Mensch und Umwelt im Spiegel der Zeit

Aspekte geoarchäologischer Forschungen im östlichen Mittelmeergebiet

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Geoarchaeology in the City of Thales
Deciphering Palaeogeographic Changes in the Agora Area of Miletus

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Abstract

Over the past millennia, the famous ancient harbour city of Miletus and its environs have experienced major changes in palaeogeography, related to (a) the progradation of the Büyük Menderes delta, (b) coastal dynamics such as littoral accumulation and fluctuations of sea level during the Holocene, (c) denudation processes from the adjacent slopes south of the city, and (d) the permanent impact of humans on the ecosystem since Late Chalcolithic times. In this paper, new results concerning the development of the city centre (agora) of Miletus are presented. Analyses of sediment cores collected between Lion Harbour embayment and South Market revealed wide areas of the later city centre to have been covered by a shallow marine environment during the time of the maximum postglacial stand in sea level around 2500 BC. Cultural layers beneath the transgression facies prove near-coast settlement activities in Late Chalcolithic times (Miletus I, 3500–3000 BC). Shallow marine and littoral conditions lasted until the Late Geometric to Archaic epochs. In the 6th century BC man-made infill was intentionally dumped in wide areas in the course of an enlargement of the Milesian city centre and the replanning of the settlement area in an orthogonal street-insula grid-system.

1. Introduction

One of the most common features in landscape evolution of the whole Mediterranean is that of the delta progradation of the major rivers. Due to this process many ancient harbour cities have become landlocked with their positions being several kilometres inland from the present coastline. This is especially true for the former Latmian Gulf in Western Turkey which has been filled due to the progradation of the Büyük Menderes (Maeander) delta. Besides the relatively small ancient Greek city-states of Priene, Myous, and Herakleia, Miletus – the hometown of Thales, the founder of Greek philosophy – was the most prominent city affected by these landscape changes. Located at the southern shore of the Latmian Gulf, Miletus started to become landlocked by the

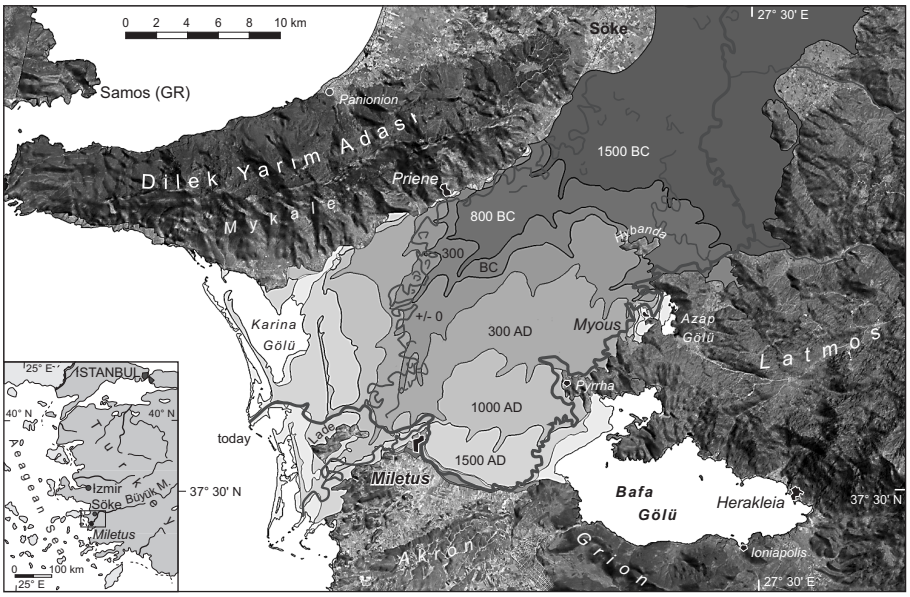

Fig. 1 *Palaeogeographic evolution of the Büyük Menderes delta and alluvial plain (Müllenhoff [2005], slightly modified)*

delta progradation in Roman Imperial times, progressively losing its connection to the open sea. The related changes in the coastline since c. 1500 BC have been studied in detail by Müllenhoff (2005). The study area with the location of the coastline in different time slices is shown in fig. 1.

