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The impacts of sea-level changes during latest Pleistocene and Holocene times on the morphology of the Ionian and Aegean seas (SE Alpine Europe)

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Abstract

The tentative coastline configuration in the Ionian and Aegean seas in three Late Pleistocene–Holocene time slices is given, based on the global eustatic sea-level curve in combination with local geological and geoarcheological data. At lowstand stage 2 (21 500 cal yr BP (years before present), sea level −120 m), extensive shelves existed in the northern Aegean Sea and, to a second degree, in the eastern Aegean Sea and in the northern and central parts of the Ionian Sea. Many islands were connected with each other and with the mainland. A great part of the periphery of gulfs that have an entrance less than 120 m deep was subaerially exposed, while in their central parts lakes were formed. At 11 500 cal yr BP (sea level −60 m) the exposed shelf was much restricted, most of the gulfs were overflowed by the advancing sea and only a few islands were still connected with the mainland. Finally, at 8000 cal yr BP and onward, the sea initially intruded the lowlands and the gulfs, but the subsequent sediment input by the rivers regressed the sea to its present position. Thus many human settlements and old cities that were maritime during Hellenistic or older times are now a few to tens of kilometers inland.

Keywords: Aegean Sea; Ionian Sea; sea-level changes; Pleistocene; Holocene; subsidence rates

1. Introduction: objectives and previous work

In the last two decades many shelf areas in Greece and Asia Minor have been geologically investigated and a reconstruction of their Late Pleistocene–early Holocene paleogeography has been attempted. The results of these studies, in addition to the known published works by geoarchaeologists carried out in the contiguous lowlands, are used in this composite paper. Its purpose is to tentatively define the coastline position and the morphological configuration in various time slices in the Aegean and Ionian seas, from the Late Pleistocene to Holocene period and up to Neolithic times.

The coastal areas of Greece and Asia Minor, both in the continent and the islands, are in their

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majority mountainous with cliffs dipping sharply toward the sea, since they have undergone the intense Alpine tectonism and post-Alpine normal faulting. Horsts and grabens alternate, while the coastal zone is usually narrow and rocky. Only in certain areas rivers drain the grabens and form valleys floored by coarse-grained terrigenous sediments. Thus comparatively extensive Quaternary coastal alluvial plains exist in northern Greece where the large rivers Evros, Nestos, Strimonas, Axios and Aliakmon (Fig. 1) have filled the basins with thick piles of Pliocene–Quaternary terrigenous sediments. This morphology continues also to the adjacent sea floor in the northeastern and northwestern Aegean Sea, where an extensive shelf exists with smooth morphology and a distinct shelf break lying from 120 to 140 m. A relatively wide shelf is also found in the eastern Aegean between Limnos and the Dodecanese islands and Asia Minor, and in certain sectors off western Greece.

In the latest Pleistocene the sea was about 120 m lower and it started rising rapidly about 18 000 cal yr BP (years before present; Fig. 2; Shackleton, 1987, Fairbanks, 1989; Bard et al., 1990). The impacts of the sea-level rise on the coastal environment have been reviewed by several scientists (Warrick et al., 1993; Bird, 1993; Nicholls and Leatherman, 1994), who emphasized the important consequences of the increase of the sea level. Thus, before the rise, large segments of now submerged areas were subaerially exposed and were later gradually covered by the sea due to the transgression. This observation led some geoscientists to reconstruct the paleogeography of the Aegean and Ionian seas during the latest lowstand and the subsequent stages, and some of them to suggest areas of geoarchaeological research (e.g. Van Andel and Shackleton, 1982; Kraft et al., 1983; Van Andel, 1989; Lambeck, 1995).

On the other hand, the lowland maritime areas of Greece and Asia Minor, especially the small hills and the adjacent plains, were, during the middle to late Holocene, sites of human settlements since they offered easy access to the land interior and to the adjacent sea. It must be noted here that during the last stage of the transgression, when the sea level was very close to its present position (ca. 8000 cal yr BP) the sea had intruded most of these areas, which were in fact embayments, something that is also verified from historical sources. These embayments and lowlands have since undergone drastic morphological changes by seaward land migration due to sediment input (Kraft et al., 1975) combined with the relative sea-level stability (Flemming, 1978; Flemming and Webb, 1986).

2. Evaluation and restraints of available data

2.1. The eustatic sea-level curve

It is known that during the Late Pleistocene the sea level had varied considerably, lowering at glacial and rising at interglacial stages. The best studied period is from 20 000 to 7000 cal yr BP (Fig. 2; Fairbanks, 1989; Bard et al., 1990). According to these studies the sea level was ca. 120 m lower at about 21 500 cal yr BP and at about 18 000 yr BP it started rising at a rate of 5 mm/yr, increasing considerably at various times. This global curve, or an earlier version of it, was used by many authors in the studied area, in combination with bathymetric and geological data, in order to define the various earlier coastline positions (see Perissoratis and Panagos, 1982; Van Andel and Lianos, 1984; Perissoratis and Mitropoulos, 1989; Perissoratis and Van Andel, 1991; Lykousis and Anagnostou, 1992).

