ACOUSTIC DETECTION OF BENTHIC ASSEMBLAGES IN A LAND-LOCKED SHALLOW MARINE ENVIRONMENT: GULF OF GERA, LESVOS, GREECE

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Abstract
In this contribution a geophysical data set and sediment samples and camera images for ground-truthing are used in order to study the morphology of the Gulf of Gera. The observed hummicky relief is due to benthic assemblages and it can be discriminated to five different sub-classes according to their morphological characteristics. The hummocks is probably the result of the regional oceanographic conditions, slow gas seepage and the protected from scallop dredging environment.

Keywords: Aegean Sea, Coastal systems, Mapping, Zoobenthos, Sediments

Introduction
The Gulf of Gera is an enclosed embayment located in the island of Lesvos. It connects with the Aegean Sea through a narrow channel that has a width of 300-800m, a length of 6.5km and depths ranging from 10 to 30m. The area of the gulf is ~42.5Km², with a maximum depth of ~18m. The Gulf of Gera receives discharges from seasonal streams/small rivers. Previous studies had focused on the sedimentology and sediment geochemistry [1] as well as on the anthropogenic influences on benthic ecology [2]. The present study examines the embayment seabed morphological features.

Materials and Methods
A single-beam echo-sounder and a side scan sonar survey were conducted for the detection of the seabed morphology. Scuba diving at 2 sites, a drop down camera system and sediment sampling at 43 stations were employed to ground-truth the geophysical results. Grain size analysis was carried out with dry sieving for the coarse fraction and with laser diffraclometry for the fine fraction. For the side scan sonar processing and data analysis/mapping, the SonarWiz Map and ArcGis were used, respectively. Additionally, a 3.5kHz old analog profile aided to the investigation of the subbottom structure of the gulf.

Results and Discussion
The main morphological features identified are numerous small hummocks that populate the seafloor (Fig. 1). They appear in water depths deeper than 12m covering an area of 16.3km², have an average height of 1.0m and occur individual or locally coalescing. Based on the hummocks morphological characteristics (shape, dimensions and distribution), 5 sub-areas have been distinguished, each showing a unique pattern (Figs. 1 and 2). An interesting finding is that the sub-area with the higher hummocks (up to 2.0m) appears to develop near the entrance of the bay.

The 3.5kHz subbottom profile has shown the presence of an almost homogeneous surficial layer 4-9m in thickness that overlies almost concordantly earlier sedimentary units at the central part of the embayment. The bottom-echo becomes more intense at the top of the hummocks. Acoustic anomalies, mainly as small in extent acoustic turbid zones as well as plumes within the surficial layer, imply the potential presence of gas in the sediments. The video images and the seabed sampling revealed that the hummocks consist of assemblages of bivalves (mainly) and gastropods of various sizes, together with fine-grained sediments. Species that are met in considerable abundance are the Mytilus galloprovincialis, Turritella communis, Vermetus semisurrectus and Ostrea edulis. Very fine muddy sediments are found in the greater part of the embayment and also seem to constitute the hummocks matrix material.

The hummocky seabed morphology may be (i) related to the oceanographic conditions prevailing in the gulf [3], (ii) associated with the slow seepage of gas that has been reported also elsewhere to be connected with high concentration of bivalves and other benthic life [4] and (iii) possibly favored by the prohibition of scallop dredging in the area.

Fig. 1. Hummocky sub-areas extent, over the side scan sonar mosaic.

Fig. 2. Qualitative morphological characteristics and corresponding side scan sonar images of the hummock sub-areas.

References