The agora, the city centre of Miletus, was the most prominent place of the ancient town (fig. 2). Situated at the southern fringe of the Lion Harbour embayment it acted as common assembling place since at least Archaic times[1]. Having initially been just an open area it underwent a complex architectural development throughout the centuries. The place was progressively divided into different functional zones where official buildings were erected. The sanctuary of Apollo Delphinius (Delphinium) which formed the religio-political nucleus of the city was situated in the northeastern corner of the agora. The Sacred Road – the route of Miletus' New Year's procession to Didyma – started between the Delphinium and the North Market. In Roman times the stone-paved 30 m wide street was lined by column halls which stood on high staircases, functioning also as platforms for the audience watching the events[2]. At its southern end, the monumental front of the Market Gate marked the entrance of the pro-

1 Herda 2005, 272–285 fig. 25. 29; Herda 2009.
2 Herda 2006, 260 fig. on frontpage.

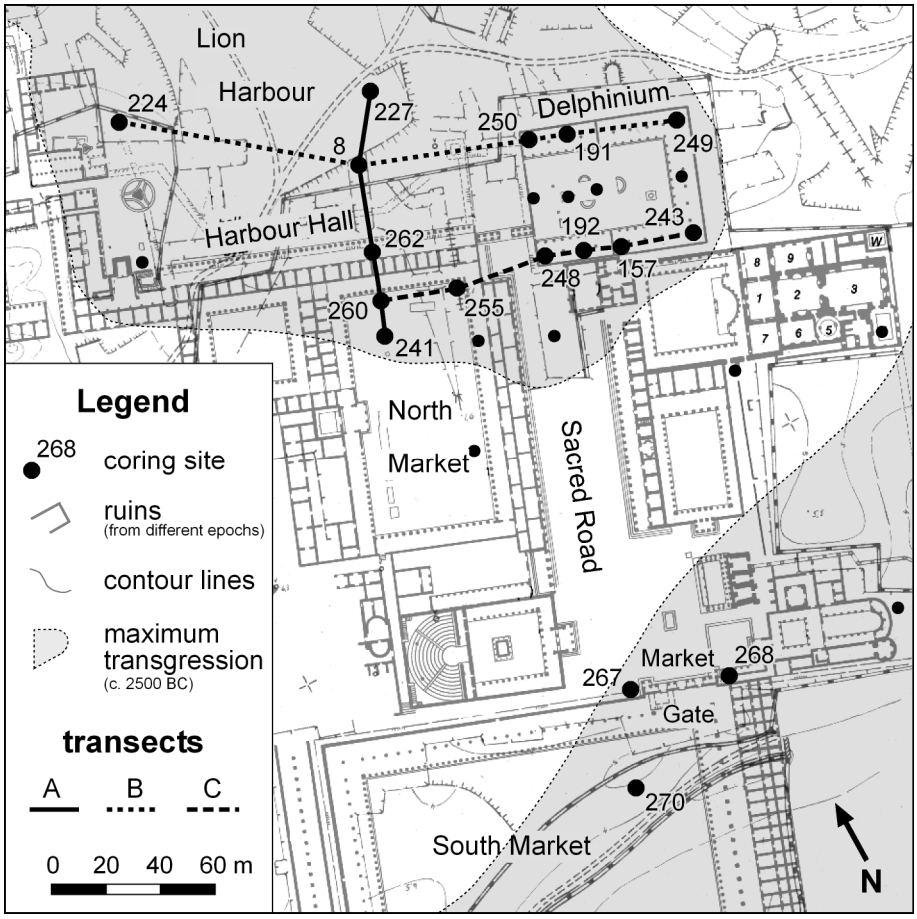

Fig. 2 *Location of corings and profile lines in the city centre (agora) of Miletus (Own draft, based on Bendt's topographical map of Miletus [Bendt 1968])*

cession to the South Market. It is obvious that this area was of special interest when excavations started in the late 19th/ early 20th centuries[3].

In order to specify the palaeogeographic changes between the southern margin of the Lion Harbour embayment and the Market Gate, several percussion cores (with Cobra mk1 corer, diameters of auger heads: 6, 5 and 3.6 cm) were taken within the area of the agora and the Sacred Road (fig. 2). For this paper 17 cores have been analysed in detail. The applied geoarchaeological methods are described by Brückner (2003), Müllenhoff (2005) and Herda (2005). Ceramic fragments as well as radiocarbon datings (cf. table 1) yielded the chronostratigraphic framework. The individual

3 Strocka 1981; Pfanner et al. 2005.

cores were then combined to three transects which provide insights into stratigraphy and palaeoecological evolution of the region.

