Microbial diversity throughout ice sheet melt season

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Michaela Musilova during fieldwork on the Greenland ice sheet

Researchers in the School of Geographical Sciences recently published the first ever study of the effects of snow and wind on the ecology of micro-organisms on the Greenland Ice Sheet.

The study, by PhD researcher Michaela Musilova and colleagues, appeared in *Frontiers in Microbiology*, which publishes articles on outstanding discoveries across a wide research spectrum of microbiology.

Glaciers and ice sheets cover around 11 per cent of the global surface and are dominated by microbial life. Debris-filled holes on the glacier surface, called 'cryoconite holes', are considered 'hot spots' for microbial activity in these environments. Glacial micro-organisms are believed to be a significant source of nutrients to downstream subglacial and coastal ecosystems. The microbial recycling of nutrients in these icy ecosystems can therefore have a regional and potentially global impact.

Despite their importance, there have been very few molecular studies of the microbes on the vast Greenland Ice Sheet (GrIS). It is thought that glacial microbial communities originate from nearby environments, for instance delivered to glacier surfaces by wind. Musilova and colleagues set out to study the effects of microbial cells in snow and windborne debris on the microbial communities on the GrIS. This was also the first time the evolution of these microbial communities was assessed throughout a whole summer season on the GrIS.

Musilova performed a variety of experiments for the project, working with researchers from the Universities of Bristol, Edinburgh, Leeds and the Woods Hole Oceanographic Institution. The project was part of an expedition in Greenland, during which the researchers camped near Leverett Glacier over the entire summer of 2012. The team also collaborated with the NERC Isotope Geosciences Laboratory (British Geological Survey) to analyse the organic matter that is delivered to glacier surfaces through snow and wind.

Cryoconite holes (microbial habitats on glacier and ice sheet surfaces)

Small amounts of microbes were found to be delivered by wind and snow to the GrIS surface. However, the bacteria dominant in the aeolian (wind and snow) samples did not establish themselves in the GrIS microbial communities. On the contrary, it was shown for the first time that these communities remained stable throughout the summer season.

Commenting on the results, lead author Musilova said: 'This information is very useful for future studies of microbial diversity on glaciers. Researchers will be able to collect samples over short expeditions, instead of having to spend many months monitoring glacial ecosystems as we did in 2012.'

The researchers also observed that microbial processes on glaciers are very important in transforming aeolian organic matter. In fact, the microbial communities on the GrIS were continuously producing and recycling organic matter over the summer, proving that indeed they are significant contributors to biogeochemical nutrient cycling on glaciers.

More information: "Stable microbial community composition on the Greenland Ice Sheet" *Front. Microbiol.*, 20 March 2015. DOI: 10.3389/fmicb.2015.00193

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