

195 As for Miletos, the winds from the west were the most dangerous since the long fetch over the Aegean Sea could create much higher waves than the winds coming from the north; the latter (“Etesien”) were even favourable for sailing in ancient times. See also above n. 56.

196 Tuttahs (2007, 338-62) gives a useful overview over the Milesian harbours, though partly outdated by our recent research.

197 Cf. Müllenhoff et al. forthcoming with fig. 1.



**Fig. 26.** Former Theatre Bay, view from the Roman cavea to the SW. In the foreground Turkish caravanserai (Han) (1). In the middle ground: entrance to Geometric-Classical Theatre Harbour (2), Athena Temple Island consisting of Stadion Hill (3) and the area around the Athena temple (4), Athena Harbour (5), Heroon II Island (6). The new Miletos Museum is visible to the left (7). In the background: Kalabak Tepe (“Burdock Hill”) (8) and Kalabak Tepe Harbour (9), Değirmen Tepe (“Windmill Hill”) (10), Zeytin Tepe (“Olive Hill”) with sanctuary of Aphrodite “in Oikous” on top (11), and German excavation house (12). Photograph H. Brückner (August 2010).

harbour embayment, when the Kale Tepe–Humei Tepe Island became landlocked as well. This happened sometime in the Geometric or in the Early Archaic period at the latest (Fig. 26).

Until late Archaic times, the Theatre Harbour would have formed the main harbour of Miletos, as it was also the largest – even larger than the Lion Harbour. Shipyards for the Milesian fleet and, from 494 BC until the later 5<sup>th</sup> century BC, the Persian-Phoenician fleet, will have been located here, as the Lion Harbour alone was not big enough (see above, § 3.1). The Theatre Harbour’s opening to the sea was less protected and much more dif-

ficult to control, but the Island of Lade some 4 km to the northwest at least diminished the impact of the dangerous western winds (Imbat).<sup>198</sup> It may not be coincidental that the only tower of the Archaic sea wall, which has been identified so far, is situated at the Theatre Harbour, east of the Hellenistic stage building.<sup>199</sup>

But the harbour’s siltation progressed rapidly: in late Classical/Hellenistic times, *insulae* with houses and the stadium were built on top of its fillings in the southern part, between the Athena Temple and Kale Tepe. The Baths of Faustina with the adjacent *palaestra* followed in the 2<sup>nd</sup> century AD.<sup>200</sup> The dredging of the harbour area

198 See already von Gerkan 1925, 114; von Gerkan 1935, 8; Kleiner 1968, 6, 48; Greaves 2000a, 42; 2002, 12-3. For *Imbat* winds see nn. 56, 195.

199 von Gerkan 1935, 91-3, 119 figs. 59-60; Tuttahs 2007, 347-8 fig. 379. For another probably Archaic tower flanking the entrance to the Lion Harbour at the NE corner of Kale Tepe see n. 82.

200 Müllenhoff *et al.* forthcoming with fig. 1.

in front of the theatre in Roman Imperial times was detected by corings.<sup>201</sup> The open harbour bay seems to have remained in use until the Selçuk period, as attested by the *Han* (caravanserai) built southeast of the theatre, marking the endpoint of a trade-route via the Maeander valley.<sup>202</sup>

#### 4.2 The “East Harbour”<sup>203</sup>

The “East Harbour” was most probably located on the eastern flank of the *tombolo*, which connected the Kale Tepe-Humei Tepe Island with the mainland in Geometric or, at the latest, Archaic times. This harbour is therefore younger than the other two (Fig. 27.6).

Several corings (Mil 131-133, Mil 300) attest to a gentle inclination of the bedrock and the overlaying shallow marine and littoral strata, as well as a smoothly domed submarine rock barrier towards the east. This situation offered perfect conditions for the landing of ships on the sheltered sandy shore in late Geometric times (c. 8<sup>th</sup>/7<sup>th</sup> century BC). From the Archaic period onwards, after the first sea wall had been erected, the harbour must have been located east of it, outside the city defences. However, the earliest building that can be connected with this harbour is the Antiochos Stoa, named after Antiochos I, who dedicated it in 299 BC.<sup>204</sup> It was one *stadion* long and had 39 double rooms opening to the west (the so-called ‘South Market’), while 39 complementary single rooms, separated by a party wall, faced the city wall and the harbour to the east. They were let to merchants to

pay for the construction of the Temple of Apollo at Didyma. The *στοὰ σταδία* was later incorporated into the so-called South Market and underwent different phases of rebuilding and reconstruction until the late Roman period.<sup>205</sup> There is also a three-aisled basilica directly east of the Antiochos Stoa, dated to the later Roman period, and so far only detected by geophysical measurements.<sup>206</sup>

Th. Wiegand and A. von Gerkan were the first to postulate a harbour east of the South Market.<sup>207</sup> This makes perfect sense in light of the natural setting and the concentration of commercial buildings. However, archaeological evidence of it is lacking to date, with the exception of a 3<sup>rd</sup> century AD topos inscription on the southern front of the famous Market Gate, facing the inner South Market. It mentions a *ἱερὸς στόλος*, a “sacred flotilla”, which seems to refer to a harbour close by.<sup>208</sup>

#### 4.3 The “Humei Tepe Harbour”<sup>209</sup>

The fourth harbour site has been identified at the eastern side of the former peninsula, where Humei Tepe forms a natural indentation. The site was already assumed to be a harbour by G. Kleiner.<sup>210</sup> From 2000 to 2005, a geophysical survey was conducted which revealed the course of the sea wall with at least two gates, as well as large scale structures in the flat area surrounding the fringe of the bay to the west. They belong to harbour facilities like warehouses and probably a quay construction, located inside and outside the city wall (Fig. 16).<sup>211</sup>

201 Brückner 1996, 574; 2003; Müllenhoff 2005, 92.

202 Tuttahs 2007, 415-7 figs. 445b-46, 438-40 fig. 475. Before large scale irrigation in the Maeander plain started in the 1950s, the area of the Theatre Harbour was still flooded during spring floods as, for example, in 1907. This is documented by a photograph of Getrude Bell, now in the Photographic Archive of Newcastle University: Thonemann 2011, 317 fig. 8.7.

203 On the naming, see n. 209.

204 Knackfuss 1924, 30-47 figs. 29-40 pls. 4-5; A. Rehm in Knackfuss 1924, 281 no. 193a (dedicatory inscription of Antiochos I for Apollo Didymeus on architrave of the stoa); Hiller von Gaertringen 1932, 1604; Mayer 1932, 1644; Kleiner 1968, 61-2 fig. 37; Günther 1971, 23-50; Bringmann & von Steuben 1995, 338-44 no. 281; Herrmann 1997, 199 no. 193a, pl. 13, 3. The stoa is called twice *ἡ Ἀντιόχειος στοά*: cf. Kawerau & Rehm 326-30 no. 145.29 (206/5 BC); A. Rehm in Knackfuss 1924, 340-1 no. 270.7 (3<sup>rd</sup> century BC); Herrmann 1997, 207 no. 270 pl. 18, 4.

205 Bringmann & von Steuben 1995, 338 no. 281.9-10.

206 Weber 2004, 233 fig. 2, 236-8 fig. 5; Stümpel *et al.* 2005, 186-7 fig. 3.

207 Wiegand 1905, 5; von Gerkan 1935, 51, 53; cf. Tuttahs 2007, 360-2 fig. 389; Greaves 2000a, 40.

208 A. Rehm in Herrmann 1997, 37 no. 209; see the commentary of Herrmann 1997, 202 who postulates a professional association of fishermen and compares it with the *ὁ στόλος τῶν σωληνοκεντρῶν*, “the flotilla of the razor shell fishermen”, in another inscription of the 2<sup>nd</sup> century AD: W. Günther in Herrmann *et al.* 2006, 89-90 pl. 16 no. 1138.