Sample	Material	Laboratory Sample Code	δ ^{13}C (‰)	^{14}C Age	Calibrated Age (range ± 1σ)
Mil 157/15H	wood	UtC 11953	-26.4	2,452 ± 45 BP	757–410 BC
Mil 157/18H	seeds	UtC 11971	-23.4	4,321 ± 37 BP	3,011–2,884 BC
Mil 191/13S	sea weed	UtC 13163	-13.3	3,115 ± 38 BP	982–886 BC
Mil 192/19H	wood	UtC 13165	-26.5	2,464 ± 34 BP	759–413 BC
Mil 227/9HK	charcoal	UtC 13739	-26.1	1,826 ± 40 BP	134–231 AD
Mil 241/14H	wood	UtC 13747	-7.1	3,087 ± 44 BP	1,413–1,312 BC
Mil 243/15HK	charcoal	UtC 13749	-23.4	4,472 ± 44 BP	3,331–3,034 BC
Mil 248/11H	charcoal	UtC 13719	-28.1	3,090 ± 60 BP	1,428–1,293 BC
Mil 248/22H	seeds	UtC 13751	-25.8	4,523 ± 47 BP	3,351–3,108 BC
Mil 249/20H	wood	UtC 13752	-25.6	3,020 ± 60 BP	1,384–1,134 BC
Mil 250A/2HK	charcoal	UtC 13753	-25.2	2,508 ± 37 BP	768–547 BC
Mil 255/16SG	sea weed	UtC 13755	-13.5	3,929 ± 49 BP	2,026–1,855 BC

Tab. 1 Radiocarbon dating results. Calibrated ages according to the radiocarbon calibration program Calib5 (Stuiver – Reimer 1993), for marine carbonate a reservoir correction of 402 years was applied. Analyses carried out by Dr. K. van der Borg, Utrecht (Netherlands)

2. Results

Earlier studies[4] have shown that the area of the later city consisted of two bigger and several smaller islands during the time of the local maximum Holocene transgression around 2500 BC[5]. This archipelago was situated several hundreds of metres off the mainland. Its transformation to the famous Milesian Peninsula in the 2nd mill. BC was the result of denudation processes from the adjacent slopes south of the city, coastal dynamics such as littoral accumulation, a slight regression after the first maximum stand of sea level plus anthropogene infill[6]. Since Roman Imperial times, the peninsula was endangered by siltation provoked by the advancing Maeander Delta. In Byzantine times, the city was still able to communicate with the open sea via brackish waters, until the prograding delta cut off the marine access and finally integrated the peninsula into the floodplain[7].

4 Brückner 1996; Brückner 2003.
5 Müllenhoff 2005; Brückner et al. 2006.
6 Brückner et al. 2006.
7 Müllenhoff 2005, 202 f. fig. 53; Müllenhoff et al. 2004; Knipping et al. 2007.

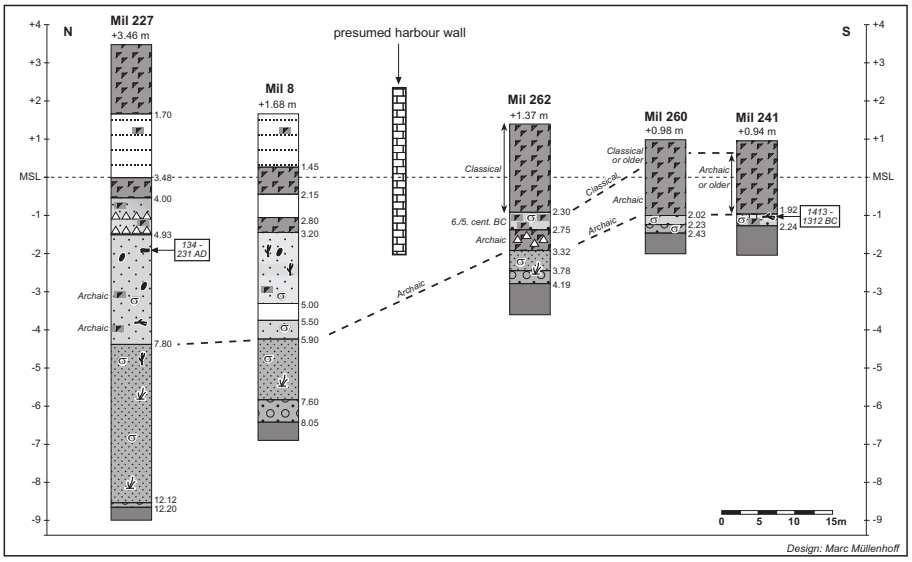

Fig. 3 Transect A (own draft, legend cf. fig. 6)

