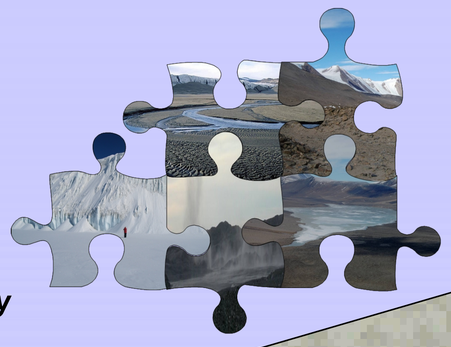
Integrated biodiversity and elemental stoichiometry across the McMurdo Dry Valleys, Antarctica

Marie Šabacká & John C. Priscu

Department of Land Resources and Environmental Sciences, Montana State University Bozeman, MT, USA, 59717

contacts: maries@montana.edu, jpriscu@montana.edu



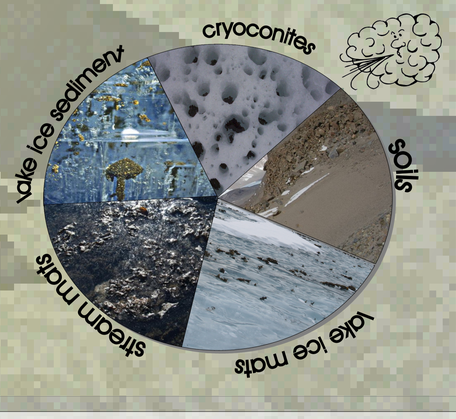
Overreaching hypothesis

Due to the prevailing strong winds, microorganisms in the McMurdo Dry Valleys are randomly distributed across landscape

1. Introduction

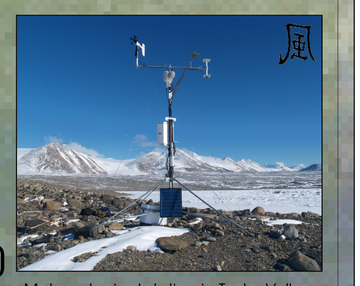
The McMurdo Dry Valleys (MCM) of Antarctica are considered to be the driest and coldest desert on Earth. The landscape of the MCM represent a mosaic of permanently ice-covered lakes, ephemeral streams, exposed soils and glaciers. The biology of each of these landscape units is dominated by microorganisms. We contend that aeolian transport during strong katabatic winds is the primary dispersive agent of organisms and associated organic matter among the MCM landscape units. Given the relatively low and seasonal growth rates observed for the microorganisms within this environment, their overall distribution should be controlled to a large degree by the physical environment. The goal of our study is to test the hypothesis that biodiversity among the landscape units of MCM is controlled by aeolian transport of organisms and that particulate C:N:P ratios (an indicator of active growth) do not change across landscape units.

McMurdo Dry Valleys (MCM)

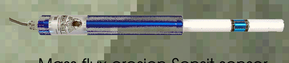


2. Methods

- Collection of samples from many different microbial habitats throughout three different MCM Valleys: Taylor, Wright and Garwood
- Microbial diversity assessment using spectral fluorescence of chl-a, light and fluorescent microscopy, and molecular techniques
- Elemental stoichiometry (C:N:P ratios)
- Evaluation of basic physico-chemical properties of studied environments
- Determination of direction and magnitude of aeolian flux within Taylor Valley and its role for dispersal of micoorganisms
- Statistical evaluation



