Submerged Prehistoric Landscapes in the Aegean Sea

A. Zavitsanou, D. Sakellariou
Institute of Oceanography, Hellenic Centre for Marine Research
azavits@hcmr.gr, sakell@hcmr.gr

Introduction

Subsidence of prehistoric landscapes results from the relative sea-level changes, a function of eustatic changes and vertical movements of the earth's crust, including isostatic and tectonic movements. In tectonically active regions like the Aegean, local vertical tectonic movements (subsidence and uplift) constitute an important factor which needs to be considered for the precise understanding of the sea level fluctuations. Consequently, submerged landscapes formed during different, successive low sea-level stands (e.g. 18 ka BP (MIS 2/ LGM), 140 ka BP (MIS 6), etc) may be found at altitudes / depths which vary considerably relative to the ones predicted from the modeled sea-level curves.

In this paper we present the preliminary results of an ongoing project aiming at the reconstruction of the Upper Pleistocene submerged landscapes in the Aegean Sea by taking into consideration the complex tectonic movements.

Methodology

High resolution swath bathymetry and sub-bottom profiling systems (e.g Pinger, Boomer, Chirp, Airgun) are employed to identify submerged prehistoric landscapes and palaeoshorelines, the current depth of which may highlight the interplay between the tectonic movements of the land masses and the fluctuation of the sea-level in the Late Pleistocene and Holocene. Typical sea level markers of paleoshorelines include topset to foreset transitions of peak glacial periods prodelta sequences, morphological terraces and palaeobeaches.

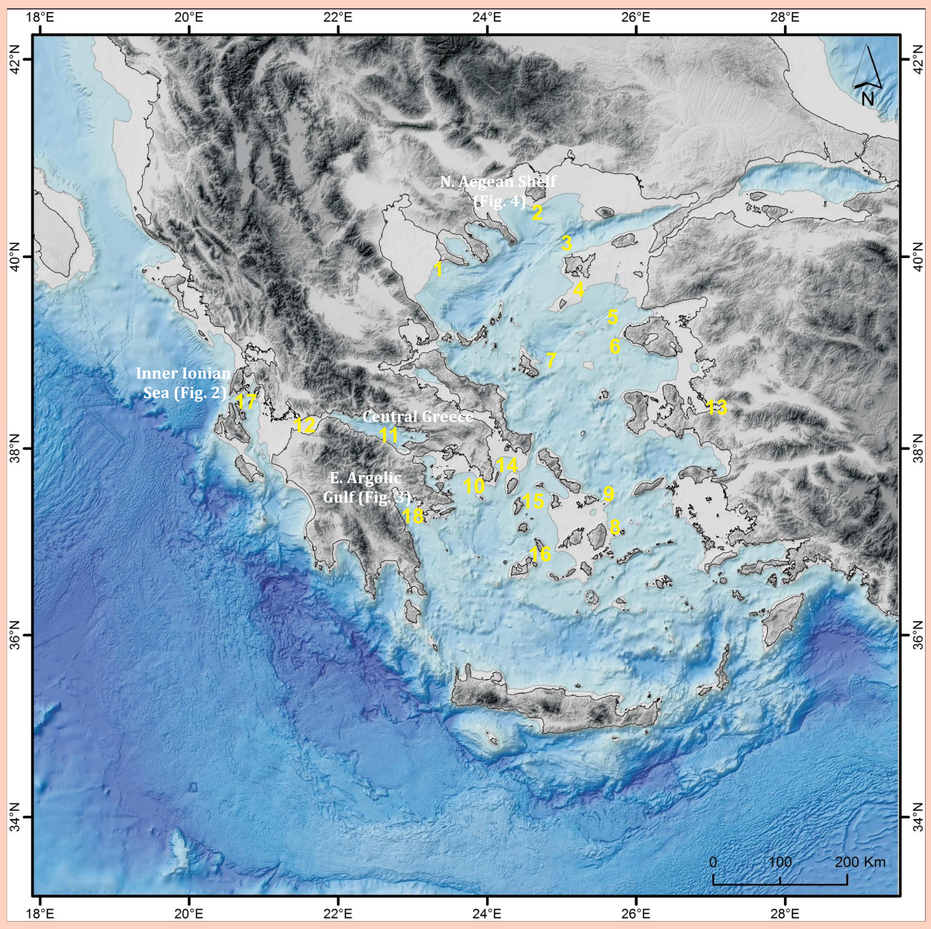

Fig. 1: The palaeogeography of the Aegean Sea during MIS 2.

Table: Subsidence rates calculated in the Aegean during the last 425 ka. Each area is represented with a number illustrated in the corresponding map at the top. [1]Lykousis, 2009, [2]Chronis et al., 1991, [3]Aksu et al., 1987a, [4]Kapsimalis et al., 2009, [5]this paper.

