

Life on the Sea Floor

The ocean floor is home to a stunning array of marine life. Deep-water sponges and corals of remarkable variety cling to precipices on mid-ocean ridges and subsea canyons; worms and crustaceans throng around hydrothermal vents; mussels live in around hydrocarbon seeps, and sea stars and sea cucumbers roam the vast plains of mud on the sea floor.

Life at the bottom of the sea is generally known as the 'benthos', which comes from the Greek word for 'depths of the sea'. Here the seafloor is mainly covered with soft clays and fine material that rains down from the surface or continental slopes, but standing out from the plains are submarine canyons, seamounts and deep trenches. The benthos is highly diverse in both its habitat structure and life forms. These include invertebrates (like shrimps and sea urchins), vertebrates (like fishes), singlecelled animals (protozoans) and prokaryotes (like bacteria and archaea). In coastal waters and estuaries the sea floor is often overgrown with different algae and flowering plants that can form beautiful underwater meadows.

The benthos' diverse life obtains energy in different ways. Some use bacterial growth from chemical energy, such as that found at methane seeps and hydrothermal vents. Hydrothermal vents are cracks in the Earth's crust where very hot water escapes after being heated in the rocks below. These vents are most often found along mid ocean ridges where the plates of the Earth's crust are slowly being pulled apart and molten lava from below forms new crust. The first hydrothermal vent was discovered in 1977 near the Galapagos Islands.

Hydrothermal vents may seem like tough places to live – thousands of metres down in permanent dark ocean, with acidic vent water heated to over 400 degrees C, which contains a toxic cocktail of chemicals that would poison most other life – but bacteria at vents are able to convert water and CO₂ into sugar by using energy from methane and sulphides contained in the vent water. This is known as chemosynthesis.

Tube worms on the sea floor





These chemosynthetic bacteria are present in the waters around vents and also in the bodies of larger animals such as *Riftia pachyptila*, the giant tube worm, which can grow to over two metres tall and has no mouth or gut but instead has a special organ for housing chemosynthetic bacteria. The worm uses its plume of gills to collect the chemicals the bacteria need and receives chemosynthetically produced sugars in return. Since the discovery of hydrothermal vents, chemosynthetic life forms have also been found at cold seeps. These are areas of the seafloor where unheated chemical rich waters, including methane, seep through the Earth's crust into the water column providing chemical energy.

The majority of the benthos' inhabitants are reliant on food originally made in the sunlit surface waters. Plants at the surface use sunlight energy to convert water and CO_2 into sugar (photosynthesis). This sugar is then eaten by animals, moving along food chains, until it is ultimately decomposed back to water and CO_2 .

Because of the importance of the benthos in carbon cycling, and its astonishing biodiversity, researching the benthos is crucial. Scientists use submersibles, remotely operated vehicles and automated observatories to help them study the ocean depths. Recent observations have shown that deep-benthic communities respond to certain climate phenomena, such as El Niño, in a similar way as land-based communities. This means that any climate variations at the sea surface will affect life on the sea floor.