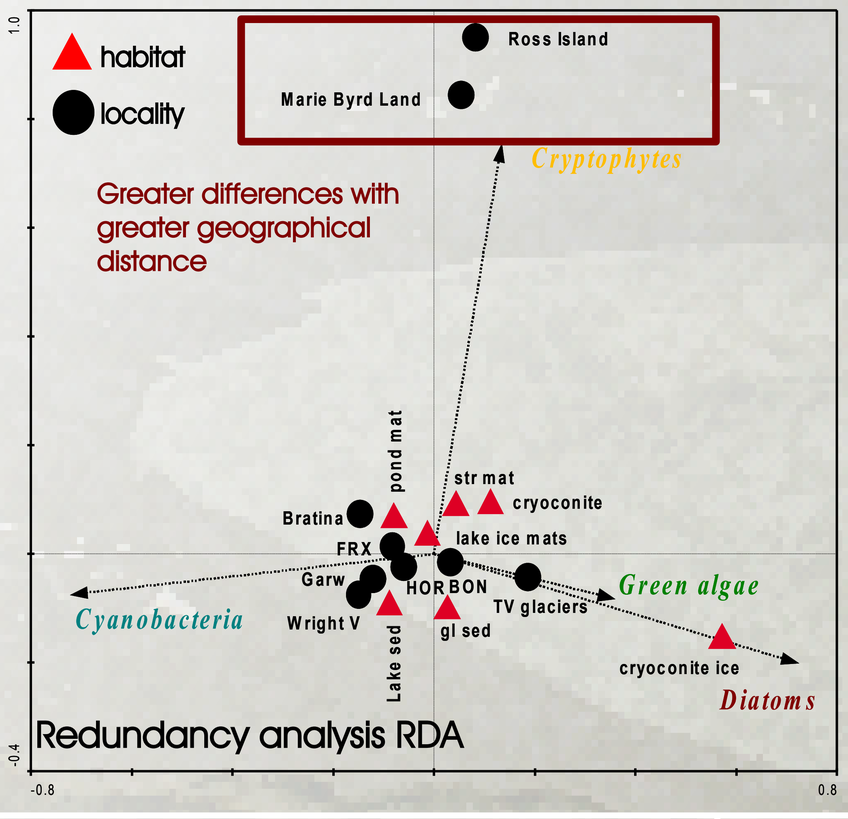
Meteorological station in Taylor Valley



Mass flux erosion Sensit sensor

Aeolian material collector

3. Results

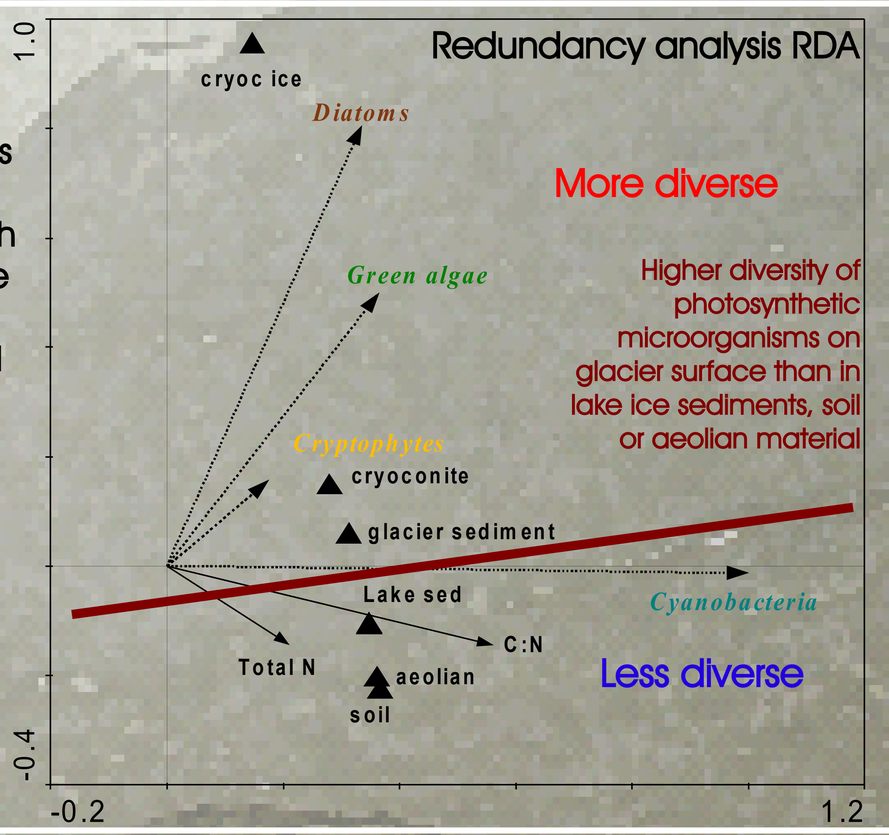


Diversity of photosynthetic microbes

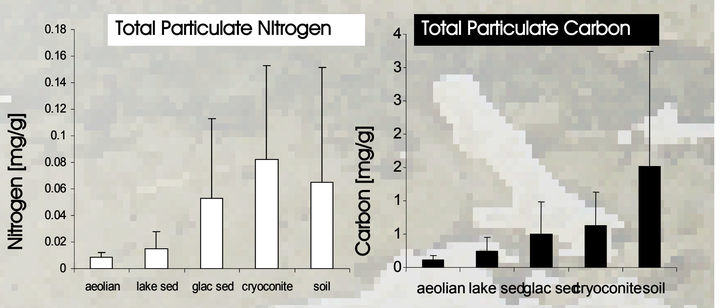
Determined using microscopical techniques and an instrument Fluoroprobe that evaluates spectral fluorescence of chl-a with assessory pigments, which allow us to place organisms into functional groups: cyanobacteria, cryptophytes, diatoms and green algae.