		Isotopic stage 6-2 (146-18 ka BP) (m ka^{-1})	Isotopic stage 8-6 (250-146 ka BP) (m ka^{-1})	Isotopic stage 10-8 (340-250 ka BP) (m ka^{-1})	Isotopic stage 12-10 (425-340 ka BP) (m ka^{-1})
1	NW AEGEAN (Thermaicos) margin[1]	0.86	1.43	1.61	1.88
2	N AEGEAN (northern) margin[1]	0.85	1.31	1.49	
3	N AEGEAN (southern) margin[1]	0.83	1.34	1.46	
4	C AEGEAN (S Limnos) margin[1]	0.49	0.67		
5	C AEGEAN (NW Lesvos) margin[1]	0.53	0.71		
6	C AEGEAN (W Lesvos) margin[1]	0.50	0.74		
7	C AEGEAN (E Skiros) margin[1]	0.45	0.59		
8	E CYCLADES margin[1]	0.34	0.57		
9	NE CYCLADES margin[1]	0.40	0.55		
10	SARONIC margin[1]	0.42	0.60		
11	CORINTH North margin[1]	0.70	1.28		
12	GULF OF PATRAS[2]	0.90			
13	IZMIR BAY[3]	0.45	0.55	Isotopic stage 8-2 (250-18 ka BP) (m ka^{-1})	Isotopic stage 12-8 (425-250 ka BP) (m ka^{-1})
14	NW CYCLADES (Kea-Makronissos)[4]	0.26-0.40			
15	W CYCLADES (E Kithnos)[4]			0.19	0.26
16	SW CYCLADES(Kimolos-Sifnos Strait)		0.50		0.25
17	NE Inner IONIAN ARCHIPELAGO	0.98	0.39		
18	E ARGOLIC GULF (Kiladha Bay)	0.26			

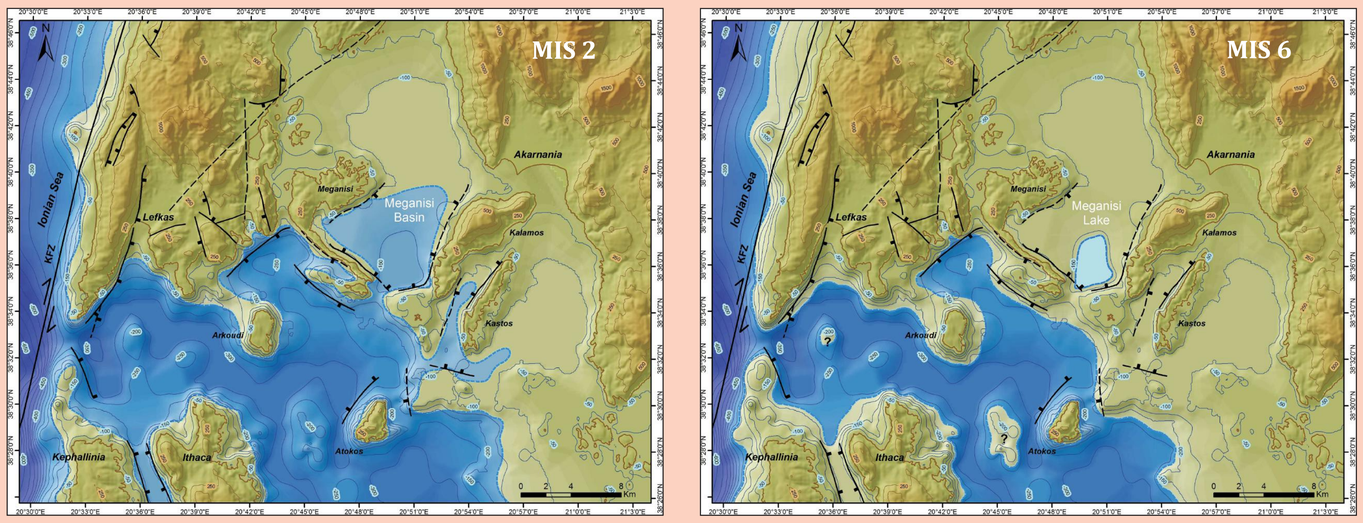

Fig. 2: Palaeogeographic reconstruction of the Inner Ionian Sea Archipelago during MIS 2 and MIS 6. MIS 2 and MIS 6 palaeoshorelines vary between 105 - 130 m and 214 m - 253 m, correspondingly. Note that most of the islands are connected with the mainland . A shallow lake is formed at MIS 6.

Results

Palaeogeographic reconstructions during low sea-level stands reveal the extent of sea level regression with direct consequences on:

1) the connection of current islands with the mainland (Fig. 2, Fig. 3)
2) the emergence of former islands presently totally submerged (Fig. 2)
3) the existence of palaeolakes (Central Greece in Fig. 1, Fig. 2) and
4) palaeorivers (Fig. 4).

Fluctuations along the palaeoshoreline position indicate the vertical tectonic effect (Fig. 3) and allow its quantification (see table).

