Geophysical Research Abstracts
Vol. 13, EGU2011-5099-1, 2011
EGU General Assembly 2011

The deep biosphere - a European challenge

Bo Barker Jørgensen (1) and R. John Parkes (2)

(1) Center for Geomicrobiology, Department of Biological Sciences, Aarhus University, Ny Munkegade 116, DK-8000 Aarhus C, Denmark (bo.barker@biology.au.dk / +4589422227), (2) School of Earth, Ocean and Planetary Sciences, University of Cardiff, Main Building, P.O.Box 914, Cardiff, CF10 3YE, United Kingdom (ParkesRJ@cardiff.ac.uk)

Marine sediments hold the largest organic carbon reservoir and the majority of all microorganisms on our planet. A significant fraction of the living biomass on Earth is thriving beneath the seafloor, and microbial cells are recorded down to a sediment depth of 1.6 kilometers with an age exceeding 100 million years. The discovery of a diverse and active sub-seafloor microbial community, both in deep sediments and in crustal rocks, has fundamentally changed our perception of life on Earth. This research is, however, only at its beginning. It is not yet resolved which of the two domains of prokaryotic life, bacteria or archaea, predominate in the subsurface or what the role of eukaryotic microorganisms or viruses may be. Similarly, the geodynamic processes fuelling biological activity, and how these processes impinge upon the emission of geofuels, hydrocarbon formation and other resources, need to be understood.

Exploration of sub-seafloor life offers an unmatched opportunity to explore the fundamental processes and mechanisms that have determined and continue to drive the evolution and dispersal of life on Earth. Resource availability deep beneath the seafloor imposes constraints on microbial growth and dispersal patterns that differ greatly from the surface world. Processes that mediate microbial evolution and diversity may also be very different in these habitats, which approach and probably pass the extreme limits of life. Communities in parts of the deep subsurface may resemble primordial microbial ecosystems, and may serve as analogues of life on other planetary bodies such as Mars or Europa that have, or once had water.

Deep drilling of marine sediments and igneous crust offers a unique opportunity to explore how life persists and evolves in the Earth's deepest subsurface ecosystems. The exploration of the deep biosphere has been recognized as one of the three main focus areas of the Integrated Ocean Drilling Program, IODP. Since 2003, the European Consortium for Ocean Drilling Research (ECORD) has joined the IODP and is responsible for operating the mission-specific platform expeditions in challenging environments such as shallow or ice-covered seas. European research groups are among the leading pioneers in deep biosphere research of the IODP, yet these groups have not been well organized and have therefore not had the optimal impact to direct its program and drive its science. The Deep Biosphere initiative of the Deep Sea and Sub-Seafloor Frontier (DS3F) project aims to: a) coordinate the European deep biosphere research, b) develop sub-seafloor sampling strategies for enhanced understanding of deep-sea and sub-seafloor processes, and c) provide a comprehensive "white paper" for future exploration and sustainable use of the deep oceans.