209 This harbour is called the “East Harbour” (“Osthafen”) by von Graeve 2006, 261; Stümpel & Erkul 2008, 25; Bumke & Tanriöver 2012, 76 with fig. 75. We prefer the designation “Humei Tepe Harbour” (cf. Tuttahs 2007, 356: “Hafenanlage am Humei Tepe”) to distinguish it from the harbour on the long stretch of the central eastern side of the peninsula around the South Market (see § 4.2).

210 Kleiner 1968, 8.

211 Stümpel *et al.* 2005, 184-5 fig. 2; von Graeve 2006, 261-2 fig. 10; Tuttahs 2007, 356-9; Stümpel & Erkul 2008, 25, 27 fig. 2.



**Fig. 27.** Aerial view of the city centre of Miletos from the NE. In the foreground: Humei Tepe (1), Lion Harbour (2) and Kale Tepe (3). In the middle ground: North Market (4), Maeander with modern dam to the west (5), area of East Harbour (6), South Market (7), Ilyas Bey Mosque (AD 1404) (8), Roman Faustina Baths in the area of the former Theatre Harbour (9). In the background: modern village of Balat (since 1955) (10). Photograph: E. Küçük (September 2011).

Geoarchaeological corings (Mil 91-93) in this area show shallow marine and littoral sediments dating to Archaic/Classical times, which are covered by anthropogenic strata. The inclination of the bedrock made the easy landing and disembarking of ships possible.<sup>212</sup>

Excavations by H. Bumke in 2011 unearthed the southern of two gates in the late Roman (c. AD 262) city wall, the so-called *Gotenmauer*, which was already visible in the 2003-2005 geomagnetic images.<sup>213</sup> In an inscribed letter of Hadrian of AD 131 found nearby, the emperor allows a corporation (*οἶκος*) of Milesian shipowners (*ναύκληροι*) to be constituted, stressing the commercial role of the Humei Tepe Harbour.<sup>214</sup>

#### 4.4 The “Athena Harbour”

Until the Hellenistic period, a small harbour embayment existed north of the temple of Athena (Figs. 10, 26.5); consequently it is called the “Athena Harbour”.<sup>215</sup> In the early 20<sup>th</sup> century, the first excavators discovered an Archaic settlement with a “Harbour Smithy”, a “House of the Fisher”, distinguished by a stone anchor, and a storage room for amphorae.<sup>216</sup>

Corings demonstrate that during the period of the maximum transgression of sea level c. 2500 BC, the embayment was part of the open sea which surrounded a small island, later the site of the Hellenistic/Roman “Heroon II”.<sup>217</sup> The fortification wall of late Bronze Age

<sup>212</sup> Tuttahs 2007, 358 fig. 388.

<sup>213</sup> Stümpel & Erkul 2008, 27 fig. 2 “T”; Bumke & Tanriöver 2012, 77-8 fig. 78.

<sup>214</sup> Bumke & Tanriöver 2012, 78 fig. 80; Erhardt & Günther 2013. The term *οἶκος* implies that the ‘corporation’ will have met in some kind of assembly building, which is to be expected in the area of the Humei Tepe Harbour.

<sup>215</sup> Kleiner (1968, 48) thought this area was related to the Theatre Harbour. The harbour was detected for the first time by the geoarchaeological research of H. Brückner (Brückner 2003; Brückner *et al.* 2006; Tuttahs 2007, 343-6 fig. 378).

Miletos VI ran much further south along the Bronze Age shoreline and was restricted to an “elite-zone”, encircling the former island around the later Athena Temple and the Stadium Hill, which was connected to the mainland via a *tombolo* before 1500 BC.<sup>218</sup>

When the Heroon II Island became connected to this peninsula in the Geometric/Archaic period at the latest, the embayment of the Athena Harbour silted up successively, though relatively slowly.<sup>219</sup> Thus, the reconstruction of the course of the city wall between the so-called Heroon II and the Stadium Hill by A. von Gerkan has to be corrected (cf. Fig. 10, dotted lines):<sup>220</sup> it was situated at least 40 m further to the south, framing the small harbour.

Maybe the northern wall of the Later Hellenistic “West Market” was grounded on the Classical/Hellenistic fortifications, as was the neighbouring stadium.<sup>221</sup> The interpretation of it as a market building (“Handelsemporium”) by A. von Gerkan and others has recently been doubted because of the lack of sufficient storage facilities.<sup>222</sup> Instead, the “West Market”, with its two 191 m long *stoai* on opposite sides, can be convincingly identified with a double *xystos*, a roofed race course of the length of one *stadion*, typical for a Hellenistic gymnasium.<sup>223</sup> It may have been part of the gymnasium, king Eumenes II of Pergamon granted to Miletos before 167 BC.<sup>224</sup>

#### 4.5 The Kalabak Tepe Harbour

An Archaic harbour was thought by V. von Graeve to exist at the northeastern foot of the settlement on Kalabak Tepe, which had been abandoned in the early Classical period (Figs. 10, 26.9).<sup>225</sup> According to our geoarchaeological corings conducted in this area it can, however, only have had a water depth of a few decimetres, which speaks for a “beach harbour”, only used by vessels of minor draught like punted barges.<sup>226</sup> In addition, the lack of protection against western winds would have constrained its functionality. G. Tuttahs mistook the stones encountered in the corings for remains of a quay wall;<sup>227</sup> the cultural debris and stones are best interpreted as dump material for drying up the area after the abandonment of the harbour.<sup>228</sup>

#### 4.6 Note on the emporion, the “commercial harbour”

It remains to be discovered which one of these harbours is identical with the ἐμπόριον, the “commercial harbour”, referred to in an early Hellenistic (c. 260-220 BC) treaty between Miletos and certain Cretan cities.<sup>229</sup> Considering the date of the inscription, the Lion and the East Harbours are the strongest candidates, since they possessed large building facilities from the late Classical (Lion

216 von Gerkan 1925, 77-82 figs. 43-5; Kleiner 1968, 40, 48; Lang 1996, 202 fig. 74. However, according to the stands of the amphorae they should rather date to the mid-5<sup>th</sup> century BC and not the Archaic period, as I. Birzescu has pointed out to us (personal communication with A. Herda, April 2013). It is also strange that they were all found turned upside down, so that W. Schiering (1979, 90 n. 62) believed that they might represent a storage area of an amphora workshop.

217 For Heroon II, see now von Mangoldt 2012, 360-3 (“B192. Milet III”) pls. 139-40; Herda 2013, 72-3, 76 figs. 6-8.

218 Voigtländer 1985, 82, 85, 87 fig. 10, see above § 2. The reconstruction of Kleine 1980, 16-7 fig. 3 is outdated (no *tombolo*), as is the one of Greaves 2000b, 65 fig. 3.

219 Brückner *et al.* 2006, 70-3 fig. 3.

220 von Gerkan 1935, 84-6.

221 Kleiner 1968, 48-50 fig. 27.

222 von Gerkan 1925, 99; cf. Mayer 1932, 1647; Kleiner 1968, 48-50; Greaves 2000a, 56; Greaves 2002, 141; Tuttahs 2007, 345.

223 This has been argued by Emme 2013, 59-63 figs. 6-8; cf. Herda 2013, 76 with n. 25. Instead, von Gerkan (1925, 104-5) explained the lack of any functional rooms in the “West Market” as an area where goods were piled in the open air; see also Hiller von Gaetring 1932, 1609: “Der offene Hof als Aufbewahrungsort für Waren ist der Typus des hellenistischen Emporiums”.