In the Aegean and Ionian seas there are no ^{14}C data defining former sea-level positions from the latest lowering to the present level. The main source of data for past sea-level changes in the Aegean and Ionian seas is from geological and archeological evidence and observations. However, the archaeological data, although numerous, are reliable only for the last 4000 yr. Older chronological data, comparable with those that were obtained from the Barbados corals that led to the construction of the sea-level curve for the last 20 000 yr (Shackleton, 1987; Bard et al., 1990), used by many authors worldwide, are lacking. This global curve has been used as a basis for correction and prediction of earlier coastline posi-

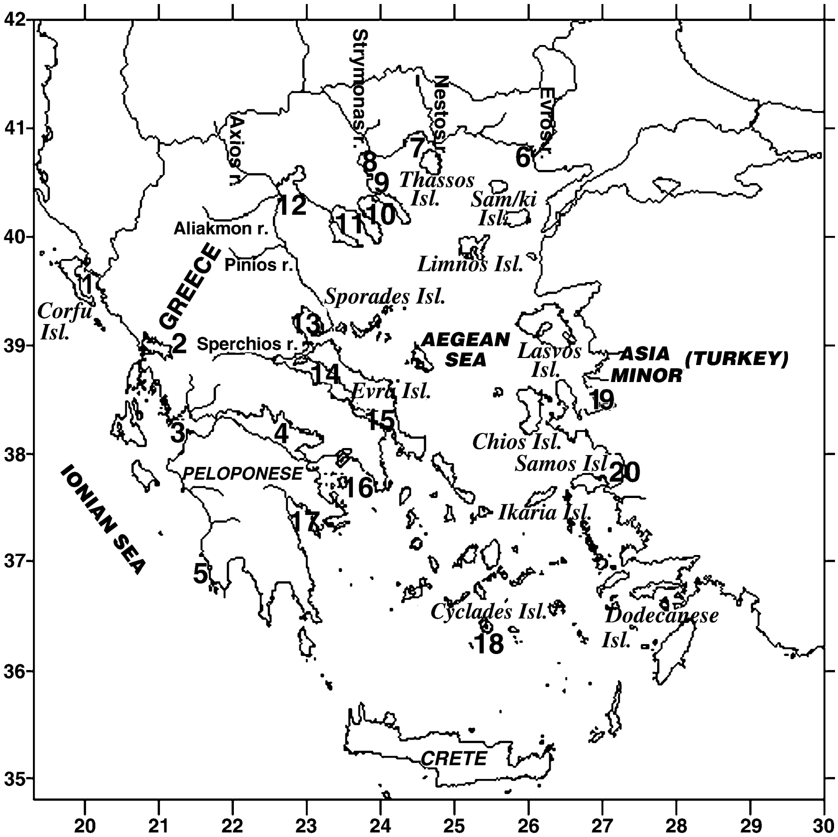

Fig. 1. The area under investigation and the locations mentioned in the text: 1. Corfu channel, 2. Amvrakikos Gulf, 3. Patraikos Gulf, 4. Korinthiakos Gulf, 5. Navarino Bay, 6. Alexandroupolis Gulf, 7. Kavala Bay, 8. Strymonikos Gulf, 9. Ierissos Gulf, 10. Sigitikos Gulf, 11. Kassandra Gulf, 12. Thermaikos Gulf, 13. Pagasitikos Gulf, 14. N. Evvoikos Gulf, 15. S. Evvoikos Gulf, 16. Saronikos Gulf, 17. Argolikos Gulf, 18. Santorini, 19. Izmir Bay, 20. Kusandassi Bay.

tions in various locations in the studied area. Of course, there are a few chronological data that yielded dates older than 4000 yr BP, for example the radiocarbon dates from peat samples taken at the western Evvoia island (Kambouroglou, 1989) and those in the ancient Troy area, by Kraft et al. (1982). Kraft also published a sea-level curve for the area, indicating a steep sea-level rise from about −30 m at 8000 yr BP, to today's level at 6000 yr BP, without considering, however, the impact of local tectonism. A wealth of data has also been produced by Pirazzoli (e.g. Pirazzoli, 1988) and his coworkers, but again these data mainly deal with the last 3000 yr, depicting clearly the variable effects induced by local tectonism on each particular area during this period.

