Microbial Diversity Across Landscape Units In The McMurdo Dry Valleys, Antarctica

Preliminary Results

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1. Background

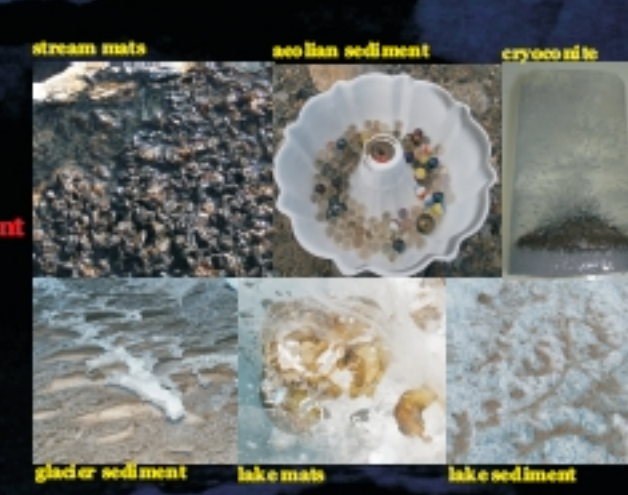
The McMurdo Dry Valleys of Antarctica (MCM) comprise the largest ice free area in Antarctica and are considered to be the driest and coldest desert on Earth. The landscape of the MCM consist of a mosaic of bare soils, perennially frozen lakes, ephemeral streams and glaciers . Despite the harshness of the environment, microorganisms persist in soils, lakes, streams and on glacier surfaces. Preliminary evidence implies that microbial diversity in MCM is extremely low (e.g. Priscu et al. 1999) allowing relationships between ecosystem function and diversity to be characterized more readily than is possible in more diverse ecosystems.

Strong katabatic winds that transport sediment composed of sand (50 to 1000 µm) and silt/clay (< 50 µm) is an important transport feature of MCM environment (Lancaster 2002). Wind is believed to be the main process redistributing organic matter in the MCM soils and for depositing sediment and associated organic matter to the permanent ice surface of the lakes (Fritsen et al. 2000). Studies of lake-ice microbial assemblages (Priscu et al. 1998, Gordon et al. 2000) and cryoconites (Christner et al. 2003) within the MCM have shown that the stream mats provide the biological seed to these environments (Priscu and Christner 2004). Recent studies also revealed the importance of wind dispersal of invertebrates in MCM soils (Nkem et al. 2006).

Despite the apparent importance of wind dispersal as a factor controlling the distribution and diversity of life in the MCM ecosystem no comprehensive research effort has been made to study the role of aeolian processes on microbial diversity and function in polar desert ecosystems.

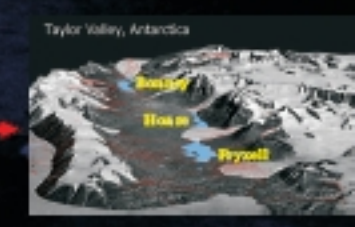
2. Null Hypothesis

- biodiversity among the landscape units of MCM (glaciers, lakes, streams and soils) is controlled by aeolian transport of organisms
- particulate C:N:P ratios do not change across landscape units in MCM
- stream and lake microbial mats are an exception: bulk liquid water during the summer allows growth rates that exceed the rate of aeolian dispersal



3. Material & Methods

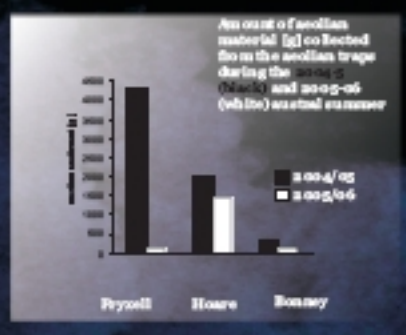
- collection of samples from soils, cryoconite holes, glacier ice, glacier sediment, lake sediment, lake and stream mats and aeolian sediment
- Diversity of photosynthetic microorganisms using spectral fluorescence of chl-a
- Elemental stoichiometry
- Prokaryotic diversity assessment using DGGE
- Statistical evaluation: Cluster + Redundancy analysis



