Degree Project Master programme

Subject Field: Ecology, Biogeochemistry, Marine

Title: Morphological diversity and carbon density of Arctic prokaryotes

Project period: Spring 2024. 30 credits.

Background: Cell volume is used to calculate the carbon density and thereby biomass of Bacteria and Archaea (prokaryotes), important variables in the Arctic Ocean carbon cycling. The prokaryotes in the Arctic Ocean are unique as adapted to survive at sub-zero temperatures. Specific cell morphologies in the natural communities are selected based on predation pressure and nutrient limitation, but reports of morphologies from marine ecosystems are limited. As 99% of the microbial isolates are still uncultured from diverse environments, their vast morphological diversity and roles are still unknown. Prokaryotes have distinct cellular shapes ranging from coccus, spirals and rods of different curvatures. They also produce a variety of morphological features such as pili, flagella, extracellular material and membrane vesicles. In the present work, the prokaryotic morphologies and biovolume from the Arctic Ocean will be analysed by electron and epifluorescence microscopy down to 500 m depth.

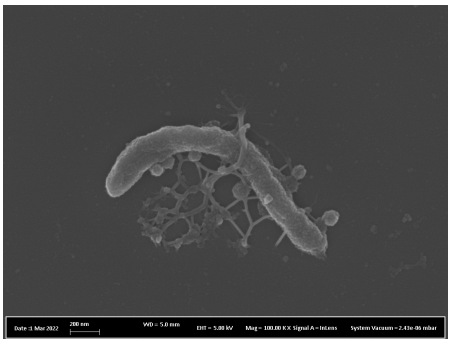

Figure 1. Electron micrograph of a marine prokaryote from ice-sea interface with the morphology of a curved-rod. A complex mesh network of stalks and attached membrane vesicles can be seen.

Overall aim: Determine the role of Arctic prokaryotes in the Arctic Ocean carbon cycling

Research question: Are there any specific morphological diversity with respect to specific growth rates and depths of Ocean?

Method: Analysis of morphological features will be done using Scanning electron microscopy (SEM). Together with SEM, the elemental composition will also be analysed using energy dispersive X-ray analysis (EDX). Cell biovolume and cell numbers will be determined by epifluorescence microscopy. Results will be analysed from different depths and sea basins using statistical tests.

Workplace: Dep. of Ecology and Environmental Science, Umeå Core for Electron Microscopy (UCEM) and Umeå Marine Sciences Centre (UMF), Norrbyn. Public transport to UMF is available and accommodation at the UMF hostel free of charge is also possible during field work.

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