Following the above and for the needs of the present paper, we have also used the global curve of Bard et al. (1990) (Fig. 2), for defining the time slices at 21 500 cal yr BP (the last lowstand, sea level at −120 m), at 11 500 cal yr BP (a temporary delay in sea-level rise, sea level at −60 m), and at 8000 cal yr BP (sea level at −15 m). The morphology in the various sectors of the studied area was depicted taking into account Holocene sediment thickness, local and regional tectonism (see below).

2.2. Sedimentary data

The sea-floor sediments can be classified with respect to the time of their deposition and in relation to the sea-level position in proteric, palimpsest, relict etc. (McManus, 1975), while they

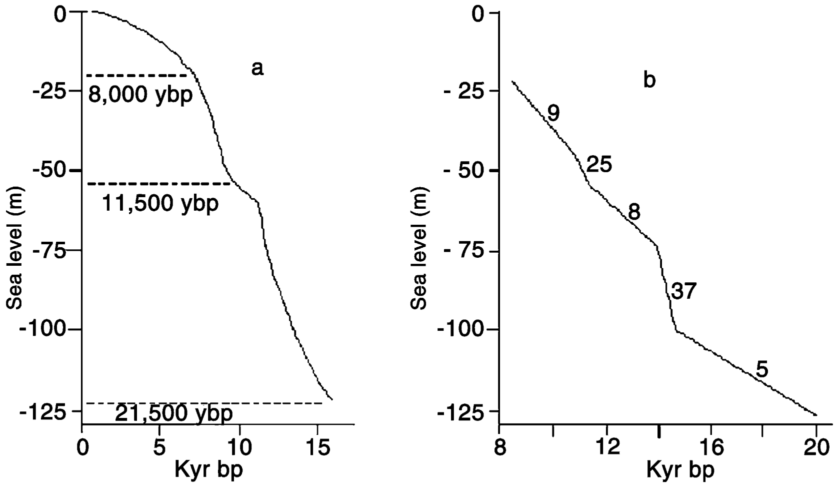

Fig. 2. Sea-level curve (a) after Fairbanks (1989) and (b) after Bard et al. (1990). Numbers in (b) indicate rate of sea-level rise (mm/yr).

can also be characterized as coastal or offshore deposits. This sediment classification and distinction was applied in the Northern Aegean but was observed in other sectors in the Aegean and Ionian seas as well (i.e. Conispoliatis, 1979, 1984; Perissoratis and Panagos, 1982; Perissoratis et al., 1987, 1988).

Thus the presence of 'clean' coarse relict sand offshore close and along the shelf break in many parts of the northern and western Aegean is obviously connected with the latest lowstand, while the presence of fine-grained proteric sediments further inshore that cover the earlier pre-Holocene terrestrial or coastal deposits is attributed to open marine conditions established in the late Holocene. This was verified quite impressively by gravity cores retrieved from the gulfs of Kavalla and S. Evvoikos in the Aegean sea. These cores have penetrated the Holocene sedimentary cover and part of the underlying horizons, which is represented in the cores by the b soil horizon that was subaerially exposed during the lowstand (Perissoratis and Van Andel, 1988, 1991). Furthermore, the contact between the two sections correlated with the high-resolution seismic records taken at the core sites defined accurately the transgressional surface in the records and helped calculating correctly the thickness of the overlying Upper Pleistocene–Holocene sediments.

2.3. Seismic reflection data

As explained above, the study of the shallow penetration seismic reflection profiles in the shelf and upper slope areas in combination with the sedimentary data was used in order to define the sediment system tract deposited during the latest transgression and to estimate the thickness of these deposits. Usually in the outer shelf of the examined area, these sediments comprise a relatively thin veneer (less than a few meters thick) deposited over a harder substratum thickening in places where old river channels occur and pinching off toward the shelf break. This is because most of the large rivers usually unloaded their suspended sediments in the lowland plains inland and on the inner shelf. On the contrary, it was observed that in the case of small rivers that drain steep near-shore Neogene–Quaternary hills, impressively large sedimentary prisms have been formed near-shore in a short time (i.e. since mid-Holocene), significantly altering the former coastline configuration (Angelopoulos et al., 1991). Finally, in many gulfs pre-Holocene ridges were identified in the inner shelf, usually not covered by Holocene sediments. In lowstand stages, this morphology had resulted in the formation of lakes in the inner part of the gulfs (Perissoratis and Mitropoulos, 1989; Perissoratis et al., 2001;

Table 1
Rates of subsidence and maximum thickness of post-transgressive sediments in each location depicted in Fig. 1

