BENTHIC PROKARYOTIC AND MACROFAUNAL COMMUNITIES IN THE DEEP IONIAN AND AEGEAN (MEDITERRANEAN SEA) AND IN THE GALICIA BANK (ATLANTIC OCEAN)

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Abstract
Relationship between depth and food availability vs prokaryotes and macrobenthos in deep (1200 to 5000m depth) central-east Mediterranean and Galicia Bank (Atlantic) is explored. Prokaryotic abundance was from 0.1 to 1.1 x108 cells g-1 i.e. 0.2 and 3.1 µgCg-1. The prokaryotic C production in the Atlantic was 7,7 to 104,6 ngCg-1 h-1. Archaea (9-36% Crenarchaeota, 4-15% Euryarchaeota) were on average 31% of total abundance. Positive correlation between prokaryotic abundance and food availability was in the Galicia bank. Mediterranean macrofauna was from 14±16 to 284±44ind/m2 and from 0,03±0,02 to 0,25±0,05g/m2 and was dominated by polychaetes. Its standing stock decreased with depth, prokaryotic abundance and biomass did not. Large organisms were more affected by loss in available energy with depth.
Keywords: Deep Sea Ecology, Biodiversity

Introduction
The deep-sea is the largest ecosystem on Earth and one of the least studied, with a variety of habitats that support one of the highest biodiversities on the planet [1]. Only a very small fraction of the deep sea has been explored to date and this gap in knowledge has been recognised by the *Census of Marine Life*. However, in parallel with the development of new technologies, industries such as deep-sea fisheries and oil exploitation at entering deep waters, start affecting an ecosystem largely unexplored and highly vulnerable because of the long life and late maturity of many deep-sea species [2]. Additionally, recent studies show that climate change also affects biodiversity and population dynamics in deep-sea ecosystems, although these processes remain largely unknown [3, 4, 5]. In this study we wanted to investigate the importance of depth and food availability for the deep prokaryotic and macrobenthic communities of the central- eastern Mediterranean sea and Atlantic ocean. For this purpose we analysed i) the distribution of prokaryotes' abundance, biomass, community structure, C production, degradation activities of extracellular enzymes; ii) the macrobenthic abundance, biomass and diversity in different deep sea sites of the central-eastern Mediterranean basin; iii) the quality and quantity of sediment organic matter in influencing prokaryotic and macrofaunal communities.

Methods
We compared areas at similar depths with different levels of productivity in the Ionian and Aegean seas (Mediterranean) and in the Galicia Bank (Atlantic). In June and October 2008 a total of 27 deployments of box corer (3 replicates per station) were performed at depths ranging from 1200 to 5000 m. For prokaryotic counts, community structure, prokaryotic activity (extracellular enzymatic activities and carbon production) and organic matter analysis, three sub-core were sectioned (0-1 cm layer) and processed.

Results and Discussion
The distribution of the prokaryotic abundance in the top 1 cm among sites ranged from 0.1 to 1.1 x 10^8 cells g^{-1} equivalent to 0.2 and 3.1 µgC g^{-1}, which are values lower than those found in previous studies; but the prokaryotic C production in the Atlantic was high (from 7,7 to 104,6 ngC g^{-1} h^{-1}) and comparable to those generally found in shallower systems. The percentage of Archaea in the prokaryotic community was on average 31% of total prokaryotic assemblage, unusually higher than values reported for deep sea sediments. Bacteria accounted the remaining portion (69% of total abundance). Archaeal assemblages were dominated by Crenarchaeota (9-36% of total Archaeal abundance) followed by Euryarchaeota (4-15%) and a small percent of unidentified Archaea. Multiple Regression Analysis evidenced a positive correlation between prokaryotic abundance and food availability only in the Galicia bank; the bacterial domain from these areas was strongly related to Biopolymeric C content. Prokaryotes in the deep Mediterranean may be affected by other factors than simply food availability. Macrofaunal abundances and biomass were generally low, from 14±16 to 284±44 ind/m^2 and from 0,03±0,02 to 0,25±0,05 g/m^2 and dominated by polychaetes in almost all stations but one dominated by crustaceans. Cnidaria and Crustaceans were the second dominant groups but unevenly distributed among stations; a more structured community was in the shallowest station where molluscs and sipunculida, were also found. Most of the polychaetes were deposit-feeders, as often when organic matter is refractory to degradation processes. Species richness (average S=4) and Shannon diversity (average H'=0.6) values were low but individuals were equally distributed among different families (average Eveness = 0.9). Abundance and biomass of macrobenthos decreased with depth (R^2=0.91) but increased with the content of phytodetritus into the sediments (R^2=0.93 and R^2=0.82); biopolymeric compounds did not show valid statistical relationships. A clear depth-related pattern was not found in prokaryotic abundances, and bacterial carbon production. The detrital organic matter of the sediments had a significant correlation with prokaryotes only in the stations in the Galicia Bank. The other factors involved in affecting their distribution, abundances and activities will be further explored. In conclusion, despite the low abundance of microorganisms, the contribution of Archaea was higher than reported until now for marine sediments [6;7]. Also macrofauna abundance and biomass were characterized by very low values and showed a negative correlation with depth, as previously reported [8;9]. Prokaryotic abundance and biomass show no decline with depth and large organisms are very likely affected by the reduction in available energy with depth more than others.

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