2.1 Southern fringe of Lion Harbour embayment

In historical times, the famous Lion Harbour of Miletus made use of a natural embayment separating Kale Tepe (with the theatre) in the west and Humei Tepe in the east. Probably since Late Classical times the port basin was separated from the adjacent southern urban area by a harbour wall. At that time the northern mouth of the harbour could be closed between two moles by a chain. On the opposite endings of the moles two monumental lion statues were positioned – the reason for harbour's name[8]. A. v. Gerkan thought that in Classical times the Lion Harbour could not be closed. During that time the walls along the fringes of the harbour may have functioned as part of the city fortification wall[9].

Due to the progradation of the Maeander Delta the harbour lost its access to the open sea and subsequently was filled with sediments[10]. Then the marine and brackish (harbour-) sediments were covered by sediments of the Maeander accumulated during flood events in Medieval times.

In order to decipher the maximum extent of the embayment at the time of the post-glacial sea-level highstand and the subsequent palaeogeographical evolution, a north-south trending transect was cored (profile A, fig. 2). It connects the southern harbour

8 v. Graeve 1996.
9 v. Gerkan 1922, 55. 82–86. 90; id. 1935, 110–114; Blum 1999, 72 f.
10 Brückner 1996; Tuttahs 1998, 161–168.

basin (Mil 227, Mil 8) with the area of the Harbour Hall (Mil 262) and the North Market (Mil 260, Mil 241; fig. 3). All corings penetrate marine sediments (at least a thin transgression facies) above the bedrock. This indicates that the maximum transgression reached further south than previously assumed. The transgression peak can be reconstructed near coring Mil 241 which shows only about 30 cm of littoral sands with numerous fossil remains and a few limestones. In the upper part of this section, a wood fragment (most probably reed) yielded a ^{14}C age of 1413–1312 cal BC (Mil 241/14H, 1.00 m b.s.l. = below sea level; table 1). Thus, aggradation in this southernmost area of the Lion Harbour embayment occurred in the Late Bronze Age. Assuming an elevation difference of c. 1 m between mean sea level and the upper beach sediments, sea level at that time may be reconstructed at a position of about 2 m b.s.l. This fits well with the results described by Brückner[11] for the area of the Temple of Athena and supports the sea-level curve for the Latmian Gulf[12] with a peak during the Early and Middle Bronze Ages and a slight regression during the 2nd mill. BC.

In Mil 227 and Mil 8, the transgressive unit is covered by thick shallow marine silts and sands with abundant fossil remains and sea weed. Then follow clayey silts with reed and several cultural remains (ceramic fragments, olive stones and grape seeds), best interpreted as near coast harbour sediments. Diagnostic ceramic fragments in the lower portion of this unit date to the Archaic epoch, whilst a piece of charcoal in its upper part dates from 134–231 cal AD (Mil 227/9HK, 1.87 m b.s.l.). This proves the use of the Lion Harbour at least until late Roman Imperial time (3rd cent. AD). Soon after, cultural debris marks the anthropogene infill of the southernmost port basin. Finally, alluvial sediments indicate the definite siltation of the embayment. On top of these sediments, 1.70 m of cultural debris represent the Late Medieval and later settlement activities as well as the debris of old excavations[13].

Corings Mil 262, 260, and 241 are located south of the assumed later harbour wall. Therefore, harbour sediments are missing. Littoral (Mil 260, 241) and shallow marine (Mil 262) facies is directly covered by anthropogene deposits made of cultural debris and settings with stones, tile and ceramic fragments. The latter predominantly date to the Archaic epoch. The debris indicates man-made infill of this area in Archaic times (first half of 6th century BC), most probably for an extension of the city centre. Herda[14] assumes that it was at that time when the new orthogonal street-insula grid-system of the city started to become established around the agora. Therefore the grid-system cannot be a creation of the famous Milesian townplanner Hippodamos, who lived in the 5th century BC.

11 Brückner et al. 2006.
12 Müllenhoff 2005, 181–186 fig. 47.
13 Schröder et al. 1995, 241 f. fig. 43.
14 Herda 2005, 278–285 fig. 29 ; Herda 2009.