Location	Rate of subsidence (mm/yr)	Thickness (m)	Data	References
Ionian Sea				
Amvrakikos Gulf	No data	15.0	Seismic	Papatheodorou et al. (1993)
Patraikos Gulf	0.30–1.00	30.0	Seismic	Chronis et al. (1991)
Korinthiakos Gulf				
in basins	0.30–1.30	15.0	Seismic–sedimentary	Perissoratis et al. (2000)
in deltas		40.0		
Offshore Navarino Bay	0.10–0.20	5.0	Seismic–sedimentary	Perissoratis et al. (2001)
within bay		25.0		
Aegean Sea				
Ierissos–Alexadroupolis Shelf	0.05–0.70	20.0	Seismic–sedimentary	Piper and Perissoratis (1991)
N. Aegean Trough	0.05–1.10	2.0	Seismic	Piper and Perissoratis (1991)
Sigitikos Gulf	0.80–1.00	8.0	Seismic–sedimentary	Piper and Perissoratis (1991)
Kassandra Gulf	0.50–1.30	6.0	Seismic–sedimentary	Piper and Perissoratis (1991)
Thermaikos Plateau	0.80–1.20	6.0	Seismic–sedimentary	Piper and Perissoratis (1991)
Pagasitikos Gulf	0.10	8.0	Seismic	Angelopoulos et al. (1991)
N. Sporades	0.15	2.0	Seismic	Angelopoulos et al. (1991)
N. Evvoikos Gulf	0.20	30.0	Seismic	Angelopoulos et al. (1991)
S. Evvoikos Gulf	0.15	14.0	Morphological–paleogeographic	Kambouroglou (1989)
Argolikos Gulf	0.10–1.0	12.0	Sedimentary	Van Andel et al. (1990)
Santorini Area (outside the caldera)	0.10	3.0	Seismic–sedimentary	Perissoratis (1995)
Izmir Bay	0.5–1.0	6.0	Seismic–sedimentary	Aksu et al. (1987b)
Kusandassi Bay	0.5–1.0	6.0	Seismic–sedimentary	Aksu et al. (1987a)
in delta		35.0		
S. Ikarian Basin	0.33–0.57	2.0	Seismic–sedimentary	Lykousis et al. (1995)

Perissoratis and Van Andel, 1991; Lykousis and Anagnostou, 1992).

Following the above, the Holocene sediment thickness for the shelf areas in the Aegean and Ionian seas was estimated (Table 1) and the relevant correction was taken into account in estimating the depth of the pre-Holocene–Upper Pleistocene surface and its morphology.

2.4. Tectonism

In the studied area, in general, the synsedimentary tectonic activity identified in the seismic records by the offsets of active normal faults affecting the Upper Pleistocene–Holocene sedimentary layers (reflectors) is in the order of 0.05–1.30 mm/yr but it is usually less than 0.5 mm/yr (Fig. 3 and Table 1). Tectonism related to strike-slip deformations is also the main factor of the evolution of some depressions in the central Aegean, like the Ikarian basin (Lykousis et al., 1995), where a continuous subsidence of the S. Ikarian margins occurred with a calculated rate of 0.33–0.57 mm/yr in the Late Quaternary, while the basin sedimentation rates for the post-glacial sediments (18 000 yr BP–today) were 0.06–0.30 mm/yr.

Based on the above values, the total tectonic effect in the studied area and for the last 21 500 yr, assuming that these rates are constant for this period, is from 0.9 to 21.0 m, with the great majority of them attaining values in the order of 2.0–5.0 m. These figures are of minor significance if compared with the total sea-level rise of about 120 m for the same period. It must be noted, however, that this is true for the early and middle stages of latest sea-level rise (average rate of sea-level rise from 5 to 37 mm/yr; Fig. 2), while during the latest stage (i.e. after 8000 yr BP), when the average rate of sea-level rise was about 2 mm/yr, the role of tectonism and sedimentation

