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Coastal Environmental Change
During Sea-Level Highstands:
A Global Synthesis with implications
for management of future coastal change

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Quaternary coastal morphology and sea level changes



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Late Quaternary coastal changes along the western shores of the Laconic gulf (Peloponnesus, Greece) based on geomorphological and archaeological data

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Abstract

The study area, located in southeastern Peloponnesus, extends along the western shores of the Laconic gulf. Morphotectonically, the gulf and its northern extension form an asymmetric graben situated between the mountain masses of Parnonas (1935m) in the east and Taygetos (2407m) in the west.

The Alpine lithology is composed of marbles, flysch, phyllites, volcanosedimentary rocks and limestones. The post Alpine formations are PlioPleistocene marls, conglomerates and sandstones together with upper Pleistocene – Holocene alluvial and coastal deposits. Regarding the tectonics, en echelon normal faults having NW-SE directions and dipping to the NE are observed in the west. As the archaeological observations suggest, these faults have been reactivated in historical times. Moreover the area is characterized by intense seismicity, as strong earthquakes have been reported since ancient times, indicating recent tectonic activity.

Geomorphological and archaeological data have been used in order to determine the changes that have taken place in the western shores of the Laconic gulf since the Tyrrhenian period (Figure 1). The archaeological remains of the study area range from the Middle Paleolithic to the Roman period testifying areas of human exploitation through time.

Lakonis: The Middle Paleolithic (120.000B.P. - 35.000B.P.) finds come from the archaeological site Lakonis, which forms a cave complex on the beach. The site preserves rich lithic and fauna material characteristic of the Middle Paleolithic period (Panagopoulou et al. 2001). The lithic assemblages of the site are made of local raw material (metamorphosed volcanic rocks, quartz and flint) and are manufactured with the Levallois technique. A human tooth has also been found in the archaeological deposits, which, according to a preliminary study, belongs to a Neanderthal (Panagopoulou et al, 2003).

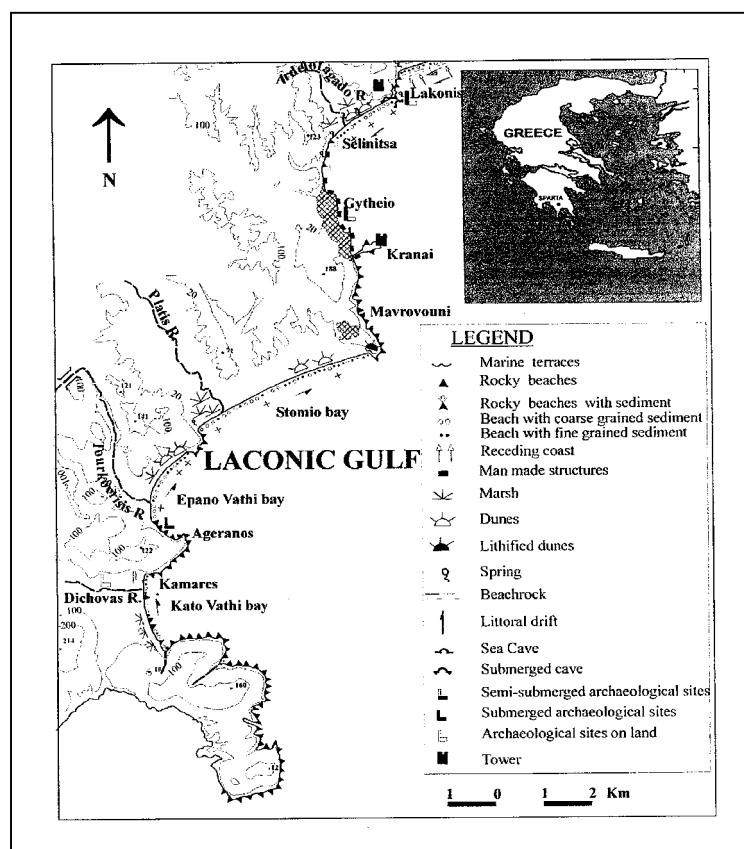


Figure 1. Coastal geomorphological map of the western shores of the north Laconic gulf.