224 The gymnasium of Eumenes II must have been located west of the Classical/Hellenistic stadium (Kleiner 1968: 89-91; Bringmann & von Steuben 1995, 346-9 no. 284 figs. 140-5). A. von Gerkan (1925, 105) has already noted that the West Market columns with filled flutes in their lower part (ibid. 103 fig. 52) are typical of the architecture of Pergamon. For a double *xystos* with an open court in between, one can compare the gymnasium of Ptolemy II(?) in Athens, located between the old agora northeast of the acropolis and the Roman agora, nowadays Odos Kyrrhestou (Hoepfner 1999, 224-7, fig. p. 224-5 “Strasse und Stoen nach Korres”). Other examples are the gymnasium of Hellenistic Stratonikeia and the gymnasium of Roman Nysa; cf. Emme 2013, 62-3 fig. 8.

225 von Graeve 2000, 126; cf. Stümpel *et al.* 2001, 419 fig. 1; Tuttahs 2007, 338-41 figs. 376-76a.

226 Mil 111, 112, 113, 115, 117; see Müllenhoff *et al.* 2003, 157-62, Müllenhoff 2005, 89-90.

227 Tuttahs 2007, 341.

228 Müllenhoff 2005, 90.

229 Kawerau & Rehm 1914, 307-12 no. 140; Herrmann 1997, 174-5 no. 140.313, 35, 61, 63.

Harbour: Harbour Hall) and the early Hellenistic (East Harbour: Antiochos Stoa) periods, respectively.

The *emporion* housed the Milesian slave market; this is clear from the fact that the inspectors (*epimeletai*) of the *emporion* monitored the observance of the *emporion* law (νόμος ἐμπορικός), which also regulated the trade of slaves.<sup>230</sup> Miletos' slave market must have been famous in late Classical and Hellenistic times: in Chariton of Aphrodisias' love novel *Chaireas and Kallirhoë*, the heroine is brought from Syracuse to Miletos to be sold. In the city she encounters the Persian satraps of Lydia and Karia, Pharnakes and Mithridates, who were in search of a new concubine.<sup>231</sup> Taking into consideration the religious, representative, and military functions of the Lion Harbour, one tends to favour the East Harbour as the *emporion* and slave market of Miletos.<sup>232</sup> This would explain why Antiochos I placed his 117-room *stoa*, which was meant to finance the temple construction in Didyma with its revenues, at the East Harbour.<sup>233</sup> It is a sign of changing times that the slave Felix could be the overseer (*vilicus*, οἰκονόμος) of the Milesian tax station in the name of his master Primio and the κοινωνοὶ τεσσαρακοστῆς λιμένων Ἀσίας, the “company of the fortieth tax of the harbours of Asia”, in the early 1<sup>st</sup> century AD.<sup>234</sup>

HELMUT BRÜCKNER

*Geographisches Institut, Universität zu Köln*  
*Albertus-Magnus-Platz, 50923 Köln*  
 Germany  
*h.brueckner@uni-koeln.de*

ALEXANDER HERDA

*Humboldt-Universität zu Berlin, Institut für Klassische*  
*Archäologie – Winckelmann-Institut, Unter den Linden 6,*  
*10099 Berlin*  
 Germany  
*alexander.herda@web.de*

MARC MÜLLENHOFF

*Lilienstraße 9, 34497 Korbach,*  
 Germany  
*info@geo-present.de*

WOLFGANG RABELL

*Christian-Abrechts-Universität zu Kiel, Institut für*  
*Geowissenschaften*  
*Otto-Hahn-Platz 1, 24118 Kiel*  
 Germany  
*wrabel@geophysik.uni-kiel.de*

HARALD STÜMPEL

*Christian-Abrechts-Universität zu Kiel, Institut für*  
*Geowissenschaften*  
*Otto-Hahn-Platz 1, 24118 Kiel*  
 Germany  
*harald.stuempel@me.com*

<sup>230</sup> The Hellenistic treaty between Miletos and Kretan cities mentions the law twice: Kawerau & Rehm 1914, 307-12; Herrmann 1997, 174-5 no. 140.49 κατὰ τὸν νόμον τὸν ἐμπορικόν (“according to the *emporion* law”) and line 63: κατὰ τὸν νόμον τῶν τοῦ ἐμπορίου ἐπιμελητῶν (“according to the law of the *epimeletai* of the *emporion*”); see above n. 12 on the *epimeletai*.

<sup>231</sup> See now Trzaskoma 2012, who stresses that Chariton in his fourth book modelled both satraps on the historical satraps Kyros and Tissaphernes, prominent in Xenophon's *Anabasis*.

<sup>232</sup> Lehmann-Hartleben 1923, 29, 147-8 favoured the Lion Harbour as the *emporion*, while Mayer 1932, 1647 thought it was the so-called West Market instead. But the West Market is probably the *palaistra* and *xystos* of the “Great Gymnasium”: see above, § 4.4 with n. 223.

<sup>233</sup> On the “Antiochos Stoa”, see above, § 4.2 with n. 204. For *stoai* as the characteristic building-type for an *emporion* see Lehmann-Hartleben 1923, 120-1, 147.

<sup>234</sup> Cf. Herrmann 1998, 33 no. 563; Kearsley & Evans 2001, 31 f., 149 no. 40.

## Works cited

- Anapniotis, G. 2006**  
‘Η μεγάλη αλυσίδα του Κεράτιου Κόλπου και η αποκατάσταση της ιστορικής αλήθειας στην Βυζαντινή Κωνσταντινούπολη’ in *2<sup>nd</sup> International Conference on ancient Greek technology*, Athens, 17-21 October 2005, Proceedings, Technical Chamber of Greece (ed.), Athens, 598-604.
- Baika, K. 2006**  
‘Military harbourworks in ancient Mediterranean: Technological aspects of their development and function’ in *2<sup>nd</sup> International Conference on ancient Greek technology*, Athens, 17-21 October 2005, Proceedings, Technical Chamber of Greece (ed.), Athens, 588-597.
- Bay, B. 1999a**  
‘Geoarchäologische Auswertung der Brunnengrabungen nördlich von Yeniköy’, *AA*, 77-88.
- Bay, B. 1999b**  
*Geoarchäologie, anthropogene Bodenerosion und Deltavorbau im Büyük Menderes Delta (SW-Türkei)*, Ph.D. Dissertation, University of Bochum.
- Bendt, W. 1968**  
*Topographische Karte von Milet (1: 2000) (Milet II.4)*, Berlin.
- Beresford, J. 2013**  
*The Ancient Sailing Season*, Leiden-Boston-Tokyo.
- Blackman, D.J. 2004**  
‘Ancient shipsheds in the harbour of Kos: an Interim Report’ in *Χάρης χαίρε: μελέτες στη μνήμη της Χάρης Κάντζια*, D. Damaskos (ed.), Athens, 77-82.
- Blackman, D.J. 2010**  
‘The Rhodian fleet and the Carian coast’ in *Hellenistic Karia. Proceedings of the first international conference on Hellenistic Karia*, Oxford 29 June – 2 July 2006, R. van Bremen & M. Carbon (eds.), Paris, 379-392.
- Blackmann, D.J., A. Yiannikouri & P. Knobloch 1996**  
‘Die Schiffshäuser am Mandrakihafen in Rhodos’, *AA*, 371-426.
- Blum, I. 1999**  
‘Die Stadtmauern von Alt-Milet. Ergebnisse des Surveys 1996 und 1997’, *AA*, 53-76.
- Bol, R. 2011**  
‘Einleitung’ in *Funde aus Milet Teil 2: Marmorskulpturen der römischen Kaiserzeit aus Milet. Aufstellungskontext und programmatische Aussage* (Milet V.2), R. Bol, S. Frede & P. Scholl (eds.), Berlin, 1-12.
- Börker, C. & R. Merkelbach 1979**  
*Die Inschriften von Ephesos Teil II, Nr. 101-599 (Repertorium)* (Inschriften griechischer Städte aus Kleinasien 12), Bonn.
- Bourboulis, Ph.P. 1949**  
*Apollo Delphinios*, Thessalonike.
- Bringmann, K. & H. von Steuben (eds.) 1995**  
*Schenkungen hellenistischer Herrscher an griechische Städte und Heiligtümer, Teil 1: Zeugnisse und Kommentare*, Berlin.
- Brückner, H. 1996**  
‘Geoarchäologie an der türkischen Ägäisküste – Landschaftswandel im Spiegel geologischer und archäologischer Zeugnisse’, *Geographische Rundschau* 10, 568-574.
- Brückner, H. 2003**  
‘Delta evolution and culture – aspects of geoarchaeological research in Miletos and Priene’ in *Troia and the Troad. Scientific approaches* (Springer Series: Natural Science in Archaeology), G.A. Wagner, E. Pernicka & H.P. Uerpmann (eds.), Berlin - Heidelberg - New York, 121-144.
- Brückner, H. 2005**  
‘Holocene shoreline displacements and their consequences for human societies: the example of Ephesus in Western Turkey’, *Zeitschrift für Geomorphologie N. F.*, (Suppl. Vol. 137), 11-22.
- Brückner, H. 2007**  
‘Holozäne Umweltrekonstruktion und Geoarchäologie’, *Zeitschrift für Geomorphologie N. F.*, (Suppl. Vol. 148), 55-58.
- Brückner, H. 2011**  
‘Geoarchäologie – in Forschung und Lehre’ in *Umweltarchäologie – Naturkatastrophen und Umweltwandel im archäologischen Befund*, 3. Mitteldeutscher Archäologentag, Halle (Saale), 7-9 October 2010, H.-R. Bork, H. Meller & R. Gerlach (eds.) (Tagungen des Landesmuseums für Vorgeschichte Halle/Saale 6), Halle/Saale, 9-20.
- Brückner, H., M. Müllenhoff, K. van der Borg & A. Vött 2004**  
‘Holocene coastal evolution of western Anatolia – the interplay between natural factors and human impact’ in *Human records of recent geological evolution*

