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

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 consists of a mosaic of bare soils, permanently frozen lakes, ephemeral streams and glaciers. Despite the harshness of the environment, microorganisms are found 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/dust (50-5 μm) is an important transport feature of MCM environment (Lancaster 2005). Wind is believed to be the main process causing the transport of organic matter in the MCM soils and for depositing sediment and associated organic material to the permanent ice surface of the lakes (Fritsen et al. 2000). Studies of lake-ice microbial assemblages (Priscu et al. 1996, Gordon et al. 2000) and cryoconites (Christensen et al. 2003) within the MCM have shown that the stream and lake sediments provide the biological soil to these environments (Priscu and Christensen 2004). Recent studies also revealed the importance of wind dispersal of invertebrates in MCM soils (Nakata et al. 2006).

Despite the apparent importance of wind dispersal as a factor controlling the distribution and diversity of life in the MCM ecosystem, a 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 ofchl-a
  - Elemental stoichiometry
  - Prokaryotic diversity using DGGE
  - Statistical evaluation: Cluster 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 Bosmy to collect wind-dispersed material

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 assessional pigment distribution. Similarity in the distribution of these functional groups among different MCM environments was determined using cluster and redundancy analysis

DGGE

5. FUTURE PLANS

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

Microbial diversity assessment using denaturing gradient 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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