

Name of research institute or organization:

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**Department of Biological Sciences, Macquarie University, Australia**

Title of project:

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Analysis of bacterial communities in fresh surface snow from Alpine regions

Part of this programme:

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Early Postdoc Mobility Fellowship, Swiss National Science Foundation

Project leader and team:

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Dr. Tina Wunderlin, project leader  
Dr. Michelle Power, Dr. Belinda Ferrari

Project description:

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Snow can be used to analyze the diversity of airborne organisms, as the classic dendritic form of the falling snow crystals efficiently scavenges any particles from the atmosphere (biotic and abiotic). A clear difference between aerially deposited bacterial assemblages at the snow surface and metabolically active bacteria in the snowpack has been shown in the Arctic. Here, we are interested in the comparison of bacterial diversity of high altitude mountain snow from the northern and southern hemisphere. Fresh surface snow samples (maximum 2 days old) from mountains in Switzerland (Jungfrauoch 3450 m.a.s.l. and Rosstock 1400 – 2360 m.a.s.l.) and the Australian Snowy Mountains (1500 – 2080 m.a.s.l.) were collected. All samples were carefully taken using sterile instruments as to avoid contamination. Snow samples were then left standing to melt, and filtered through membranes to collect the biomass. The latter was then subjected to DNA extraction and sequencing of the V1-V3 region of the 16S ribosomal RNA gene. Diversity was detected and analyzed using Qiime and the R software. Selected snow samples were also subjected to cell enumerations using fluorescence microscopy as well as enrichment and isolations of strains on diverse low nutrient media. Cell numbers averaged at  $6.9 \times 10^5$  cells/ml ( $\pm 7.5 \times 10^4$ ). Over 59 isolated strains of fungi or bacteria from 12 different samples were obtained. Paired-end sequencing of the 16S rRNA gene amplicon resulted in over 70'000 sequences from 25 samples, ranging from 543 to 5173 sequences per sample.

Based on isolated strains as well as high throughput sequencing, we detect a great diversity of bacteria in samples from high altitude snow of the Swiss Alps as well as the Snow Mountains in Australia. The sequence data allows the comparison of the bacterial snow populations of a mountain from the northern and southern hemisphere and shows overlap and differences in community compositions according to geographic location (Swiss snow communities similar to each other than to Australian snow communities). Also, the data provides insight into differences in bacterial populations across altitudinal gradients of the mountains. With the isolated strains, further studies on the survival mechanism and metabolisms of snow bacteria can be conducted. Knowledge on microbial diversity in snow from high altitude mountains is still very limited due to accessibility issues as well as only recent technological developments to analyze samples with extremely low biomass. To our knowledge, this is the first bacterial high-throughput sequencing dataset of snow from mountains of both hemispheres. Not only does this research provide an inventory of bacterial diversity in alpine snow but it provides answers to the geographic distribution and the origins of bacteria in snow.

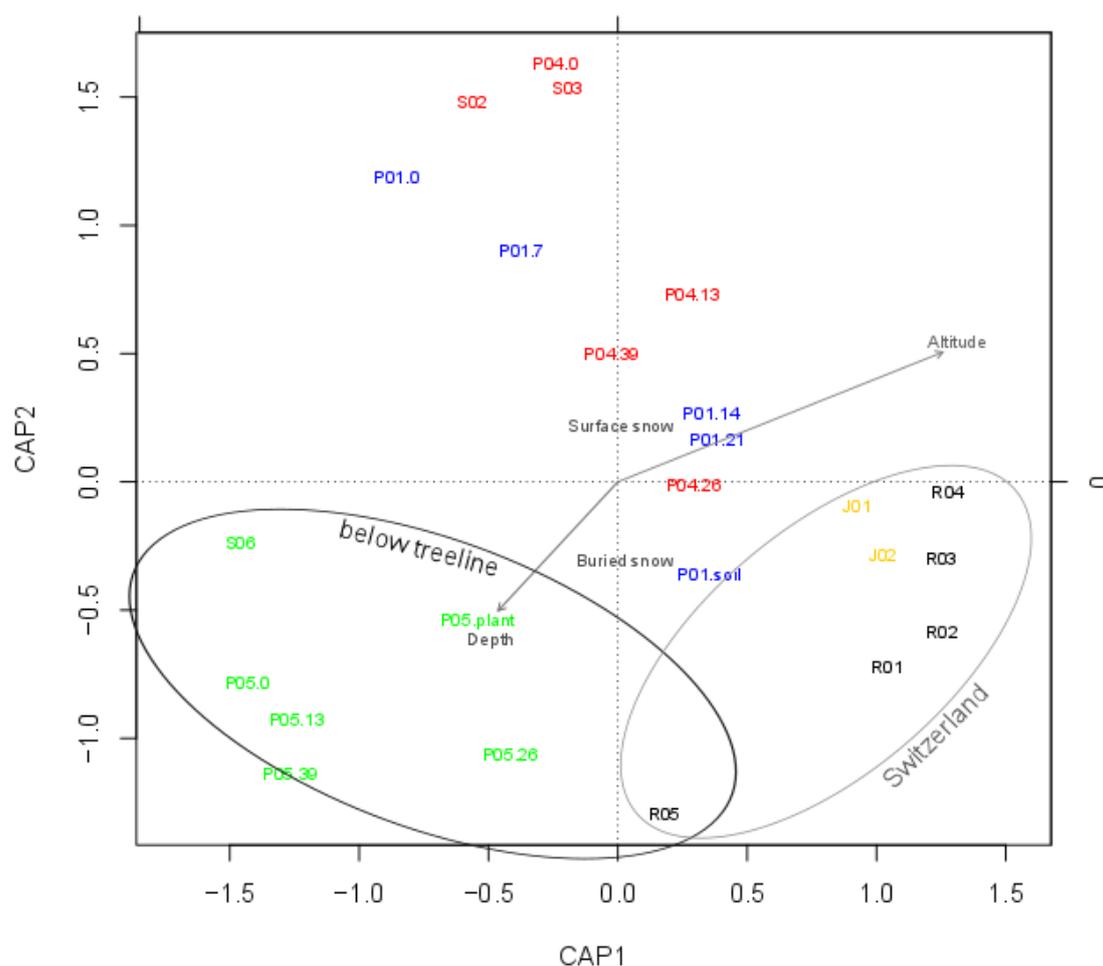


Figure 1. Principal coordinates analysis of bacterial sequencing data. The graph shows community similarity of bacteria in Swiss snow samples (black and yellow) as opposed to a larger variation in bacterial community assemblage in the snow from Australian mountains (blue, red and green).

Key words:

Bacterial diversity, snow, alpine, 16S rRNA gene, community structure, altitude

Internet data bases:

Bacterial sequences from snow can be accessed via Sequence Read Archive (SRA),  
<http://www.ncbi.nlm.nih.gov/bioproject/PRJNA304036/>

Scientific publications and public outreach 2015:

**Refereed journal articles and their internet access**

Wunderlin, T., B. Ferrari, and M. Power, Global and local-scale variation in bacterial community structure of snow from the Swiss and Australian Alps, *FEMS Microbiology Ecology*, in review.

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