*in the Mediterranean Basin – historical and archaeological evidence*, Santorini, Greece, 22-25 October 2003, CIESM (Commission Internationale pour l'Exploration Scientifique de la mer Méditerranée) (ed.) (CIESM Workshop Monographs, 24), Monaco, 51-56.

**Brückner, H., A. Vött, M. Schriever & M. Handl 2005**

'Holocene delta progradation in the eastern Mediterranean – case studies in their historical context', *Méditerranée*, 2005/1-2, 95-106.

**Brückner, H., M. Müllenhoff, R.**

**Gehrels, A. Herda, M. Knipping & A. Vött 2006**

'From archipelago to floodplain – geographical and ecological changes in Miletos and its environs during the past six millennia (Western Anatolia, Turkey)', *Zeitschrift für Geomorphologie N. F.*, (Suppl. Vol. 142), 63-83.

**Brückner, H. & R. Gerlach 2011**

'Geoarchäologie – von der Vergangenheit in die Zukunft' in *Geographie - Physische Geographie und Human-geographie*, H. Gebhardt, R. Glaser, U. Radtke & P. Reuber (eds.), Heidelberg (2<sup>nd</sup> ed.), 1179-1186.

**Brückner, H., A. Herda, M. Müllenhoff, W. Rabbel & H. Stümpel in press.**

'Der Löwenhafen von Milet – eine geoarchäologische Fallstudie' in *Harbors and Harbor Cities in the Eastern Mediterranean from Antiquity to Byzantium. Recent Discoveries & New Approaches, Acts of the International Colloquium in Istanbul, 30.5.-1.6.2011* (Byzas), F. Pirson, S. Ladstätter & Th. Schmidts (eds.), Istanbul.

**Bumke, H. & A. Tanrıöver 2012**

'Milet 2011 – Neue Forschungen am Humeitepe im Norden der Stadt' in *Jahresberichte des Instituts für Archäologische Wissenschaften für das Akademische Jahr 2010-2011*, Ruhr-Universität Bochum (ed.), Bochum, 75-78.

**Bürchner, L. 1903**

'Dokimos 1' in *RE V* 1, 1274.

**Cobet, J. 1997**

'Die Mauern sind die Stadt. Zur Stadtbefestigung des antiken Milet', *AA*, 249-284.

**Deppert-Lippitz, B. 1984**

*Die Münzprägung Milets vom vierten bis ersten Jahrhundert v. Chr.* (Typos V), Aarau - Frankfurt a.M. - Salzburg.

**Ehrhardt, N. 1988**

*Milet und seine Kolonien. Vergleichende Untersuchung der kultischen und politischen Einrichtungen*, Frankfurt (2<sup>nd</sup> ed.).

**Ehrhardt, N. 2000**

'Review of SEG 42/43', *Gnomon* 72, 517-520.

**Ehrhardt, N & W. Günther 2013**

'Hadrian, Milet und die Korporation der milesischen Schiffseigner. Zu einem neugefundenen kaiserlichen Schreiben', *Chiron* 43, 2013, 199-220.

**Emme, B. 2013**

'Das Märchen von den drei Märkten - Bauten merkantiler Funktion und die städtebauliche Entwicklung des hellenistischen Milet', *IstMitt* 63, 51-74.

**Feuser, S. 2009**

*Der Hafen von Alexandria Troas* (Asia Minor Studien, Vol. 63), Bonn.

**Fleet, K. 1999**

*European and Islamic trade in the early Ottoman state. The merchants of Genoa and Turkey*, Cambridge.

**Frederiksen, R. 2011**

*Greek city walls of the Archaic period, 900 – 480 BC*, Oxford.

**Freyer-Schauenburg, B. 1974**

*Bildwerke der archaischen Zeit und des Strengen Stils* (Samos II), Bonn.

**Garlan, Y. 1974**

*Recherches de poliorcétique grecque* (Bibliothèque des Ecoles Françaises d'Athènes et de Rome, Vol. 223), Athens – Paris.

**Gorman, V.B. 2001**

*Miletos, the Ornament of Ionia. A History of the city to 400 B.C.*, Ann Arbor, Michigan.

**Grandjean, Y. 2011**

*Le Rempart de Thasos* (Étude Thasiennes, Vol. 22), Athens - Paris.

**Greaves, A. 2000a**

'Miletos and the Sea: a stormy relationship' in *The Sea in Antiquity*, G. Oliver, R. Brock, T. Cornell & S. Hodkinson (eds.), (BAR International Series 899), Oxford, 39-61.

**Greaves, A. 2000b**

'The shifting focus of settlement at Miletus' in *Further studies in the ancient Greek Polis*, P. Flensted-Jensen (ed.), (Historia Einzelschriften, Vol. 138), Stuttgart, 57-72.

**Greaves, A. 2002**

*Miletos. A History*, London.

**Greaves, A. 2007**

‘Milesians in the Black Sea: trade, settlement and religion’ in *The Black Sea in Antiquity. Regional and interregional economic exchanges*, V. Gabrielsen & J. Lund (eds.), (Black Sea Studies, Vol. 6), Aarhus, 9-21.

**Günther, W. 1971**

*Das Orakel von Didyma in hellenistischer Zeit. Eine Interpretation von Stein- Urkunden* (IstMitt BH 4), Tübingen.

**Günther, W. 1999**

‘Funde aus Milet IX. Ein milesisches Proxenie-Dekret des 4. Jahrhunderts v. Chr.’, *AA*, 475-479.