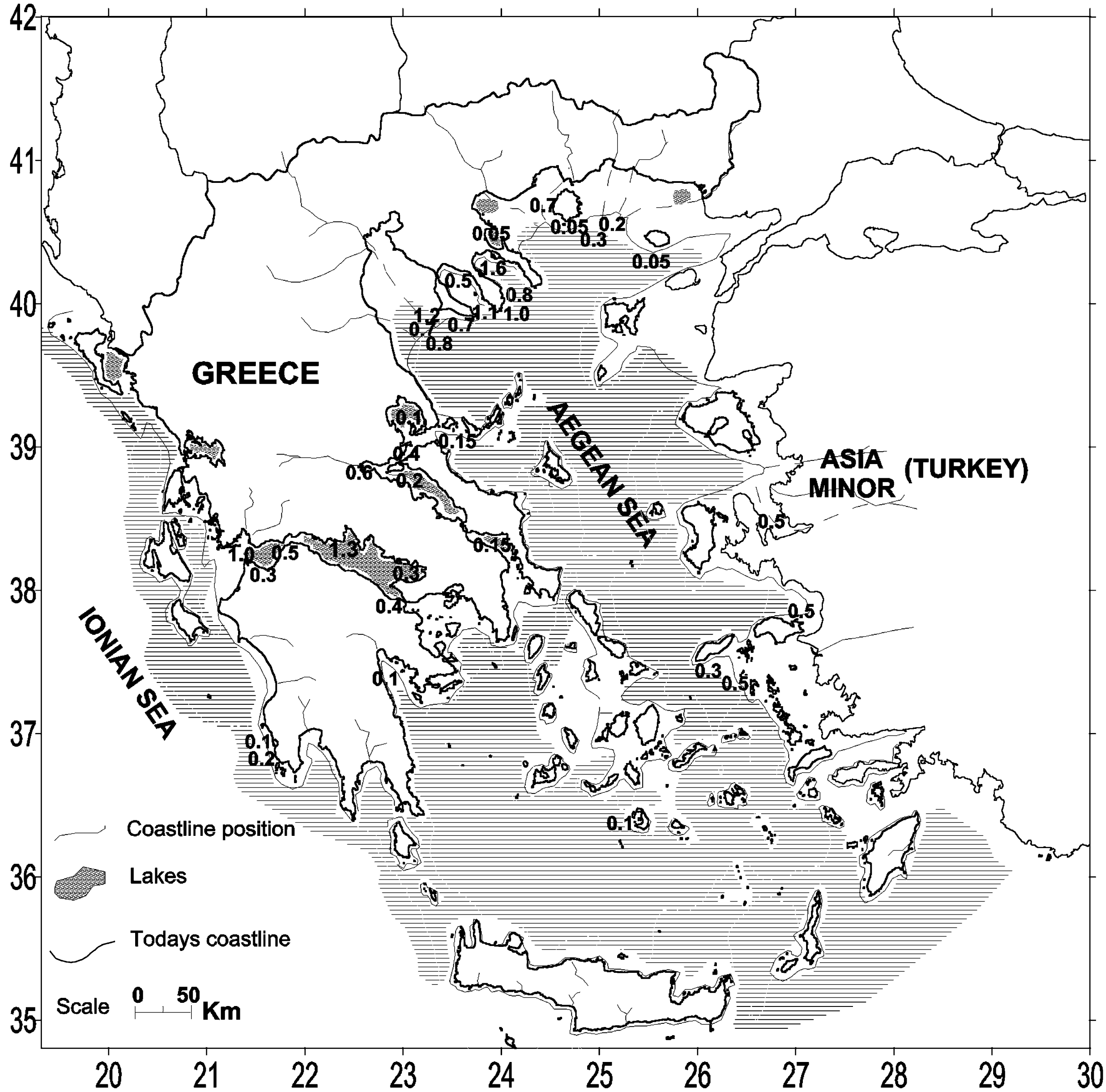

Fig. 3. Tentative morphology of coastal areas and tentative coastline position at lowstand stage 2 (cal 21 500 yr BP). Horizontal lines depict areas that today are deeper than 200 m. Numbers represent subsidence rates (mm/yr).

is more evident, becoming dominant during the last 4000 yr, when the sea level was more or less stable.

Closely associated with the tectonic offset rates is also the glacio-isostatic effect caused by the ice melting, which in the studied area was examined by Lambeck (1995, 1996). Based on the known Barbados curve, he also produced a sea-level change curve for the Aegean area, taking into account the glacio-isostatic effect, where he indicated that the difference with the known curve is on the order of a few meters. He also suggested that the sea level at 18 000 yr BP was between 115 and 135 m, while at 10 000 yr BP the values ranged from 43 to 45 m, with the greatest values to the south (Crete) due to the distance from the North Pole. For the same stages, the relevant values from the Barbados curve are about 120 and 43 m, respectively. In our sedimentological and seismic reflection data from the Aegean the lowest sea-level position was recognized at a depth of 110–130 m, coinciding in general with the estimates of Lambeck. Furthermore, it is shown that in the northern Aegean there is an uplift of the crust, partly compensating the tectonic subsidence, while in the southern part the isostatic effect is added to the tectonic subsidence (Lambeck, 1995).

Local tectonism has also played a significant role shaping today's sea-bottom morphology, a fact that explains the relative variability of the shelf break if it is taken as the approximate position of earlier low sea-level stand. This glacio-isostatic factor, although of less importance than the tectonic subsidence, again was taken into account for depicting the sea-bottom morphology during low sea-level stands.

2.5. Geoarchaeological evidence

The Ionian and Aegean areas have been the sites of the Greek civilization from Neolithic times (12 000 yr BP) up to today. Thus there are many testimonies from ancient authors (i.e. Homer, Herodotus, Aristotle, Strabo, Plinius) describing near-shore cities and/or events and indirectly giving information about earlier strandline positions. Each case, however, has its own peculiarities and characteristics and, of course, a separate setting and evolution. A few of these sites have been geologically surveyed and their configuration depicted in a specific time slice, especially after the early Helladic period (5000 yr BP), for which most of the testimonies exist (Kraft et al., 1977; Kraft and Rapp, 1988). In this paper we give examples of the morphological configuration in some lowlands for which there are archaeological testimonies of ancient settlements, tentatively depicting the coastline to the time slice of 3800 yr BP.

