Getting to the Bottom of Marine Biodiversity: Sedimentary Habitats: Ocean bottoms are the most widespread habitat on Earth and support high biodiversity and key ecosystem services

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Getting to the Bottom of Marine Biodiversity: Sedimentary Habitats

Ocean bottoms are the most widespread habitat on Earth and support high biodiversity and key ecosystem services

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The oceans encompass habitats ranging from highly productive coastal regions to lightless, high-pressure, and low-temperature deep-sea environments. The benthic (bottom-living) species that reside within the sediments in these habitats form one of the richest species pools in the oceans and perhaps on Earth. Even though 70.8% of the earth is covered by oceans, and most ocean floor is covered by sediments, there is still much to learn about biodiversity in marine sediments. The major reasons for the gaps in knowledge are logistics and effort. Approximately 65.5% of the planet is covered by ocean that is greater than 130 m in depth (i.e., the approximate depth limit of the continental shelf) and is accessible only by submersibles or remote-sampling gear. Even the remaining shallow areas (i.e., approximately 5% of the earth's surface) present challenges in terms of ship availability and cost, as well as loss of experiments and ship time to weather.

Despite these logistical difficulties, it is important to improve our understanding of biodiversity in marine sediments. In this article, I describe the biodiversity of organisms residing in the marine sedimentary environment, the patterns that have been observed, why these patterns are thought to exist, and why we should care. Further discussions of marine biodiversity (NRC 1995), and biodiversity in marine sediments in particular (Snelgrove et al. 1997), may be found elsewhere.

Estimates of total species numbers suggest that less than 1% of marine benthic species are presently known

The oceans harbor tremendous biological diversity. Of the 29 nonsymbiont animal phyla that have been described so far, all but one has living representatives in the ocean, and 13 are represented only in the oceans; all of these phyla have representatives in the benthos, and most have representatives in marine sediments. Most of the species diversity in marine ecosystems consists of invertebrates residing in (infauna) and on (epifauna) sediments. These invertebrates include large animals (megafauna), such as scallops and crabs, that can be identified from bottom photographs. However, most species are polychaetes, crustaceans, mollusks (macrofauna, larger than 300 µm), and tiny crustaceans and nematodes (meiofauna, 44–300 µm). In addition, there are the poorly known microbiota (smaller than 44 µm), which include bacteria and protists.

Living in marine sediments

Organisms that live in marine sediments face numerous challenges. Except in the shallowest areas, where there is sufficient light to allow photosynthesis at the bottom, most sedimentary organisms are dependent on phytoplankton and other organic material sinking down from surface waters above. The spatial decoupling of production from most marine benthic environments makes these environments fundamentally different from those of terrestrial (Wall and Moore 1999) and freshwater (Covich et al. 1999) benthos. With increasing water depth, the amount of material reaching the bottom decreases; most deep-sea sedimentary environments are thought to be food limited.

To take advantage of whatever food is present, some organisms (suspension feeders) are able to remove suspended particles from near-bottom water; others (deposit feeders) rely on particles that have settled onto the bottom. Some mega- and macrofaunal species suspension feed, many deposit feed, and a few macrofaunal species do both. Meiofauna and microbiota depend on deposited organic material. The mobility of many benthic organisms is relatively limited; many are sessile, and others have only limited mobility within sediments. As a result, many benthic species rely completely on the water above them to supply food.

Water also supplies oxygen, a basic requirement for most organisms residing in sediments. As organisms respire and use up oxygen, sediments

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