Gytheio: Gytheio used to be an important port of Sparta during Classical and Hellenistic times (5th – 2nd century B.C.) and it became a Roman conquest after 195 B.C.

Unfortunately the modern city has been built on the classical one leaving no traces of the latter. A small theater from the Late Hellenistic/Early Roman period (Cavanagh et al. 1996) is preserved and several roman buildings are under excavation testifying the glory of the city during the Roman period. Some of the buildings (according to Foster (1906-7) they are baths) are semi-submerged up to -0.50m. According also to Scoufopoulos-Stavrolakis (1985) several wall like structures have been traced in 5m depth.

Kranai: the small island today connected to the mainland preserves only surface sherds from Mycenaean (1,600 - 1,100 B.C.) to the Ottoman (1,453 - 1900 A.D.) period (Scoufopoulos-Stavrolakis, 1985).), which is traced underwater at 0.40-1.30m (Tsartsidou et al. 2002). Its long shape implies that this could be a quay. The structure (material and method of construction) attributes it to the Roman period.

Kamares: Roman villas preserved up to the roof have been located on the beach of Kamares village. There are several remnants of Roman buildings in the fields suggesting a serious exploitation of the area by the Romans.

The morphology of the coasts is determined by the recent tectonic activity of en echelon normal faults dipping to the NE. In this way the faulted blocks dip to the SW. Thus at the eastern side of each coastal block we have the outcropping of limestones at Selinita, Stomio, Epano Vathi and Kato Vathi bays, forming pocket beaches with recent

At closer view, two Neo-Tyrrhenian terraces have been traced along the west coasts of the Laconic gulf (Figure 1). First, at the archaeological site Lakonis, at the northeast end of Selinita bay, and the second at the east end of Stomio bay (Photo 1). Both of them are 1-4m above sea level. The deposits of the second one contain characteristic fossils (*Strombus bubonius* Lmk). The beach conglomerate in the first terrace (Lakonis) is covered by travertine, which is underlying a 7m sequence of terrestrial strata with archaeological finds. U- series measurements on the travertine that covers the beach conglomerate yielded an age of $94\text{ka} \pm 14.000$, while some ^{14}C dates from the uppermost terrestrial strata are between 35-40ka (Panagopoulou et al, 2003). Three submerged notches have been found at the rocky coast at the eastern end of Selinita (Lakonis) 0.50m, accompanied with lithophaga boreholes, a second one at 1m and a third one at 2m below sea level. Based on geomorphological and archaeological evidence it is concluded that vertical tectonic movements since Late Pleistocene-Holocene played a minor role in comparison to eustatic and isostatic movements of the crust. Considering the fact that the sea level corresponding to Tyrrhenian period was very close to the present one with the Tyrrhenian terrace at 1-4m it is determined that tectonism was insignificant in this time period. In the Late Holocene relative sea level which includes both eustatism and tectonism has risen at least 2m, since all Roman coastal sites in the study area are submerged by 1-2m.



Figure 2. Neo-Tyrrhenian terrace at east end of Stomio bay. It is composed of marine coastal deposits and aeolianites having a total thickness of 3-4m and overlies Neogene marls and sands.

coastal sediments extending west of these formations. Marine processes in these beaches prevail over fluvial forming straight sandbars and blocking in many instances older small embayments thus creating coastal marshes.

The flow of the three main torrents (Ardelolagado, Platis and Tourkovrisis) is influenced by the general geotectonic setting of the study area. All three are located at the western end of their corresponding fault block. The largest torrent, Platis Remma, has formed a 3m alluvial terrace and presents several meander scars. Ardelolagado too, has a 2.5m terrace.

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