MARINE GEOARCHAEOLOGICAL RESEARCH ALONG THE SOUTHWESTERN ANATOLIAN COASTS

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Abstract
Marine archaeological and geophysical surveys were performed on submerged archaeological remains along the southwestern Anatolian coastline in order to determine the Late Holocene sea level changes. High-resolution acoustic data were acquired, and archaeological and geomorphological observations were carried out on the coastal archaeological sites and their surroundings. Submerged archaeological and biological remains provided significant evidence of vertical tectonic subsidence in the region. The results show that the observed changes are produced by the vertical tectonic movement for this coastline since the Hellenistic period.

Keywords: Sea level, Aegean Sea, Geomorphology, Tectonics

In antiquity, humans generally preferred coastal living in order to take advantage of seafood resources and marine transportation. However, since prehistoric times humans have been affected by sea level changes. Numerous ancient coastal settlements can be found along the southwestern Anatolian coastline. Their coastal installations (e.g. moles, quays, public buildings) are now submerged due to relative sea level rise.

Southwestern Anatolia region is a seismically active part of the Aegean–Anatolian microplate. The eastern Mediterranean lithosphere subducts under the Aegean microplate resulting in the generation of serious earthquakes and volcanic activity along the Hellenic – Pliny Strabo arcs and Aegean volcanic arc [1, 2] (figure 1a). This tectonic regime has an impact on the submergence of ancient harbour structures.

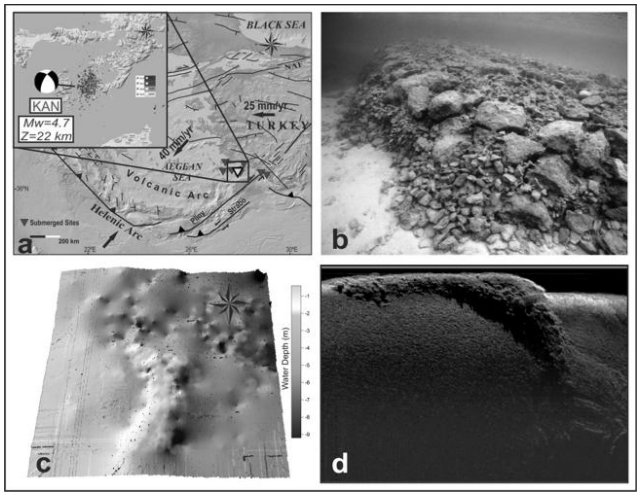

Fig. 1. (a) Location and tectonic structure around the study area (modified [2]; http://www.geomapapp.org). The inset map shows the earthquakes in the Yesilova Gulf in 2002 (http://www.koeri.boun.edu.tr/sismo). (b) Submerged breakwater remains in the southern Yesilova Gulf. (c) Multibeam bathymetric data and (d) side scan sonar images of breakwater.

Late Holocene sea level changes along the coast of southwestern Anatolia were investigated based on the correlation of archaeological and geophysical data. The positions of submerged archaeological structures, dating from Hellenistic to late Roman / early Byzantine periods, were measured with respect to the present sea level. Side scan sonar and multibeam bathymetric data were obtained to provide acoustic images and a high-resolution digital elevation model of submerged remains (figure 1c, d). In addition to archaeological data, geomorphological observations were also made of the ancient harbour sites. On the limestone coast, measurements were made of submerged tidal notch traces, which indicate the sea level change [3].

In Yesilova Gulf, a submerged breakwater is located in a small ancient harbor, which has onshore building remains dated to Hellenistic Period (figure 1b). The upper surface of the breakwater lies 1.5 m below present sea level (figure 1c). Besides this, submerged tidal notches have also been observed in the region at approximately 0.5 m below sea level, indicating vertical tectonic movement. Recent earthquake activity that occurred in Yesilova Gulf in 2012 contributed to tectonic movement in the region. This activity lasted for one-week, generating more than 100 earthquakes (figure 1a), which support the active seismicity of the region.

Eustatic–isostatic sea-level change related to the melting glaciers did not exceed 0.5 m during the last 2000 years [4]. Considering the eustatic–isostatic sea level change, period of construction, and the present positions of archaeological remains, we were able to calculate the tectonic subsidence rate of 0.65 m±0.05. We suggest that tectonic movement has been the dominant cause since the Hellenistic period for the submersion of the southwestern Anatolian coastline, rather than eustatic sea level rise.

References

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