Master Thesis in biology, microbiology

Title (working title): **Diversity deep and cold. Characterisation of permafrost cores from Svalbard**

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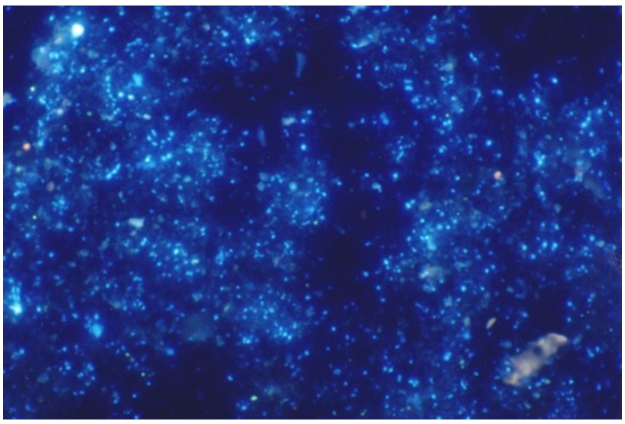
Research group:
Marine microbiology

The microbial ecology of The Arctic is intrinsically fascinating: the low temperatures, extreme seasonality are striking and yet this is a biologically active environment in which nutrients are turned over and pollutants are degraded. However the study of the Arctic has gained a new urgency as it is, and will remain, the most rapidly warming region on the planet. The microbial world will mediate much of the anticipated change. There is a ticking “time bomb” buried in the Arctic tundra. There are enormous quantities of naturally occurring greenhouse gasses trapped in ice-like structures in the cold northern muds and at the bottom of the seas. These ices, called clathrates, contain 3000 times as much methane as is in the atmosphere. Methane is more than 20 times as strong a greenhouse gas as carbon dioxide.

The microbial community is central to one of the most disturbing aspects of this warming: the fate of the 400 gigatons of methane locked in the frozen arctic tundra. The microbial community constitutes a lock, currently in a closed position, on these reserves of carbon and the fate of this reservoir. It is correspondingly desirable to understand the nature of this lock, which in turn implies a predictive understanding of the microbial ecology of Arctic soils in our present environment and in a putative and uncertain warmer future. Microbes also mediate localized perturbations.

While there are approximately 1.000.000.000.000.000.000.000 (10^{21}) stars in the universe, it is thought that there are 1.000.000.000.000.000.000.000.000.000.000 (10^{30}) bacteria. “Microbiological diversity is an unexplored area of astronomical proportions.



The picture seems to depict astronomical objects, but is 1 gram of earth that has been treated with a fluorescent pigment that attaches itself to DNA. (Photo: Lise Øverås)

The tundra and permafrost are full of biological diversity – and much of it is still undiscovered. Changes in the climate could cause much of this diversity to disappear, before we find out what's there.

Melting ice creates more methane.

Tundra and permafrost constitute a large part of the global terrestrial biotopes. It will be important to have a better understanding of the microbiological diversity that is hidden here.

Bacteria are responsible for most of the primary production in the tundra. Both carbon-setting (photosynthesis, the production of methane and methane oxidation) take place in the tundra, and nitrogen is also produced there. In many ways, the tundra works as a lid. Much of the world's methane is locked inside the permafrost. We get climate gas emissions when the tundra begins to thaw out.

For this master project we have started to analyse a pemafrost core from Adventdalen in Svalbard . These sample shave been processed and will be analysed to follow the fate of methane and CO_2 as a consequence of temperature increase in the arctic. The project is in collaboration with researchers at Berkeley Lab, California, and Center for Permagfrost studies. Most of the work will be molecular biology and bioinformatics methods.