

Reading Human Contemporary History from the Submerged Landscape: Representative Seabed Images from the Gulf of Valona (Southern Albania, Mediterranean Sea)

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Abstract

Conventional seafloor mapping techniques, such as multibeam echosounders, high-resolution reflection seismic and side-scan sonars, are commonly employed in sea research and exploration programmes to provide accurate and reliable geomorphological and sedimentary models of the seafloor and sub-seafloor environment. Envisioning the submerged landscape via remote acoustic imagery deeply sustains scientific research and economic exploitation of sea resources by industries, but also recently opened up the submerged landscape for new opportunity of investigation, or even exploitation, by a far more cultural perspective.

Here we report, through a presentation of a case study, the significance of detecting, from analysis of seafloor acoustic data, the mark of human development, from the wartime to the present day, in the submerged landscape of the Gulf of Valona (eastern Mediterranean Sea).

Keywords: Multibeam echosounders; Sonars; Remote acoustic imagery

Introduction

With the end of the last century, scientific and technological progress has witnessed important break-through in the exploration of the marine environment, making the ocean and the seafloor not only less remote places than they were 70 years ago, but also new frontiers for research and economical exploitation [1]. In addition to established (i.e.: fishery, oil and gas, etc..) and emerging industries (e.g. blue biotechnology), many field of research benefited indeed from the capability to remotely investigate the submerged environment, from geology in first line, to biology, ecology and not last marine archaeology. Acoustic methods have been shown to be extremely useful where researchers need to 'visualise the submerged landscape' (giving them a model that displays the principal morphometric characteristics as well as important information about the nature of mapped materials) and therefore became extremely powerful to identify or inspect wrecks and other submerged evidence of human activity (See among others [2-4]). Human activity (that changed through historical times, according to social and economic development) can leave indeed important marks (i.e.: physical remains such as buildings and/or infrastructures, etc., associated to the socio-economic exploitation of our earth system) even underwater, making the submerged environment a cultural landscape, as well as it has been acknowledged on land [5,6]. Cultural landscapes are defined as cultural properties that represent the "combined works of nature and of man" (as designated in Article 1 of the World Heritage Convention Operation Guidelines - [7]). They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal [7].

Materials and Methods

Results here presented were obtained analysing seafloor mapping data acquired on board the R/V *Universitatis* (present-day R/V *MinervaUno*) in the Vlora Gulf and offshore southern Albania, in 2007 and 2008 (Figure 1). Traditional acoustic systems for seafloor mapping were employed: (1) the Reson Seabat8160 MultiBeam EchoSounder (MBES),

(2) the Reson Seabat8125 MBES (for shallow water), (3) the GeoChirp II GeoAcoustic Sub-Bottom Profiler (SBP), and (4) the Klein3000 Side Scan Sonar system. All the measured data were georeferenced by a differential global positioning system (DGPS). Additional details on data acquisition and processing are reported in [8].

Result and Discussions

The rich set of acoustic data allowed for an accurate interpretation of the benthic geomorphology of the Vlora gulf [8,9], but has also revealed the presence of numerous wrecks of world wars I and II (Figure 2A-E), underlining how much the submerged landscape of the Valona Gulf is linked to the hostilities of the 20th century. Historically and still today the Gulf of Valona and particularly the bay, has been the site of intensive and varied human activity, as well documented especially by the photo-mosaic obtained from processing of side-scan sonar data and firstly reported in [8]. In reviewing the results from the inspections of the obtained "model" of the submarine landscape, the features of immediate concern were the relatively high number of shipwrecks that lay on the seafloor. The research has identified first, the wreck of the hospital ship, *Po*, the largest and the most important wreck recorded during the survey, situated in the south-east area of the bay (Figures 2A and 3). The hull is lying on the sea floor at around 35 m of water depth (w.d.). The research has also plotted the wreck of the *Daisy Queen*, also a large and important ship, just off Cape *Linguetta* and other wrecks, as yet unidentified, both within the bay

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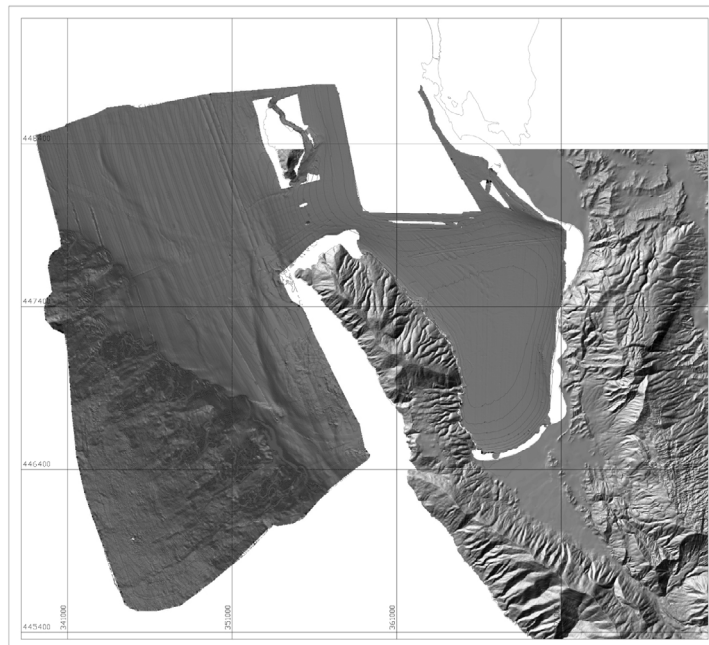


Figure 1: Morpho-bathymetric map of Valona gulf with location of shipwreck detected in the study area (black stars). Interval of bathymetric contour lines is 50 m, map was plotted in UTM34, zone north (adapted from [8]).