**Günther, W. 2006**

‘Zwischen Widerstand und Integration. Die westkleinasiatischen Griechen und Rom im 1. Jh. v. Chr. am Beispiel von Milet’ in *Einblicke in die Antike. Orte - Praktiken - Strukturen*, C. Ronning (ed.), Munich, 157-179.

**Hammond, N.G.L. (ed.) 1981**

*Atlas of the Greek and Roman World in Antiquity*, Park Ridge, NJ.

**Herda, A. 2005**

‘Apollon Delphinios, das Prytaneion und die Agora von Milet. Neue Forschungen’, *AA* 2005/1, 243-294.

**Herda, A. 2006**

*Der Apollon-Delphinios-Kult in Milet und die Neujahrsprozession nach Didyma. Ein neuer Kommentar der sog. Molpoi-Satzung* (Milesische Forschungen, Vol. 4), Mainz.

**Herda, A. 2008**

‘Apollon Delphinios – Apollon Didymeus: Zwei Gesichter eines milesischen Gottes und ihr Bezug zur Kol-

onisation Milets in archaischer Zeit’ in *Kultu(ur)kontakte. Apollon in Milet/Didyma, Histria, Myus, Naukratis und auf Zypern, Akten der Table Ronde in Mainz, vom 11.-12. März 2004*, R. Bol, U. Höckmann & P. Schollmeyer (eds.), Rhaden, 13-86.

**Herda, A. 2009**

‘Karkiša-Karien und die sog. Ionische Migration’ in *Die Karer und die Anderen, Internationales Kolloquium an der Freien Universität Berlin, 13. bis 15. Oktober 2005*, F. Rumscheid (ed.), Bonn, 27-108.

**Herda, A. 2011**

‘How to run a state cult: The organisation of the cult of Apollo Delphinios in Miletus’ in *Current approaches to ancient Greek religion, Proceeding of the International Conference at the British School and Swedish Institute at Athens, April 2008*, M. Haysom & J. Wallensten (eds.), Stockholm, 57-93.

**Herda, A. 2013**

‘Burying a sage: The heroön of Thales on the agora of Miletos. With remarks on some other excavated heroön and on cults and graves of the mythical founders of the city’ in *The dead in the city. Practices, contexts and impacts of intramural burials in Anatolia, from EBA to Roman times, 2<sup>nd</sup> Archaeological Meetings of the IFEA, Istanbul 14-15 November 2011*, O. Henry (ed.), Istanbul, 1-55.

**Herda, A. forthcoming**

*From Anax to Thales: The many founders of Miletos in Asia/Ionia* (Center for Hellenic Studies Series), Cambridge, Mass. - London.

**Herda, A., H. Brückner & M. Müllenhoff forthcoming**

*Geoarchaeology in the city of Thales: palaeogeography and its impact on the settlement history of Miletos. Geoarchaeological research 2002-2014.*

**Herrmann, P. 1994**

‘Milet unter Augustus. C. Iulius Epikrates und die Anfänge des Kaiserkultes’, *IstMitt* 44, 203-36.

**Herrmann, P. 1995**

‘Γέρας θανόντων. Totenruhm und Totenehrung im städtischen Leben der hellenistischen Zeit’ in *Stadt und Bürgerbild im Hellenismus, Kolloquium, München, 24. bis 26. Juni 1993*, M. Wörle & P. Zanker (eds.), (Vestigia, Vol. 47), Munich, 189-197.

**Herrmann, P. 1996**

‘Milet unter Augustus. Erkenntnisse aus einem Inschriftenneufund’ in *ENEPEIA. Studies in ancient history and epigraphy presented to H.W. Pleket, J.H.M. Strubbe, R.A. Tybout & H.J. Versnel* (eds.), Amsterdam, 1-18.

**Herrmann, P. 1997**

*Inschriften von Milet Teil 1. A. Inschriften n. 187-406 von Albert Rehm mit einem Beitrag von Hermann Dessau, B. Nachträge und Übersetzungen zu den Inschriften n. 1-406 von Peter Herrmann* (Milet VI.1), Berlin - New York.

**Herrmann, P. 1998**

*Inschriften von Milet Teil 2. Inschriften n. 407-1019* (Milet VI.2), Berlin - New York.

**Herrmann, P., W. Günther & N.**

**Ehrhardt 2006**

*Die Inschriften von Milet Teil 3: Inschriften n. 1020-1580* (Milet VI.3), Berlin - New York.

- Hiller von Gaertringen, F. 1906**  
*Die Inschriften von Priene*, Berlin.
- Hiller von Gaertringen, F. 1932**  
‘Miletos [1] Geschichte’ in *RE* 15:2, 1586-1622.
- Höckmann, O. 2007**  
‘Reinigungsarbeiten in antiken Häfen’, *Kölner Jahrbuch* 40, 335-350.
- Höckmann, O. forthcoming**  
‘Zu den Kriegshäfen von Milet’.
- Hoepfner, W. 1999**  
‘Die Epoche der Griechen’ in *Geschichte des Wohnens. Band 1: 5000 v. Chr. - 500 n. Chr. Vorgeschichte, Frühgeschichte, Antike*, W. Hoepfner (ed.), Stuttgart, 123-608.
- Hoepfner, W. 2000**  
‘Der Koloss von Rhodos’, *AA*, 129-153.
- Hughes, J.D. & J.V. Thirgood 1982**  
‘Deforestation, erosion, and forest management in Ancient Greece and Rome’, *Journal of Forest History*, 26.2, 60-75.
- Jones, C.P. 1992**  
‘Hellenistic History in Chariton of Aphrodisias’, *Chiron* 22, 91-102.
- Kahane, H., R. Tietze & A. Tietze 1958**  
*The Lingua Franca in the Levant. Turkish nautical terms of Italian and Greek origin*, Urbana.
- Kästner, V. 2009**  
‘Die Spolie mit der Justiniansinschrift vom milesischen Markttor’ in *ZeitRäume. Milet in Kaiserzeit und Spätantike, Exhibition catalogue Pergamonmuseum Berlin, 6<sup>th</sup> May 2009 – 10<sup>th</sup> January 2010*, O. Dally, M. Maischberger, P.I. Schneider & A. Scholl (eds.), Regensburg, 204-211.
- Kawerau, G. & A. Rehm 1914**  
*Das Delphinion in Milet (Milet I.3)*, Berlin.
- Kearsley, R.A. & T.V. Evans 2001**  
*Greeks and Romans in Imperial Asia. Mixed language inscriptions and linguistic evidence for cultural interaction until the end of AD III* (Inschriften griechischer Städte aus Kleinasien, Vol. 59), Bonn.
- Kekule von Stradonitz, R. 1900**  
‘Vorläufiger Bericht über die von den königlichen Museen begonnenen Ausgrabungen in Milet’, *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, 104-115.
- Kienast, H. 1978**  
*Die Stadtmauer von Samos (Samos XV)*, Bonn.
- Kienast, H. 2004**  
‘Die Tyrannis inszeniert sich. Großbauten auf der Insel Samos’ in *Macht der Architektur – Architektur der Macht, Bauauforschungskolloquium in Berlin vom 30. Oktober bis 2. November 2002, veranstaltet vom Architekturreferat des DAI* (Diskussionen zur Archäologischen Bauauforschung 8), E.-L. Schwandner & K. Rheidt (eds.), Mainz, 69-78.
- Kleine, J. (ed.) 1980**  
*Milet - Didyma und Priene. Ein Führer durch die Ruinen* (Die Karawane. Vierteljahresshefte der Gesellschaft für Länder- und Völkerkunde 21/1-2), Ludwigsburg.
- Kleiner, G. 1968**  
*Die Ruinen von Milet*, Berlin.
- Kleiner, G. 1970**  
‘Das römische Milet. Bilder aus der griechischen Stadt in römischer Zeit’, *Sitzungsberichte der Wissenschaftlichen Gesellschaft an der Johann Wolfgang Goethe-Universität Frankfurt am Main* 8, 1969, No. 5, Wiesbaden.
- Knackfuß, H. 1924**  
*Der Südmarkt und die benachbarten Bauanlagen (Milet I.7)*, Berlin.
- Knipping, M., M. Müllenhoff & H. Brückner 2008**  
‘Human induced landscape changes around Bafa Gölü (Western Turkey)’, *Vegetation History and Archaeobotany* 17, 365-380.
- Kocabaş, U. 2008**  
*The ‘Old Ships’ of the ‘New Gate’. Yenikapı’nın eski gemileri (Yenikapı Shipwrecks 1)*, Istanbul.
- Kolonas, L. 1989-90**  
‘Ανασκαφή Οτνιαδών. Τα νεώρια’, *Archaïgnosia* 6, 153-158.
- Kraft, J.C., İ. Kayan, H. Brückner & G. Rapp 2003a**  
‘Sedimentary facies patterns and the interpretation of paleogeographies of ancient Troia’ in *Troia and the Troad. Scientific approaches* (Springer Series: Natural Science in Archaeology), G.A. Wagner, E. Pernicka & H.P. Uerpmann (eds.), Berlin - Heidelberg - New York, 361-377.
- Kraft, J.C., G. Rapp, İ. Kayan & J.V. Luce 2003b**  
‘Harbor areas at ancient Troy: sedimentology and geomorphology