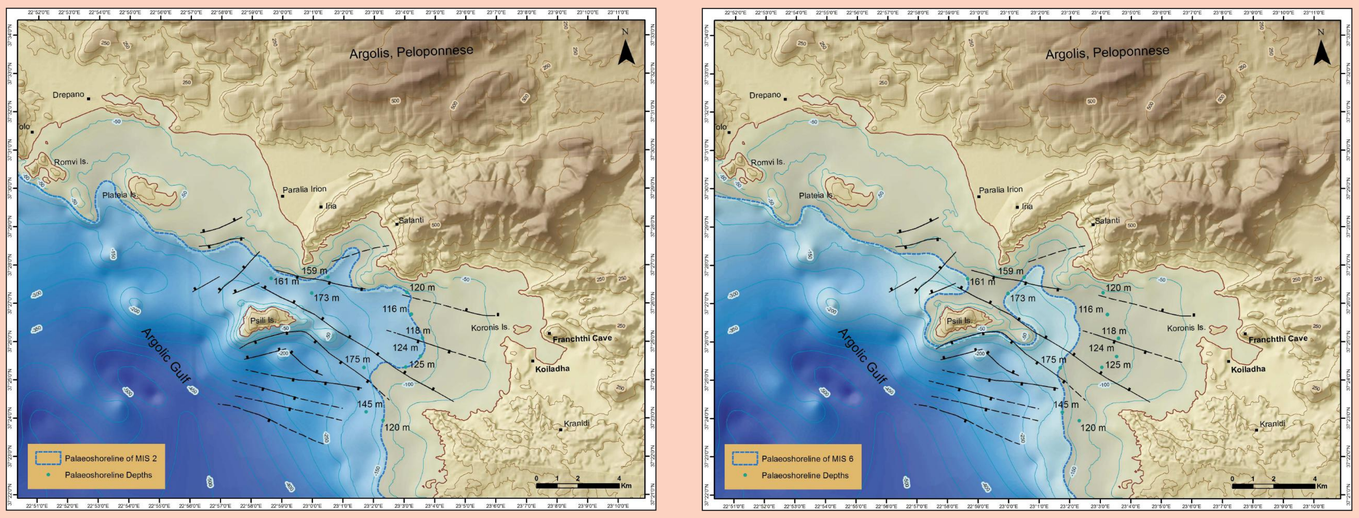

Fig. 3: Palaeogeographic reconstruction of the East Argolic Gulf during MIS 2 and MIS 6. MIS 2 and MIS 6 palaeoshorelines vary between 116 m - 125 m and 150 m - 170 m, correspondingly.

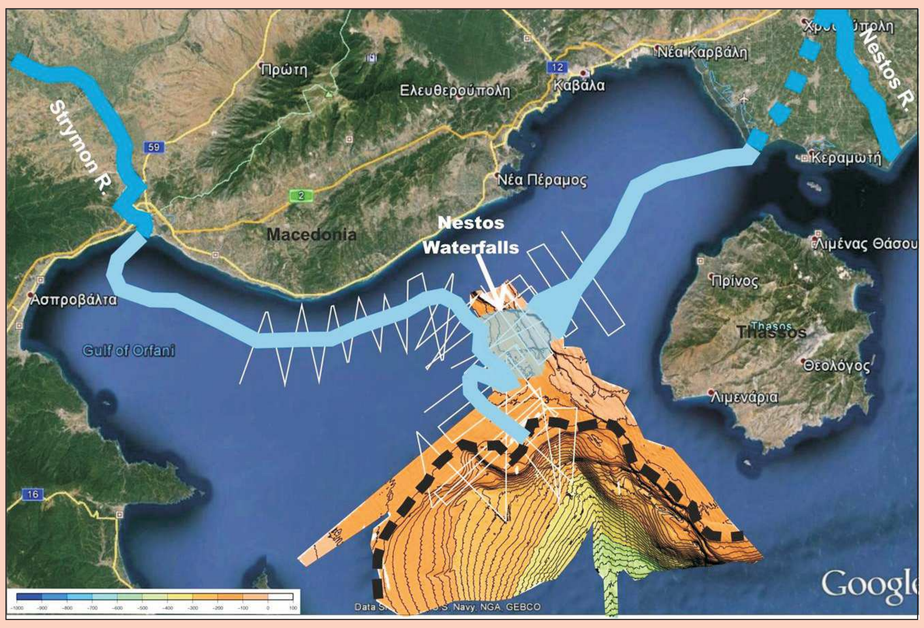

Fig. 4: Reconstruction of the submerged riverbeds of Strymon and Nestos rivers on the North Aegean Shelf during the MIS 2. The black dashed line denotes the corresponding palaeoshoreline located approximately at 120 m bpsl.

Conclusions

Detection and dating of palaeoshorelines constitute the first step for the understanding of the relative sea-level changes and achieving realistic palaeogeographic reconstructions. Ongoing research shows that vertical tectonics has a great impact on the location of submerged prehistoric landscapes and therefore, it should be regarded as a dominant factor within the relative sea-level equation in tectonically active areas.