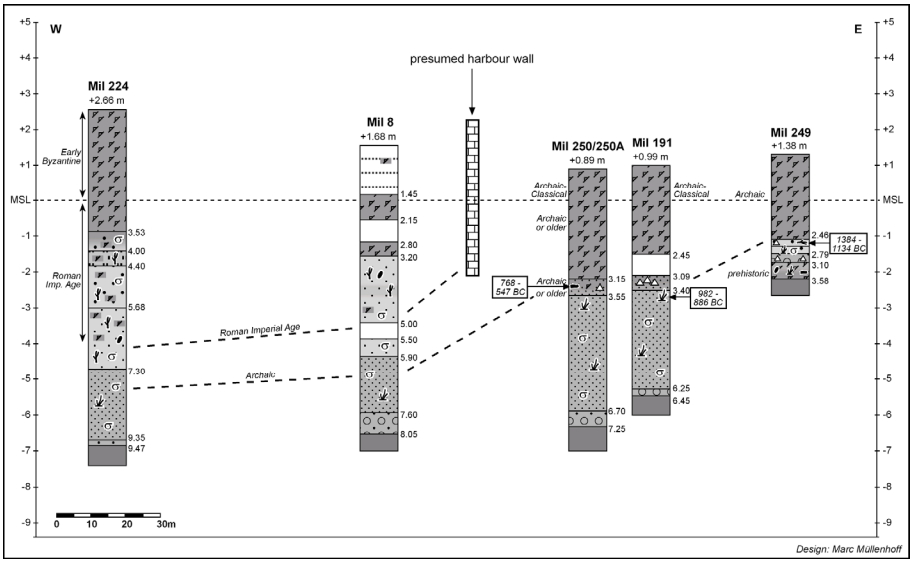

Fig. 4 Transect B (own draft, legend cf. fig. 6)

In Mil 262, the first anthropogene debris between 1.95–1.38 m b.s.l. is topped by 45 cm of sand with marine fossils and artefacts, most probably intentionally piled up in order to drain the area. As evidenced by diagnostic ceramic finds, the deposits date to the 6th/5th cent. BC. It was not until then that this area was definitely dried up by man-made infill which served as groundings for the erection of the monumental Harbour Hall in Late Classical times[15].

2.2 The Delphinium and its vicinity

The sanctuary of Apollon Delphinios is situated southeast of the Lion Harbour (fig. 2). The Prytaneion, cultic and political nucleus of the polis, is supposed to have been located within the Delphinium[16]. The cultic and architectural history of the sanctuary has been studied in the framework of an interdisciplinary geoarchaeological project managed by Dr. A. Herda (Berlin) since 2002. First results have already been published[17].

The transects B and C (fig. 2) shed new light on the palaeogeographic evolution of the Delphinium site and its vicinity since Late Chalcolithic times (Miletus I, c. 3500–3000 BC). The first one starts in the harbour basin and reaches the northern flank of the sanctuary. The second one spans the northern agora and the southern flank of the Delphinium.

15 v. Gerkan 1922, 89–91.
16 Herda 2005, 249 f. 263–278. 291 fig. 25; Herda 2006, 78–83. 183–150. 157–167; Herda 2009.
17 Herda 2005; Brückner et al. 2006, 73–75 fig. 4.

The stratigraphy of transect B (fig. 4) shows two different units: Mil 224 and Mil 8, located in the southwestern part of the harbour basin, penetrate thick shallow marine and harbour sediments with marine fossils, sea weed or reed fragments, covered by cultural debris and alluvial sediments of the Maeander River. In addition, the nearcoast site of Mil 224 shows about 2 m of littoral to semi-terrestrial facies with an intercalated peaty layer at 1.74–1.34 m b.s.l. Characteristic ceramic fragments date the deposits to Roman Imperial times. Soon after, cultural debris was dumped in order to drain the area.

East of the later harbour wall the shallow marine facies is directly covered with cultural layers of Archaic age. The debris provided a foundation for the marble architecture of the Delphinium. Marine conditions prevailed at least until 982–886 cal BC (Mil 191/13S, 2.46–2.41 m b.s.l.). Man-made infill started around 768–547 cal BC (Mil 250A/2HK, 2.41–2.36 m b.s.l.). Therefore, in the north-western part of the Delphinium human activities started in Late Geometric times at the earliest, although first building activities can only be traced back to the 6th century BC[18]. Mil 249 in the north-eastern corner of the sanctuary penetrated a Late Chalcolithic (c. 3500–3000 BC) cultural layer which is superposed by transgression, shallow marine, and regression facies. The latter dates to 1384–1134 cal BC (Mil 249/20H, 1.29–1.22 m b.s.l.).