- complement Homer's Iliad', *Geology* 31, 163-166.
- Kraft, J.C., H. Brückner, İ. Kayan & H. Engelmann 2007**  
 'The geographies of ancient Ephesus and the Artemision in Anatolia', *Geoarchaeology* 22 (1), 121-149.
- Kraft, J.C., G. Rapp, H. Brückner & İ. Kayan 2011**  
 'Results of the struggle at ancient Ephesus: natural processes 1, human intervention o' in *Human Interactions with the Geosphere: the geoarchaeological perspective* (Geological Society, London, Special Publications, Vol. 352), L. Wilson (ed.), London, 27-36.
- Lang, F. 1996**  
*Archaische Siedlungen in Griechenland. Struktur und Entwicklung*, Berlin.
- Lehmann-Hartleben, K. 1923**  
*Die antiken Hafenanlagen des Mittelmeeres. Beiträge zur Geschichte des Städtebaus im Altertum*, Leipzig.
- Lentini, M. & D.J. Blackman 2009**  
*Naxos di Sicilia. L'abitato coloniale e l'arsenale navale. Scavi 2003-2006*, Messina.
- Lentini, M., D.J. Blackman & J. Pakkanen 2009**  
 'The Shipheds of Sicilian Naxos: a second preliminary report (2003-6)', *BSA* 103, 299-366.
- Lohmann, H. 1995**  
 'Survey in der Chora von Milet. Vorbericht über die Kampagnen der Jahre 1990, 1992 und 1993', *AA*, 293-333.
- Lohmann, H. 2006**  
 'Zur historischen Topographic des südlichen Ionien', *Orbis Terrarum* 8, 2002 (2006), 163-272.
- Lovén, B. & M. Schaldemose 2012**  
*The Ancient Harbours of the Piraeus I.1. The Zea shipsheds and slipways: architecture and topography*. By Bjorn Lovén;  
*The ancient harbours of the Piraeus – I.2. The Zea shipsheds and slipways: finds, Area 1 shipshed roof reconstructions and feature catalogue*. By Bjørn Lovén & Mette Schaldemose with contributions by B. Klejn-Christensen & M.M. Nielsen (Monographs of the Danish Institute at Athens, Vol. 15), Athens.
- Marcellesi, C. 2004**  
*Milet des Hécatomnides à la domination romaine. Pratiques monétaires et histoire de la cité du IV<sup>e</sup> au II<sup>e</sup> siècle av. J.-C.* (Milesische Forschungen, Vol. 3), Mainz 2004.
- Marsden, E.W. 1969-1971**  
*Greek and Roman artillery I: Historical development - II: Technical treatises*, Oxford.
- Martini, W., H. Brückner, N. Eschbach, D. Kelterbaum & M. Recke 2008**  
 'Der Flusshafen von Perge in Pamphylien. Ein geoarchäologischer Survey löst ein altes Problem', *AA* 2008/1, 163-179.
- Mayer, M. 1932**  
 'Miletos 2. Topographie, Bauwerke', *RE* 15 (2), 1622-1655.
- Meckelnborg, C. & K.-H. Schäfer (eds.) 2006**  
*Chariton. Kallirhoë, griechisch und deutsch*, Darmstadt.
- Meriç, R., R. Merkelbach, J. Nollé & S. Şahin 1981**  
*Die Inschriften von Ephesos Teil VII, 1, Nr. 3001-3500 (Repertorium)* (Inschriften griechischer Städte aus Kleinasien, Vol. 17.1), Bonn.
- Merkelbach, R. & J. Nollé, 1980**  
*Die Inschriften von Ephesos Teil VI, Nr. 2001-2958 (Repertorium)* (Inschriften griechischer Städte aus Kleinasien, Vol. 16), Bonn.
- Milner, N.P. 1997**  
 'Conclusions and recent developments' in *Hellenistic Fortifications from the Aegean to the Euphrates*, A.W. McNicoll, with revisions and an additional chapter by N.P. Milner (Oxford Monographs in Classical Archaeology), Oxford, 207-223.
- Müllenhoff, M. 2005**  
*Geoarchäologische, sedimentologische und morphodynamische Untersuchungen im Mündungsgebiet des Büyük Menderes (Mäander), Westtürkei* (Marburger Geographische Schriften 141), Marburg.
- Müllenhoff, M., A. Wullstein & H. Brückner 2003**  
 'Holozäne Küstenverlagerung und paläogeographischer Wandel im Umfeld der antiken Städte Myous und Milet (Westanatolien/Türkei)', *Berichte Forschungs- und Technologiezentrum Westküste der Universität Kiel* 28, 151-163.
- Müllenhoff, M., M. Handl, M. Knipping & H. Brückner 2004**  
 'The evolution of Lake Bafa (Western Turkey) – Sedimentological, microfaunal and palynological results', in *Geographie der Meere und Küsten*. 22. AMK-Tagung Rostock-Warnemünde, 28.-30.04.2004 (Coastline Reports 1/2004), G. Schernewski & T. Dolch (eds.), Warnemünde, 55-66.

**Müllenhoff, M., A. Herda & H.**

**Brückner 2009a**

‘Geoarchaeology in the city of Thales. Deciphering palaeogeographic changes in the Agora area of Miletos’ in *Mensch und Umwelt im Spiegel der Zeit. Aspekte geoarchäologischer Forschungen im östlichen Mittelmeergebiet* (Philippika. Marburger Altertumskundliche Abhandlungen 1), T. Mattern & A. Vött (eds.), Wiesbaden, 97-110.

**Müllenhoff, M., A. Herda, & H.**

**Brückner 2009b**

‘Auf Meeressand gebaut – Landschaftswandel in Milet im Spiegel geoarchäologischer Zeugnisse’ in *ZeitRäume. Milet in Kaiserzeit und Spätantike, Exhibition catalogue Pergamonmuseum Berlin, 6<sup>th</sup> May 2009 – 10<sup>th</sup> January 2010*, O. Dally, M. Maischberger, P.I. Schneider & Andreas Scholl (eds.), Regensburg, 18-23.

**Müllenhoff, M., A. Herda & H.**

**Brückner forthcoming**

‘Die paläogeographische Entwicklung im Gebiet der Faustina-Thermen und die Bedeutung für deren städtebauliche Einbindung’ in *Die Faustina-Thermen in Milet*, M. Maischberger, P.I. Schneider & O. Dally (eds.), Berlin.