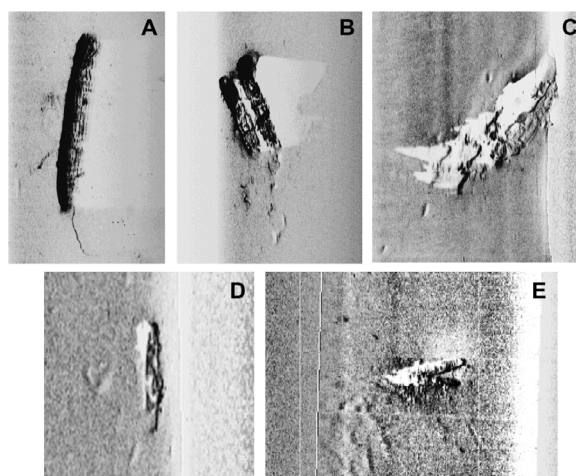


Figure 2: Snapshots taken from side-scan sonar data, representing all shipwrecks detected in the study area (locations are indicatively reported in Figure 1). A: Hospital ship Po (sunken during World War II). B: Unknown shipwreck. C: heavy cruiser Regina Margherita (World War I). D: Unknown shipwreck (submarine). E: Unknown shipwreck sunken within the western sector of the Gulf of Valona.

and off Cape Linguetta. A minefield laid effectively between Saseno Island and Cape Linguetta, at the small opening of the gulf for the passage of ships [10].

The seabed of the bay is also studded with other objects of unknown origin and typology. Bearing in mind that, during wartime, the Adriatic Sea was mined, some of them may well be unexploded devices. Some of the detected “anomalies” are displayed as seabed marks that can clearly be ascribed to human activity, such as:

- Linear morphologies resembling tracks on the sea floor: some are caused by trawling nets used in the intense exploitation of fish stocks in the Gulf. More marked traces are the result of mines weeping.
- In the southern part of the bay, near the Albanian navy base, the seafloor is dotted with circular features, indicating the deposition of coarser sediment in forms of small-scale weakly positive rings of no more than few meters in diameters (Figure 4). This is the typical aspect of terrain impacted by explosions, so mines, exploded on the sea floor, likely caused them. Such activity could be ascribed to military training, although it is worth nothing that blast fishing or dynamite fishing was a practice largely in use in Albania to stun or kill schools of fish for easy collection. The practice was generally known prior to world War I, but in Albania it probably offered people what post-communist Albanian government cannot: jobs and food for most part of families living along the coastline.

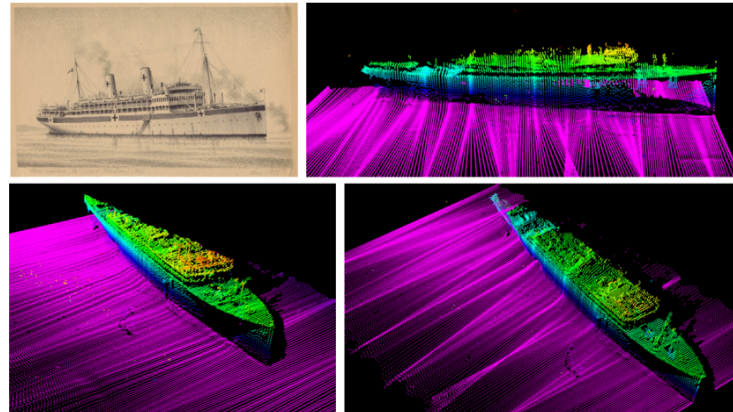


Figure 3: An historical image of the Hospital ship Po (upper left corner) and 3D view of the shipwreck obtained from multibeam data collected within the study area.

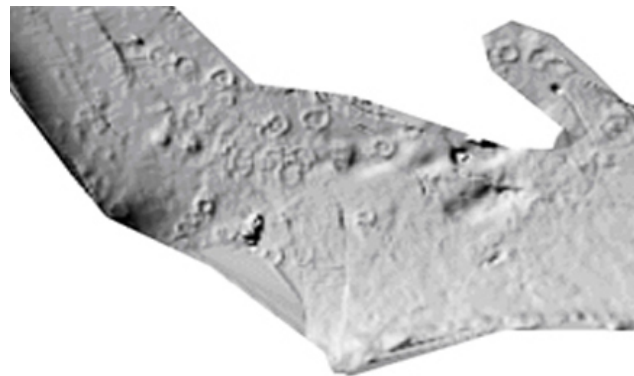


Figure 4: Example of seafloor anomalies detected within the Gulf of Valona.

Further direct investigations (sampling, visual exploration, and so on) are necessary in order to better identify the nature of the different individual marks of human activity left on the Gulf of Valona seabed.

Nevertheless, the acoustic mapping carried out so far has yielded a model of the submerged landscape and has revealed not only the presence of important wrecks, but also underlined how much human interaction there has been over the years with the maritime environment. The wars alone left a huge impact, with both the wrecks and the following mine-clearing operations, and Albania's later economic upturn also left its mark.

Conclusion

The Gulf of Valona illustrates how much seafloor acoustic imagery provide an essential representation of the submerged landscape, that is also able to investigate its temporal evolution obtaining contemporary, historical information about important human stories such as wars and the following phases of development.

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