Transect C (fig. 5) traces very well the former topography of the southern fringe of the Lion Harbour embayment. The deepest position of bedrock and the thickest shallow marine strata were encountered in Mil 248 in the central part of the profile line. Towards the east and the west bedrock topography rises whilst the marine sediments thickness decreases. Shallow marine facies started in Late Chalcolithic times (Mil 248/22H, 4.11–4.01 m b.s.l.: 3351–3108 cal BC; Mil 192: chalcolithic ceramic fragment within the transgression facies) and ceased sometime after the Late Bronze Age (Mil 248/11H, 1.83–1.81 m b.s.l.: 1428–1293 cal BC). Man-made infill started – more or less at the same depth of about 1.60 m b.s.l. – after 759–413 cal BC (Mil 192/19H, 1.71–1.63 m b.s.l.) and 757–410 cal BC (Mil 157/15H, 1.54–1.49 m b.s.l.), respectively. It has to be stressed that the extended 1 sigma error range for these samples is due to the fact that the ^{14}C calibration curve unfortunately shows a so-called plateau for this time period[19]. The date can be specified by diagnostic ceramic finds within the cultural debris. They date to the Archaic epoch, thus confirming the results of the corings in the northern (Mil 191, Mil 249, Mil 250; fig. 4) as well as in the eastern (Mil 193, Mil 194[20]; fig. 4) parts of the Delphinium. In the marginal parts of the embayment, littoral sediments reached a comparatively higher altitude marking the transgression peak in the Early Bronze Age (c. 2500 BC). In Mil 255, Mil 249, and Mil 243, a prehistoric cultural layer beneath the transgression facies clearly documents human impact in Late Chalcolithic times.

18 Herda 2005, 250–258. 290 f.; Brückner et al. 2006, 73 f.
19 Herda 2005, 253 n. 57; Brückner et al. 2006, 73.
20 cf. Brückner et al. 2006, 74 f.

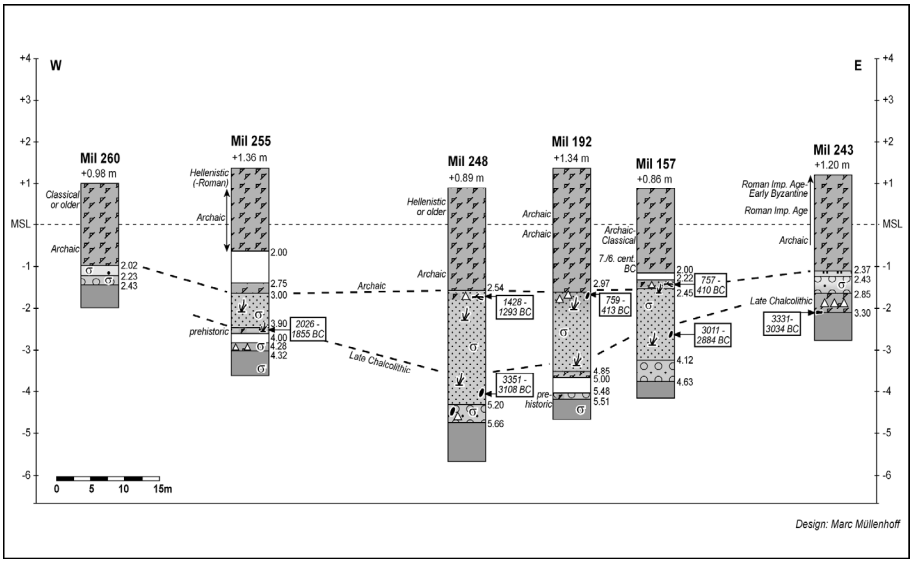

Fig. 5 Transect C (own draft, legend cf. fig. 6)

The described results confirm the conclusions received from transect A (cf. chapter 2.1). In the early phase of Miletus (Late Chalcolithic times and Early Bronze Age, Miletus I and II)[21] settlement history in this area was closely connected with sea-level changes. In the course of the enlargement and replanning of the city centre in the 6th cent. BC, the southern margin of the Lion Harbour embayment (area of the North Market and the Delphinium) was levelled by man-made infill covering the littoral and shallow marine sediments. Thus, marine and harbour sediments of later times are only found north of the assumed Harbour wall.