**Müller-Wiener, W. 1994**

*Die Häfen von Byzantion – Konstantinoplis – Istanbul*, Tübingen.

**Myres, J. 1954**

‘The Battle of Lade, 494 B.C. (Herodotus VI. 6-17. With Map)’, *GaR*, 2<sup>nd</sup> ser., 1, no. 2, 50-55.

**Niemeier, W.-D. 2007**

‘Milet von den Anfängen menschlicher Besiedlung bis zur Ionischen Wanderung’ in *Frühes Ionien: Eine Be-*

*standsaufnahme, Panionion-Symposion Güzelçamlı, 26. September – 1. Oktober 1999*, J. Cobet, W.-D. Niemeier, V. von Graeve & B. Weber (eds.), (Milesische Forschungen, Vol. 5), Mainz, 3-20.

**Niewöhner, Ph. 2008**

‘Sind die Mauern die Stadt? Vorbericht über die siedlungsgeschichtlichen Ergebnisse neuer Grabungen im spätantiken und byzantinischen Milet, mit einem geoarchäologischen Beitrag von Helmut Brückner und Marc Müllenhoff’, *AA* 2008/1, 181-201.

**Niewöhner, Ph. 2009**

‘Milet in frühbyzantinischer Zeit’ in *ZeitRäume. Milet in Kaiserzeit und Spätantike, Exhibition catalogue Pergamonmuseum Berlin, 6<sup>th</sup> May 2009 – 10<sup>th</sup> January 2010*, O. Dally, M. Maischberger, P.I. Schneider & Andreas Scholl (eds.), Regensburg, 60-67.

**Niewöhner, Ph. 2010**

‘Byzantinische Stadtmauern in Anatolien. Vom Statussymbol zum Bollwerk gegen die Araber’ in *Aktuelle Forschungen zur Konstruktion, Funktion und Semantik antiker Stadtbefestigungen* (Byzas, Vol. 10), J. Lorentzen, F. Pirson, P.I. Schneider & U. Wulf-Rheidt (eds.), Istanbul, 239-260.

**Ober, J. 1987**

‘Early artillery towers: Messenia, Boiotia, Attica, Megarid’, *AJA* 91, 569-604.

**Ober, J. 1992**

‘Towards a typology of Greek artillery towers: The first and second generations (c. 375-275 B.C.)’ in *Fortificationes Antiquae* (McGill University Monographs in Classical Archaeology and History 12), S. Van de Maele & J.M. Fossey (eds.), Amsterdam, 147-169.

**Philippson, A. 1936**

*Das südliche Ionien. Mit Karte: Jonien, südlicher Teil (1:100.000) bearbeitet von Karl Lyncker* (Milet III.5), Berlin.

**Plepelits, K. 1976**

*Chariton von Aphrodisias. Kallirhoe*, Stuttgart.

**Rabbel, W., H. Stuempel & S. Woelz 2004**

‘Archaeological prospecting with magnetic and shear-wave surveys at the ancient city of Miletos (western Turkey)’, *The Leading Edge* 23, 690-703.

**Rabbel, W., H. Stümpel & S. Wölz 2006**

‘Milet als Musterfall geophysikalischer Prospektion in der Archäologie’ in *Maiandros – Festschrift für Volkmar von Graeve*, R. Biering V. Brinkmann, U. Schlotzhauer & B.F. Weber (eds.), Munich, 205-212.

**Rackham, O. & J. Moody 1996**

*The making of the Cretan landscape*, Manchester – New York.

**Reardon, B.P. 2004**

*Chariton. De Callirhoe narrationes amatoriae*, Munich – Leipzig.

**Rihll, T.E. 2006**

‘On artillery towers and catapult sizes’, *BSA* 101, 379-383.

**Rihll, T.E. 2007**

*The catapult. A history*, Westholme.

**Robertson, N. 1987**

‘Government and society at Miletus, 525-442 B.C.’, *Phoenix* 41, 356-398.

- Ruiz-Montero, C. 1994**  
‘Chariton von Aphrodisias: Ein Überblick’ in ANRW II.34.2, 1006-1054.
- Schiering, W. 1979**  
‘Milet: Eine Erweiterung der Grabung östlich des Athenatempels’, *IstMitt* 29, 77-108.
- Schneider, P. 1996**  
‘Neue Funde vom archaischen Apollontempel in Didyma’ in *Säule und Gebälk. Zu Struktur und Wandlungsprozeß griechisch-römischer Architektur, Bauforschungskolloquium in Berlin vom 16. bis 18. Juni 1994, veranstaltet vom Architekturreferat des DAI* (Diskussionen zur Archäologischen Bauforschung 6), E.-L. Schwandner (ed.), Mainz, 78-83.
- Schollmeyer, P. 2011**  
‘Großes Hafendenkmal’ in *Funde aus Milet Teil 2: Marmorskulpturen der römischen Kaiserzeit aus Milet. Aufstellungskontext und programmatische Aussage*, R. Bol, S. Frede & P. Scholl (eds.), (Milet V.2), Berlin, 13-18 pl. 1.
- Schröder, B. 1990**  
‘Archäologie-begleitende Geologie zur Grabung Milet 1989’, *IstMitt* 40, 62-68.
- Schröder, B., H. Brückner, H. Stümpel & Ü. Yalçın 1995**  
‘Milet 1992-1993, Geowissenschaftliche Umfelderkundung’, *AA*, 238-244.
- Scott, L. 2000**  
‘Were there polis navies in Archaic Greece?’ in *The Sea in Antiquity* (BAR International Series 899), G. Oliver, R. Brock, T. Cornell & S. Hodkinson (eds.), Oxford, 93-115.
- Seltman, C. 1955**  
*Greek Coins. A history of metallic currency and coinage down to the fall of the Hellenistic kingdoms*, London (2<sup>nd</sup> ed.).
- Senff, R. 2003**  
‘Das Aphroditeheiligtum von Milet’ in *Neue Forschungen zur Religionsgeschichte Kleinasiens. Elmar Schwertheim zum 60. Geburtstag gewidmet*, G. Heedemann & E. Winter (eds.), (Asia Minor Studien, Vol. 49), Bonn, 11-25.
- Senff, R. 2006**  
‘Die Löwen der Aphrodite’ in *Maiandros. Festschrift für Volkmar von Graeve*, R. Biering, V. Brinkmann, U. Schlotzhauer & B.F. Weber (eds.), München, 269-278.
- Shiple, G. 1987**  
*A History of Samos, 800 – 188 BC*, Oxford.
- Simossi, A. 1991**  
‘Underwater Excavation Research in the Ancient harbor of Samos: September – October 1988’, *International Journal of Underwater Archaeology* 20, 1991, 281-298.
- Simossi, A. 1998**  
‘Σάμος, Αρχαίο λιμάνι Σάμου (δεύτερη περίοδος ανασκαφικής έρευνας)’, *ArchDelt* 48, 1993 [1998], *Chronika B* 2, 592-595.
- Simossi, A. 1999**  
‘Σάμος, Πυθαγόρειο’, *ArchDelt* 49, 1994 [1999], *Chronika B* 2, 858-862.
- Stümpel, H. 2001**  
‘Geophysikalische Prospektion in Milet 1998-1999’, *AA*, 418-422.
- Stümpel, H., F. Demirel, S. Lorra & S. Wende 1995**  
‘Geophysikalische Messungen im Umfeld von Milet’, *AA*, 245-253.
- Stümpel, H., C. Bruhn, F. Demirel, M. Gräber, M. Panitzki & W. Rabbel 1997**  
‘Stand der geophysikalischen Messungen im Umfeld von Milet’, *AA*, 124-134.
- Stümpel, H., F. Demirel, W. Rabbel, I. Trinks & S. Wölz 1999**  
‘Geophysikalische Prospektion im Umfeld von Milet 1996-1997’, *AA*, 89-98.
- Stümpel, H., S. Wölz, P. Musmann & W. Rabbel 2005**  
‘Geophysikalische Prospektion in Milet. Arbeiten in den Kampagnen 2000-2002’, *AA* 2005/1, 183-194.
- Stümpel, H. & E. Erkul 2008**  
‘Geophysikalische Prospektion in Milet 2003-2005’, *AA* 2008/2, 25-32.
- Talamo, C. 2004**  
*Mileto. Aspetti della città arcaica e del contesto ionico*, Rome.
- Thommen, L. 2009**  
*Umweltgeschichte der Antike*, München.
- Thonemann, P. 2011**  
*The Maeander Valley. A historical geography from Antiquity to Byzantium*, Cambridge.
- Tilg, S. 2010**  
*Chariton of Aphrodisias and the Invention of the Greek Love Novel*, Oxford.
- Triantafyllidis, P. 2010**  
*Agathonisi on the Frontier. The archaeological investigations at Kastraki (2006-2010)*, Athens.

