

● Microbes and meltwater

Field studies investigate glacial retreat

The outlet glaciers which drain the Greenland Ice Sheet, calving fleets of icebergs into the Arctic ocean, are now thinning and retreating at a dramatic rate.

This is due not only to enhanced melting from increased atmospheric and oceanic temperatures, but also 'feedback' processes, the true impact of which remains undetermined.

With the Society's support and that of the Gilchrist Educational Trust, two leading scientists have been investigating the effects of distinct phenomena affecting melting ice-sheets' vulnerability to warming.

Andy Hodson, a specialist in glaciology from the University of Sheffield, received our [Peter Fleming Award](#) in 2009 for his research into the existence of microorganisms across the world's glaciers and ice sheets. Every litre of glacial meltwater contains up to 1 million microbial cells which are released each spring and summer when the ice thaws.

Collaborating with a multi-disciplinary team from the UK, Norway and Russia to study glaciers at differing stages of melt in High Arctic Svalbard and Greenland, Andy is amongst the first to examine glacial retreat as a combined physical and biological process.

His work reveals that glaciers are thriving ecosystems, and that the microbes which colonise these vast expanses of ice may actually be accelerating their melting. Trapping wind-blown particles and other debris which would otherwise be washed away, the micro-organisms form dark patches called 'cryoconite'. The change in colour of the ice surface means that more of the sun's energy is absorbed, melting it more quickly.

To test their ideas, Andy and the team incubate microbes on the surface of the ice. They employ modern DNA methods and microscopy to study how cryoconite forms and to directly observe why it persists upon the ice by influencing its surrounding habitat.



Their results have shown that in some areas, this has been enough to increase the absorption of solar radiation by more than 30%, causing a corresponding increase in surfacemelt and water run-off. The impact made on the movement of the ice-sheet by these huge volumes of meltwater, which form large lakes of up to 5km wide on its surface, is Alun Hubbard's particular passion. A glaciologist from Aberystwyth University, Alun has been leading an international field-campaign in Greenland investigating the process by which surface meltwater drains down through the ice-sheet and lubricates the bed where it meets the underlying rock. This reduces friction and accelerates the ice-sheet's movement, ultimately increasing its vulnerability to warming and further meltwater production.

Alun first began work in Greenland in 2007, with a project using high-precision GPS data to monitor the movement cycle of the ice-sheet, and was startled by his findings: "The velocity cycles we observed were just remarkable", he remembers. "This behaviour was characteristic of alpine glaciers less than a few 100 metres thick. For it to occur on the Greenland Ice Sheet was something very new. We really had to try to understand what was happening."

Supported by the [Gilchrist Educational Trust Award](#) in 2008, a grant the Society administers, Alun has been conducting detailed glaciological, geophysical and meteorological research into this hydraulic phenomenon ever since, allowing him to predict the response of the ice-sheet to future warming



scenarios. He has now secured more than £1.2 million of funding from the UK Natural Environment Research Council and commercial sources to continue his round-breaking research for the next three years.

Andy and Alun's innovative scientific expeditions and field studies are just two of more than 65 projects the Society has selected to support in polar regions in the past five years.

We are open to ideas for projects anywhere in the world, making more than 80 funding awards every year within our programme of 23 grants.

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