3. Configuration of shelf areas at various time slices

3.1. Latest Pleistocene (time slice at 21 500 yr BP, sea level at −120 m)

Ionian Sea: In the northern sector (Fig. 3), Corfu island was connected to the mainland, while a lake was formed between the island and the mainland with a probable outlet to the south. Further south the coastline was up to 10 km offshore. A more extended shelf existed west of the present Patraikos Gulf (Chronis et al., 1991; Piper and Panagos, 1979). Most islands and islets were connected, forming greater islands, in some cases connected also with the mainland. A deep lake existed in Korinthiakos Gulf (depth >750 m; Perissoratis et al., 2000) and a shallower one in Amvrakikos Gulf (depth about 70 m; Papatheodorou et al., 1993). Off the western Peloponnese the coastline was about 5–8 km westward from today's position.

Aegean Sea: In the northern sector extended coastal plains existed, having a width of 20–30 km, drained by a number of rivers, some of which had a different path than today, with the islands of Thassos and Samothraki constituting high mountains (1225 m and 1731 m, respectively). Small lakes were formed in Alexandroupolis, Strymonikos and Ierissos gulfs, but in the peninsulas to the west the coastline was at a short distance (2 km) from the land. An extensive alluvial plain was also present in Thermaikos Gulf, drained by the extensions of the big Axios, Aliakmon and Pinios rivers, the offshore path of which is not known due to the lack of adequate seismic data.

In the western Aegean the gulfs of Pagasitikos, S. Evvoikos, N. Evvoikos and Saronikos were subaerially exposed and in their central part lakes were formed, having depths ranging from a few tens to over 300 m (Perissoratis and Van Andel, 1991; Lykousis and Anagnostou, 1992). Off southern Greece, because of the steep coastal cliffs, the sea did not retreat much offshore.

In the central Aegean, the northern Sporadhes islands were connected with the mainland, while further south a 'semicontinent' was formed by the interconnection of most of the Cycladhes islands (Van Andel and Shackleton, 1982). This semicontinent extended northward to a distance of a few km from the Greek mainland. Relatively extended coastal plains were also formed off the various embayments in northern Crete. In the eastern Aegean, the Dardanelles were cut off from the Aegean (Stanley and Blanpied, 1980). Alluvial plains were present around Limnos, Chios and Dodecanese islands that were connected with the mainland and drained by the rivers of Asia Minor. It is evident from Fig. 3 that during lowland stage 2, the land projections present on both sides of the Aegean were forming a kind of bridges connecting Greece and Asia Minor, separated locally by sea channels.

3.2. Time slice at 11c500 cal yr BP (sea level at −60 m)

At this time slice the significant sea-level rise had greatly modified the previous coastal configuration in all sectors of the studied area (Fig. 4).

Ionian Sea: In the northern Ionian sea, Corfu island was still connected with the mainland only with a narrow land bridge to the north, but to the south Corfu channel was opened to the sea. More southward the coastline had retreated to a distance of less than 2 km from today's position. Amvrakikos Gulf still constituted a lake, while to the west only a few islands were still connected with the mainland. Korinthiakos Gulf was also a lake but most probably with high saline water input in periods of surging, since its western entrance must have been approximately at sea level, at −60 m.

Aegean Sea: In the northern Aegean, part of the shelf was still subaerially exposed in the eastern and western sectors. Samothraki island was isolated by a narrow channel from the mainland but Thassos island was still connected with it. The lakes formed during marine isotope stage 2 in both the northern and western Aegean were overflowed by the sea except in north and south Evvoikos, the latter consisting probably of a high-saline water lake, since the barrier in its entrance was around −60 m as in Korinthiakos Gulf (Perissoratis and Van Andel, 1991). In the rest of the Aegean, most islands were disconnected from each other and from the mainland. A land bridge, however, still existed between central Greece and the western part of N. Sporadhes and between a few eastern Aegean islands (Samos, Lesvos) with Asia Minor. Finally, the Cycladhes semicontinent was restricted to a small central area.

