

# Biannual report VISTA 2011\_July 15<sup>th</sup> 2011

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Project duration: 01.03.09 – 29.02.12  
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Project number: 6501

## Object

The main goal of this project is to use cutting-edge metagenomic and metaproteomic technologies on deep arctic hydrothermal systems to characterize the diversity, physiological potential and adaptive features of archaea and bacteria in these habitats. Samples from unusual and pristine environments of the Arctic will be compared to those from cold methane seeps at the Nyegga region. We expect the presence of highly diverse populations of extremophilic archaea and bacteria, defined as organisms that can thrive optimally in habitats that are hostile for human life as elevated temperatures (up to 110°C), high pressure in the deep sea (up to 1000 bar) and extremes of pH (0-12). It is well-known that enzymes derived from extremophiles (extremozymes) are superior to the traditional catalysts because they can perform industrial processes even under harsh conditions, under which conventional proteins are completely denatured.

The sub-goals are:

- 1) Explore the phylogenetic diversity and physiological potential of bacteria and archaea in sediment samples from the Nyegga region using 16S rDNA amplicon analysis.
- 2) Study the functioning of the microbial communities in cold seep cores using comparative metagenomics and proteomics
- 3) Sampling at Loki's castle and construction of metagenomes
- 4) Screening of metagenomes for novel biocatalysts and enzymes involved in novel metabolic pathways
- 5) Extraction and identification of expressed proteins in samples from where metagenomes have been constructed
- 6) Writing of papers and synopsis

## Status:

Subgoal 1: One paper describing the fine-scale variation with depth of microbial communities below white microbial mats within Pingo structures in the G11 pockmark Nyegga, is accepted for publication in FEMS Microbiology Ecology. (see below). Another manuscript is in preparation describing the microbial communities within and above methane sulfate transition zones in deeper sediment horizons in a core taken just outside the rim of the G11 pockmark.

Subgoals 2 and 5: Tools for integration of metagenomic and metaproteomic data have been developed. One manuscript entitled "Integrated metagenomic and metaproteomic analyses of an ANME-1 dominated community in marine cold-seep sediments" has been submitted for publication with Roalkvam as second author. A similar approach has been used for studying the functional properties of communities dominated by ANME-2.

Subgoals 3 and 4: The metagenomic data obtained from microbial mats situated on deep sea hydrothermal chimneys at Loki's Castle the arctic mid-Ocean ridge are currently annotated and the biotechnological relevance explored.

Sub-goal 6: One paper is accepted, one submitted and two more manuscripts are in preparation.

Deviations from targets: All experimental data have been generated. There will be a focus on writing manuscripts and submission of these. The data obtained are complex and time is needed for analyses and interpretations. Thus, the submission some of the manuscripts may be delayed.

**Publications:**

Roalkvam, I., Jørgensen, S-L., Chen, Y., Stokke, R., Dahle, H., Hocking, W-P, Lanzen, A., Haflidason, H., and Steen. IH. New insight into stratification of anaerobic methanotrophs in cold seep sediments. FEMS Microbiology Ecology In press.