2.3 Palaeogeographical setting around the Market Gate and in the South Market area

Around the Market Gate and in the northeastern part of the South Market three corings were sunk (Mil 267, 268, and 270; fig. 6). From an architectural point of view the corings are of special interest since today the remains of the building show an inclination towards the east where the building level is about 25 cm lower than in its western part[22]. In the following, a possible explanation for this phenomenon is presented.

All corings show littoral sands on top of the bedrock documenting for the first time marine influence in this area. Mil 267, located directly west of the Market Gate (fig. 2), reaches bedrock at a depth of 1.92 m b.s.l. Above the bedrock follows 0.85 m of littoral sand covered by a thin layer of clayey silts rich in organic matter. The upper

21 cf. Parzinger 1989; Niemeier 2007, 6–8.
22 Pfanner et al. 2005, 84 pp, fig. 8.

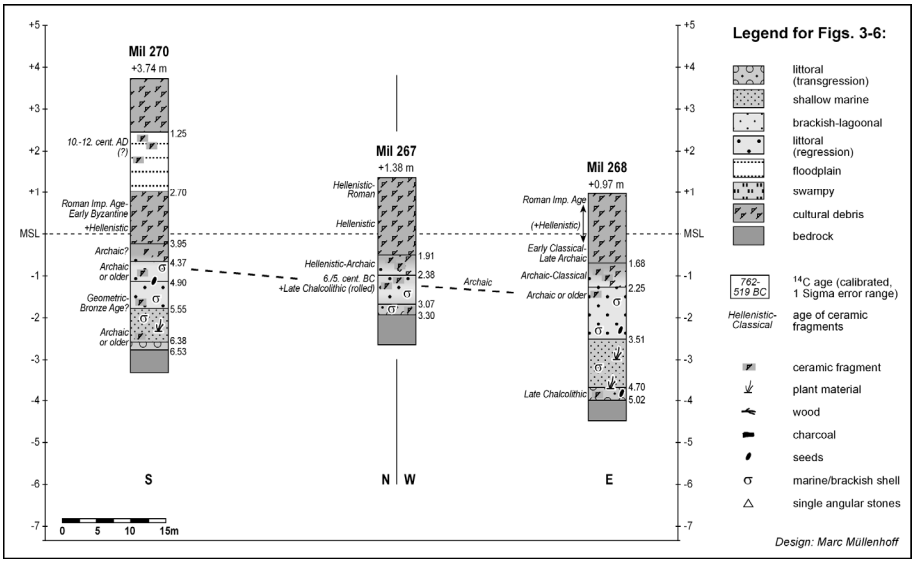

Fig. 6 Corings around the Market Gate (own draft)

portion of the sand represents the Archaic-Classical beach evidenced by rolled ceramic finds dating mainly to the 6th/5th centuries BC. A small fragment (1 cm) with Late Chalcolithic age at 1.10–1.07 m b.s.l. was most likely relocated. Subsequently, clayey silt accumulated in a backbeach environment, indicating the final silting up of the area. The top of the core is anthropogene debris, in the lower part probably mixed with deposits of the upper beach. These cultural layers date from the Archaic-Classical to the Hellenistic-Roman periods.

Mil 268 was cored 30 m east of Mil 267 at the opposite side of the Market Gate (fig. 2). The stratigraphy is quite similar, except for 1.2 m of sand with fossil remains and sea weed intercalated between the transgression (with Late Chalcolithic cultural impact) and regression facies. The latter is terminated by upper beach sediments, containing marine fossils, rounded gravel and several subrounded or rolled ceramic fragments dating to the 6th/5th centuries BC. This proves the occurrence of former littoral and shallow marine strata, deepening eastwards. Settlement activity started in Archaic times and continued until the Roman period, represented by the uppermost layer at 0.71 m b.s.l. to 0.97 m a.s.l. Obviously, the Roman architects laid the foundation of the Market Gate on the dry beach sand not being aware of the subsurface strata. The geological setting may give an explanation for the inclination of the whole building of 0.25 m towards the east: it is most probably due to the later compaction of the up to 1.50 m thick layer with abundant sea weed beneath the regression facies. This compaction may have been a longer process as can be seen at a building directly west of the Market Gate: there the eastern end of the so-called South Market-Wall

built in the 2nd cent. BC had already inclined about 4 cm when the Market Gate was erected (c. AD 100)[23]. It should be noted that the described type of sediment tends to liquifaction during earthquakes whereof we have several reports. Such an event may have triggered or at least accelerated the inclination process; it may also have caused the final collapse of the building which happend around AD 1000[24].