3.3. Time slice at 8000 cal yr BP (sea level at −15 m): late Holocene coastal developments in deltaic lowlands

Because of the steep configuration of most coastal areas and islands of Greece, the isodepth of −15 m is very close to the shore and the coastline position was similar to that of today. However, in the lowland plains the situation must have been different. Many studies have shown that in these plains, late Holocene terrigenous sediments are deposited, having thickness of tens of meters, overlying shallow marine or brackish deposits of early Holocene or older age (Kraft and Rapp, 1988). Thus from this time slice onward the sea initially intruded all lowlands and gulfs and in most cases far inland than it is today (Fig. 4). Gradually, however, these coastal river plains of Greece and Asia Minor were filled by the terrigenous sediment input and the morphology was greatly modified. According to Vita-Finzi (1972), between the years 5000 and 2000 BP, there was an increased proportion of sediments trapped in deltas of the Mediterranean in comparison to the present day. Some of these were sites of historical settlements or of events of particular significance. Thus it is known that in Axios plain at 3500 yr BP, the sea was about 35 km inland since the city of Pella, the capital of Macedonia and the birthplace of Alexander the Great, was at that time a port (Kraft et al., 1977). Also, at Sperchios plain, at the time of the Thermopylae battle (2500 yr BP), the shoreline was about 5 km inland (Kraft et al., 1987). Apart from these examples a number of ancient cities that were near-shore settlements at late Helladic (3000 yr BP) or classical time (2500 yr BP) lie now inland at various distances (Kraft et al., 1977, Bateman, 1985). One parameter that has lately been considered for its impact

