

WHAT ARE COLD SEEPS?



GEOLOGY STUFF: Deep water cold seeps occur on the seafloor close on the margins of our continents at depths ranging between 400 and 8000 m. Cold seeps are usually associated with oil and gas reservoirs under the seabed or subduction zones where one of the Earth's rigid outer plates collides with another and one of the plates bends and sinks under the other, forming a trench. Cold seeps are characterised by seeping of cold fluids containing the chemical methane. Some cold seeps also have high levels of sulphide in the sediments. Both, methane and sulphide play a major role in the survival of animal life at cold seeps.

WHEN WERE THEY DISCOVERED?: Cold seep communities were first discovered in 1984 just off Monterey Bay, California and simultaneously off the coast of Florida in the Gulf of Mexico – 7 years after the discovery of the similar communities surrounding hot water vents on the Galapagos Rift. Since these discoveries, many cold seeps have been discovered on continental margins around the globe. The deepest known cold seep community exists at 6,500m in the Sea of Japan.



WHAT ANIMALS LIVE THERE?: The most common animals found at cold seeps are clams, mussels and tubeworms. The tubeworms often form bush-like clumps and these bushes in turn provide a home for other organisms such as crabs and a variety of sponges, bryozoans, and bristle worms. A new kind of animal was recently discovered on cold seeps in the Gulf of Mexico at ~500m depth. It has been named the "ice worm", *Hesiocaeca methanicola*. It lives in extensive burrows that it excavates in seafloor deposits of gas hydrate – a natural substance of ice crystals with gas inside. Scientists have analysed the stomach contents of these worms and found sediments and large bacterial cells, which could be obtained by grazing hydrate surfaces. However, there is still much more to learn about the nutrition and life history of this animal.



BIOLOGICAL STUFF: The communities that live at cold seeps are related to those found at hydrothermal vents in that many of the animals survive by their close relationship with the bacteria that use chemicals as a food source. Until the discovery of hydrothermal vents, photosynthesis was the best known process for the survival of life on earth. Photosynthesis is a process that ends up in the production of food and that requires light as a source of energy and carbon dioxide as a source of (inorganic) carbon. In cold seep and hydrothermal vent environments, the source of carbon is again carbon dioxide, but the source of energy is chemical, obtained from sulphide or methane emanating from the Earth's interior. This process is called chemosynthesis. The bacteria of cold seeps are found both living freely on the sea floor and may form giant mats, and in symbiotic relationships with animals such as tube worms, mussels and clams. This form of symbiosis is an association between two forms of life from which both organisms benefit – one provides protection in the form of shelter and energy in the form of concentrated chemicals from the surrounding environment and the other (the bacteria) provides dinner!

Image Copyright: C. Fisher, Penn State University, I. MacDonald, Texas A&M, L. Levin, Scripps, D. Bergquist, University of Florida