The purpose of coring Mil 270 in the northeastern edge of the South Market was to complete the palaeogeographic scenario around the Market Gate and to trace the coastline position southeast of Kaletepe during the time of the maximum transgression (fig. 2). Bedrock was encountered at 2.79 m b.s.l. The stratigraphy shows a typical transgression-regression cycle: Sands with an abundant occurrence of gastropods and bivalves and some subangular limestone pebbles in the lowermost part are covered by shallow marine sediments rich in sea weed and fossils, and finally by littoral and upper beach deposits with some gravel, fossil remains and mainly rolled ceramic fragments dating from Late Bronze Age to the Archaic epoch. The final aggradation of this area seems to have taken place not before Archaic times. The ground was consolidated with stone debris (marble, 'poros'-limestone) and perhaps parts of mud-bricks which prove building activities. Then follow different cultural layers and alluvial sediments of the Maeander River up to the present surface. Diagnostic ceramic fragments date these deposits from the Classical and Hellenistic-Roman periods to the Medieval times.

In summarizing, the Archaic age of the earliest anthropogene strata within the beach sands in corings Mil 267, 268, and 270 shows that not only the southern margin of the Lion Harbour embayment, but also the northeastern part of the South Market were occupied by a littoral environment at least until Archaic times when they were intentionally infilled in order to extend the settlement area.

3. Conclusions

This paper presents evidence of palaeogeographic changes between the southern margin of Miletus' Lion Harbour embayment and the Market Gate. All corings penetrated at least a thin transgression facies on top of the bedrock. In some cases, cultural layers of Late Chalcolithic age beneath the littoral sediments were encountered (Miletus I, 3500–3000 BC). They hint at near-coast settlements which were later on flooded in the course of the postglacial transgression of the Aegean Sea. At some places (cf. Mil 192) debris was intentionally dumped in order to fight the rising sea level. The most landward position of the shoreline can be reconstructed for the Early and Middle Bronze Ages (fig. 2). This confirms the results for the Temple of Athena and its surroundings[25] and supports the sea level curve for the Latmian Gulf[26] with a peak in the Early and Middle Bronze Ages and a slight regression during the 2nd mill. BC. In wide areas of the later agora, shallow marine and littoral conditions lasted

23 Pfanner et al. 2005, 85 fig. 8.
24 Knackfuß 1924, 69–72 fig. 58; Herda et al. 2009.
25 Brückner et al. 2006.
26 Müllenhoff 2005.

until Late Geometric to Archaic times. It was only in the 6th cent. BC when man-made infill was dumped in the course of an enlargement of the agora as city centre. This enlargement formed part of a far-ranging replanning of the northeastern parts of the settlement (including Kale Tepe/Theatre Hill and Humei Tepe) in an orthogonal street-insula grid-system.

The newly discovered artificial enlargement of the Milesian city centre in the 6th cent. BC is most probably reflected in an episode told by the ancient author Plutarch. In his 'Life of Solon' (12, 11) he mentions that the famous Milesian philosopher Thales, who died c. 550 BC, chose "a cheap and disregarded place in the Milesian territory" to be the place of his grave "by foreseeing that this place would once be the agora of Miletus." It seems reasonable to search for the grave of Thales on the Milesian agora; perhaps even in the areas where our geoarchaeological approach evidenced the anthropogene transformation from a wet, "cheap" state to a comfortable meeting place for the citizens[27].

The observation of the dynamic palaeogeographic development of Miletus, which as a harbour town has always been exposed to the impact of water (first to the sea, later to the Maeander River) on one hand, the influence of Aegyptian cosmological ideas on the other, may have led Thales to his famous saying that "water is the principle of all" and that "the earth lies on water"[28]. By saying this he created the first 'physical', non-mythological theory which explained nature as a whole.

Acknowledgements

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27 Herda 2005, 278-280; Herda 2009.

28 Aristotle, Metaphysica 1. 983b, 6–24.

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