**Trzaskoma, S.M. 2012**

‘Why Miletus? Chariton’s choice of setting and Xenophon’s Anabasis’, *Mnemosyne* 2012/2, 300-307.

**Tuchelt, K. 1979**

*Frühe Denkmäler Roms in Kleinasien. Beiträge zur archäologischen Überlieferung aus der Zeit der Republik und des Augustus, Teil 1: Roma und Promagistrate* (IstMitt BH 23), Tübingen.

**Tuttahs, G. 1998**

*Milet und das Wasser, ein Beispiel für die Wasserwirtschaft einer antiken Stadt*, Ph.D. Universität Gesamthochschule Essen, Essen.

**Tuttahs, G. 2007**

*Milet und das Wasser – Ein Leben in Wohlstand und Not in Antike, Mittelalter und Gegenwart* (Schriften der Deutschen Wasserhistorischen Gesellschaft [DWhG] e.V., Sonderband 5), Siegburg.

**Vött, A. & H. Brückner 2006**

‘Versunkene Häfen im Mittelmeerraum. Antike Küstenstädte als Archive für die geoarchäologische Forschung’, *Geographische Rundschau* 58 (4), 12-21.

**Voigtländer, W. 1985**

‘Zur Topographie Milets. Ein neues Modell zur antiken Stadt’, *AA*, 77-91.

**von Gerkan, A. 1922**

*Der Nordmarkt und der Hafen an der Löwenbucht* (Milet I.6), Berlin.

**von Gerkan, A. 1925**

*Kalabaktepe, Athenatempel und Umgebung* (Milet I.8), Berlin.

**von Gerkan, A. 1935**

*Die Stadtmauern* (Milet II.3), Berlin.

**von Graeve, V. 1996**

‘Zu den Hafenzinnen von Milet’ in *Fremde Zeiten. Festschrift für Jürgen Borchardt zum sechzigsten Geburtstag am 25. Februar 1996, dargebracht von Kollegen, Schülern und Freunden*, Vol. I, F. Blakolmer, K.R. Krierer & F. Krinzinger (eds.), Wien, 317-327.

**von Graeve, V. 1997/98**

‘Neue Ausgrabungen und Forschungen im archaischen Milet’, *Nürnberger Blätter zur Archäologie* 14, 73-88.

**von Graeve, V. 2000**

‘Die Belagerung Milets durch Alexander den Großen’ in *Civilisation grecque et cultures antiques périphériques. Hommage à Petre Alexandrescu à son 70<sup>e</sup> anniversaire*, A. Avram & M. Babeş (eds.), Bucharest, 113-129.

**von Graeve, V. 2006**

‘Milet’ in *Stadtgrabungen und Stadtforschung im westlichen Kleinasien* (Byzas 3), W. Radt (ed.), Istanbul, 241-261.

**von Mangoldt, H. 2012**

*Makedonische Grabarchitektur: die Makedonischen Kammergräber und ihre Vorläufer*, Tübingen.

**Walker, K.G. 2004**

*Archaic Eretria. A political and social history from the earliest times to 490 BC*, New York.

**Wankel, H. 1979**

*Die Inschriften von Ephesos Teil 1a, Nr. 1-47 (Texte)* (Inschriften griechischer Städte aus Kleinasien 11.1), Bonn.

**Weber, B. 2004**

‘Der Stadtplan des kaiserzeitlichen Milet’ in *Macht der Architektur – Ar-*

*chitektur der Macht, Bauforschungskolloquium in Berlin vom 30. Oktober bis 2. November 2002, veranstaltet vom Architekturreferat des DAI*, E.-L. Schwandner & K. Rheidt (eds.), (Diskussionen zur Archäologischen Bauforschung 8), Mainz, 231-240.

**Wiegand, Th. 1901**

‘Ausgrabungen zu Milet’, *AA Beiblatt*, 191-199.

**Wiegand, Th. 1905**

‘Vierter vorläufiger Bericht über die von den Königlichen Museen begonnenen Ausgrabungen zu Milet’, *Abhandlungen der Königlich Preussischen Akademie der Wissenschaften, Anhang*, Berlin.

**Wiegand, Th. 1911**

‘Siebenter vorläufiger Bericht über die von den Königlichen Museen in Milet und Didyma unternommenen Ausgrabungen’, *Abhandlungen der Königlich Preussischen Akademie der Wissenschaften, Anhang*, Berlin.

**Wiegand, Th. 1929**

*Die Milesische Landschaft. Mit Beiträgen von Kurt Krause, Albert Rehm und Paul Wilski* (Milet II.2), Berlin.

**Wiegand, Th. 1970**

*Halbmond im letzten Viertel. Briefe und Reiseberichte aus der alten Türkei von Theodor und Marie Wiegand 1895 bis 1918, herausgegeben und erläutert von Gerhard Wiegand*, Munich.

**Wiegand, Th. & H. Schrader 1904**

*Priene: Ergebnisse der Ausgrabungen und Untersuchungen in den Jahren 1895-1898*, Berlin.

**Wille, M. 1995**

‘Pollenanalyse aus dem Löwenhafen von Milet’, *AA*, 330-333.

**Wilski, P. 1906**

*Karte der Milesischen Halbinsel (1:50.000) (Milet I.1)*, Berlin.

**Wittek, P. 1934**

‘Das Fürstentum Mentesehe. Studie zur Geschichte Westkleinasiens im 13.-15. Jh.’, *IstMitt* 2.

**Wölz, S. 2003**

*From Low to High Fidelity Geophysics: 3-D Multi-Component Shallow Seismic Surveying in the Lions’ Harbour of Miletus (Turkey)*, PhD Thesis, Faculty of Mathematics and Natural Sciences, Christian-Albrechts-University Kiel.

**Woelz, S. & W. Rabbel 2005**

‘Seismic Prospecting in Archaeology: A 3-D shear wave study of the ancient harbour of Miletus (Turkey)’, *Near Surface Geophysics* 3, 245-257.

**Woelz, S., W. Rabbel & C. Müller**

**2009**

‘Shear waves in near surface 3D media – SH-wavefield separation, refraction time migration and tomography’, *Journal of Applied Geophysics* 68, 104-116.

**Wulzinger, K., F. Wittek & P. Sarre**

**1935**

*Das islamische Milet (Milet III.4)*, Berlin.

**Zachariadou, E.A. 1983**

*Trade and Crusade. Venetian Crete and the Emirates of Mentesehe and Aydin (1300-1415)*, Venice.