Limits of Life

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Background:
Microbial life is widespread in marine sediment, which cover more than two-thirds of the Earth's surface. Estimates show that prokaryotes of sub-seafloor sediment constitute as much as one-third of Earth's total living biomass and about 90% of all prokaryotic organisms (Whitman et al. 1998). Despite the ubiquity of life in the deep Sub-Seafloor biosphere, little is known about it in terms of metabolic activities, community composition, variation from one environment to another and its relation to the photosynthetic surface world (D'Hondt et al. 2004).

Several meters below the seafloor, population sizes are still large (10^5-10^8 cells per ml), yet the energy flux available for the microorganisms is very low (Parkes et al. 2000; D'Hondt et al. 2004). Accordingly the metabolic rates are 10^3-10^5 times lower than in near-surface sediments (Parkes et al. 2005) and it has been estimated that the mean generation times range from years to thousands of years (Whitman et al. 1998).
It remains poorly understood how accessible organic matter is as energy and carbon sources for the deep Sub-Seafloor microbial communities. Within the past decade there has been growing evidence that bacteria themselves play an important role in the formation of organic matter that accumulate over longer biological time scales in marine sediments (Pedersen et al. 2001; Grutters et al. 2002; Lomstein et al. 2006; Lomstein et al. 2009), but the actual time scale of their degradation still remains unresolved.

Methods:
Bacterial activity, biomass, and their role in the preservation of organic matter in the deep Sub-Seafloor are investigated by quantification of diagnostic cell compounds uniquely produced by bacteria and by analysis of the sedimentary amino acid composition (see e.g. Lomstein et al. 2009).

Possible projects:
In the coming years I have planned research in the following areas:
- Deep sediment from the tropical Pacific Ocean
- Deep sediment from the Arctic Bering Sea
- Deep sediment from our local key site in Aarhus Bay
- Deep sediment from the Juan de Fuca Ridge, in the North-Eastern Pacific Ocean