4. Preliminary Results

Aeolian sediment traps

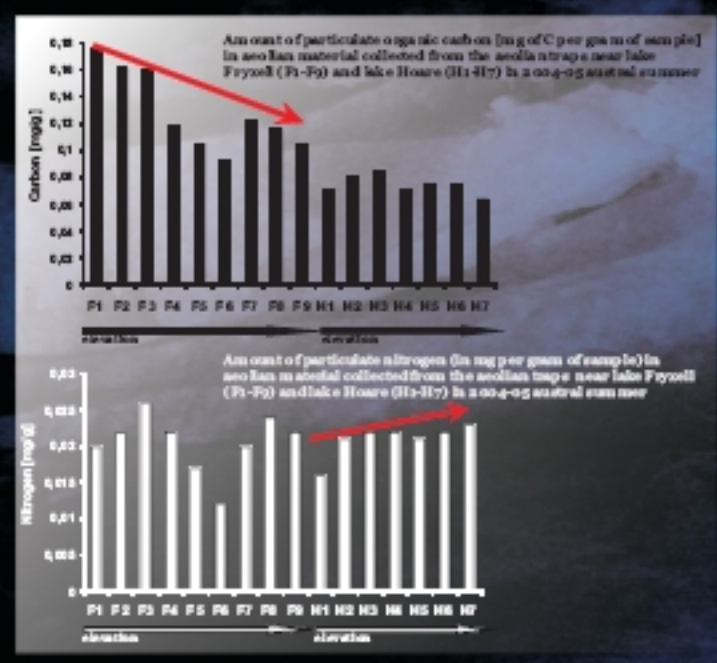
Set of 3 transects of aeolian trap for collection of airborne material were installed on soil near lake Fryxell, Hoare and West Bonney to collect wind-dispersed material



Significant differences in the amount of sediment [g] between 2004/05 and 2005/06 years oobserved at Fryxell

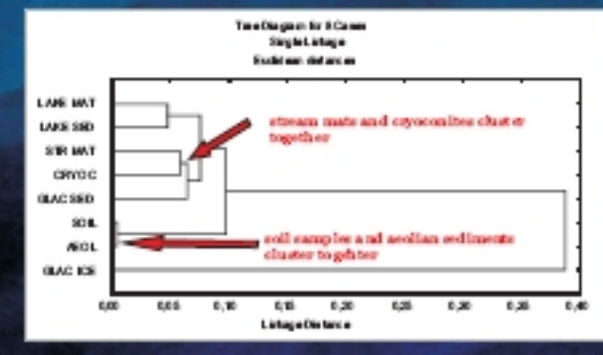
Higher amounts of org. C in low-elevated traps at Fryxell

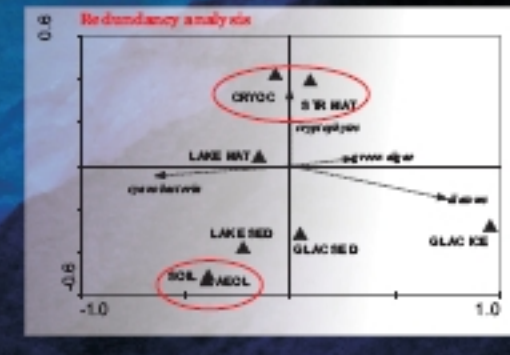
Higher amount of org. N in high-elevated traps at Hoare



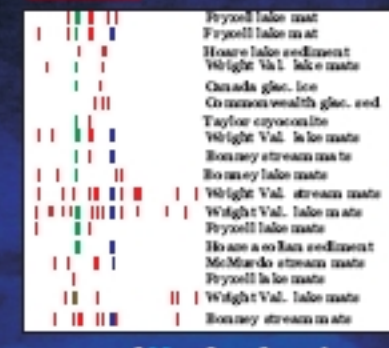
The diversity of photosynthetic microorganisms

Determined using spectral fluorescence of chl-a: allow us to place organisms into functional groups (cyanobacteria, green algae, diatoms and cryptophytes) based on assessory pigment distribution. Similarity in the distribution of these functional groups among different MCM environments was determined using cluster and redundancy analysis





DGGE



green and blue bands: microorganisms found in several different environments including aeolian sediment

References:

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5. Future Plans

Evaluation of elemental stoichiometry in samples from glaciers, lakes, streams and soils

Microbial diversity assessment using denaturating gel electrophoresis on remaining samples

Identification of microorganisms deposited throughout the MCM region by wind

Future installation of aeolian traps on glacier and lake surface

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