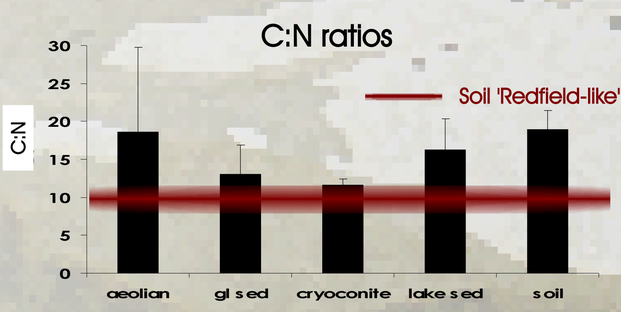
All habitats throughout localities in MCM and other parts of Antarctica

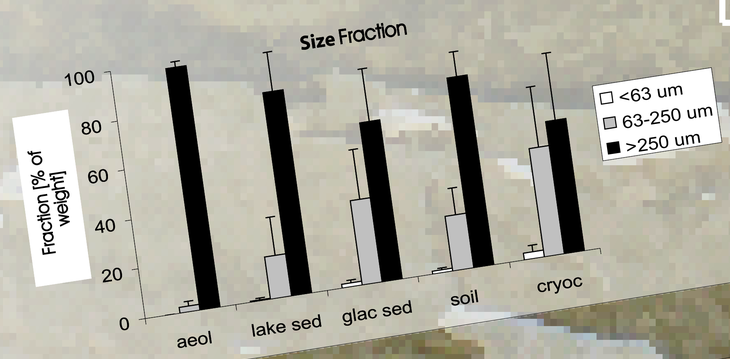
Soil/sediment habitats from Taylor Valley



Basic stoichiometry

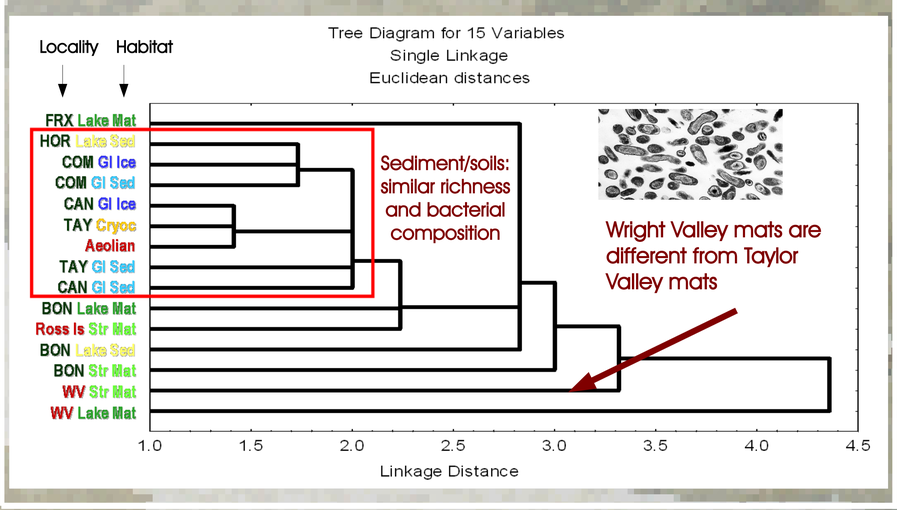




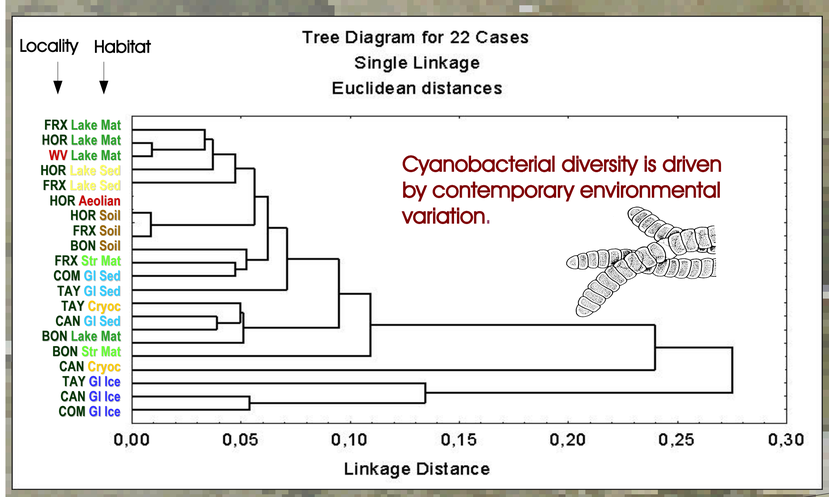


Molecular diversity

Cluster analysis of DGGE banding profile of partial bacterial 16S rDNA extracted from collected samples



Cluster analysis of DGGE banding profile of partial cyanobacterial 16S-ITS rDNA



Glacier habitats: finer texture, higher C and N content and lower C:N ratio than lake ice sediment and aeolian material

4. Conclusion

Microorganisms in the MCM are not randomly distributed across landscape and therefore we can reject our overreaching hypotheses that their spatial distribution is mainly controlled by wind dispersal. Conversely, the distribution of microorganisms in the MCM reflects strongly the effect of contemporary environmental factors and to some degree the effect of lingering historical events (geographical distance).

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