SEARCHING FOR THE DEEP SUB-SEAFLOOR BIOSPHERE IN THE DEEP SEDIMENT HABITAT

MCKENZIE, JUDITH A. Geological Institute, ETH-Zentrum, 8092 Zürich, Switzerland

In the early to mid-1990's, geomicrobiologists working with samples recovered from drill holes cored by the Ocean Drilling Program (ODP) discovered that bacteria are not only present at much greater depths (750 meters) beneath the deep seafloor than was previously thought but actually thrive there in colossal numbers. The extent of this major biosphere and the nature of the extremophiles living there are essentially unknown. Ocean drilling offers the potential to probe this unexplored world of the deep sub-seafloor, which represents a unique habitat that couples biosphere/geosphere cycles. Exploring down to the base of the deep sub-seafloor biosphere will have important societal implications for new biotechnology applications, for better understanding the generation of hydrocarbons and ore deposits, for defining as yet unknown components of the carbon cycle, and for evaluating the origins of life on Earth and elsewhere. The deep sub-seafloor biosphere requires an initial high input of viable organic matter into the deep-sea sediments in order to maintain a sufficient supply of metabolizable organic matter for continued microbial activity at depth. A continued flux of specific oxidants serving as terminal electron acceptors, such as sulfate ions, would also be essential to promote active metabolism in the deep sediments. An example of an active deep biosphere exists in deep Mediterranean sediments, where there is a close proximity of microbially viable organic matter in buried sapropel layers to underlying Messinian evaporites in relatively young (not deeply buried) sediments. This and other examples of microbial activity in the deep sediment habitat will be presented.