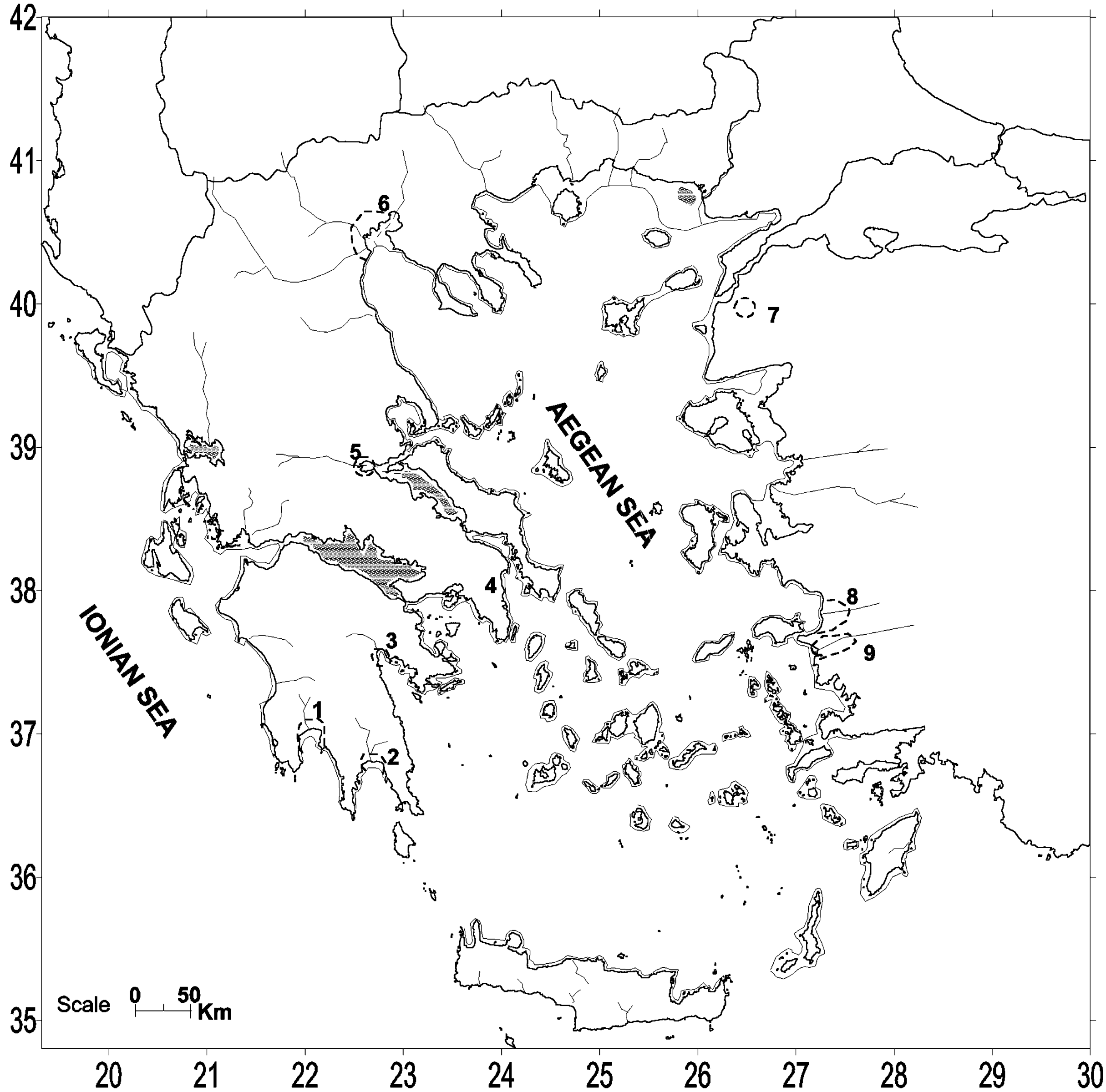

Fig. 4. Tentative coastline position at 11 500 cal yr BP. Dashed line depicts supposed location of coastline in historical settlements at 3800 cal yr BP: 1. Pamisos river valley (Messenia), 2. Elos valley (Laconia), 3. Tiryns (Argolid), 4. Marathon (Attika), 5. Thermopylae (Thessaly), 6. Pella (Macedonia), 7. Troy (Dardanelles), 8. Ephesus (Asia Minor), 9. Militos (Asia Minor). Other symbols as in Fig. 3.

on the morphological changes in the ancient coastal settlements and the retreat of the sea is the role of the anthropogenic factor. According to various authors (e.g. Morhange et al., 2000) the humans reacted to the filling of the settlement area by sediments brought by the rivers by, for example, building dams or diverting the river routes in order to defend settlements. These constructions, where present, could have temporarily halted the gradual terrigenous sedimentation process of coastal plain filling, producing 'sedimentary crises' in the coastal plain areas.

4. Discussion and conclusions

The coastal morphology in the Ionian and Aegean seas is variable but it usually consists of steep cliffs and a narrow coastal zone. The most extended shelf areas exist in the northern Aegean and, to a lesser degree, in certain sectors in the Ionian Sea and the eastern Aegean. The definition of a coastline position in specific time slices during the Late Pleistocene–Holocene period requires ^{14}C dating, which is not available in the studied area for ages older than 4000 yr BP. As a result, the coastline configuration was depicted by using the global eustatic sea-level curve combined with bathymetric, stratigraphic and seismic data. Based on the above, the tentative position of the coastline was defined in three time slices. These are at 21 500 cal yr BP, the latest lowstand (sea level at −120 m), at 11 500 cal yr BP (sea level at −60 m), when there was a temporary delay in the sea-level rise, and at 8000 cal yr BP (sea level at −15 m), when sea level approached today's position and its rate of rising was much slower thereafter. For the definition of the coastline the data were corrected for tectonic subsidence and the isostatic factor, assuming that these were constant during the examined period, and also subtracting the Upper Pleistocene–Holocene sediment thickness. However, since the rate of sea-level rise (from 5 to 20 mm/yr) up to 8000 cal yr BP much exceeded the tectonic and isostatic effects (up to 1.30 mm/yr), the tectonic factor is of secondary importance. On the other hand, in most of the studied areas, the seismic data have indicated that the Holocene sediment tract was in most cases of minor thickness (a few meters) because the greater part of the sediment load was deposited in the lowland plains. At the same time the rapid sea-level rise did not allow the sediment to accumulate on the shelf, except for minor thickening in old river channels. Thus the effect of both these parameters on the sea-level curve is minor. After the 8000 yr BP time slice the sea initially intruded most lowlands and deltaic areas, but the rate of sea-level rise was much slower (average of 2 mm/yr; Fig. 2a), partly compensated by the rate of subsidence. Thus gradually the sediment input filled the alluvial plains, resulting in a considerable sea regression. Because of this process, many old coastal cities and historical sites that are referred to in ancient testimonies as maritime, are now a considerable distance inland. For each site there is a different historical account, but geoarchaeological studies have indicated that the coastline position in a number of ancient near-shore cities at late Helladic (3000 yr BP) or classical times (2500 yr BP) was from a few to tens of kilometers inland. These data were used here in order to tentatively estimate the position of the coastline at the time slice of 3800 yr BP.

The conclusions that can be drawn from this paper are the following:

During the latest lowstand (21 500 cal yr BP; sea level at −120 m), extensive shelf areas existed at the northern Aegean and in parts of the Ionian and the eastern Aegean seas. Many near-shore islands were connected with each other and/or with the mainland. Thus seaward projections from Greece and Asia Minor extended to the sea. In the central Aegean an extensive land area was formed in the Cycladhes sector.

At 11 800 cal yr BP (sea level at −60 m), when there was a relative stillstand in the sea rise, the subaerially exposed shelf was considerably diminished. Coastal plains existed in the same areas as before, but most of the islands had obtained their present shape.

At 8000 cal yr BP, the coastal configuration was much like that of today in the steep coastal areas, and the sea gradually intruded the lowlands. However, the low rate of sea-level rise allowed the tectonism and mainly the sediment input to play an increasingly dominant role by filling the bays and migrating the land seaward over a distance of a few to tens of kilometers. In some locations human intervention temporarily halted the sediment filling process.

For the establishment of the coastline position after 8000 cal yr BP, there is a need for detailed studies in each deltaic or lowland area, in combination with the historical data and testimonies.

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