Landscape Change and the Biogeochemistry of Svalbard Rivers

Andy Hodson, Department of Geography, University of Sheffield, UK

Glaciers and permafrost are key agents that fashion the composition of Svalbard rivers because they control the production and availability of reactive fine sediments for weathering reactions. The fine sediments are also the locus of significant microbial activity, even in glacial tills where organic matter availability is far lower than is the case for permafrost sediments. For these reasons, and against many peoples' expectations, microbially-mediated rock weathering dominates the anionic composition of Svalbard's glacier-fed rivers soon after the onset of snowmelt runoff. The processes by which this is achieved, along with the importance of other abiotic processes that govern the composition of Svalbard rivers, will therefore be described. The sensitivity of glacier and permafrost thermal regimes to climate change will also be discussed. This is because there are unexpected changes in glacier thermal regime of great potential significance to runoff biogeochemistry on account of the fact that many valley glaciers in Central Spitsbergen are freezing to their beds and becoming dominated by cold ice. The loss of temperate ice from Svalbard glaciers has great consequences for subglacial weathering reactions, and might also lead to significant changes in the recharge of ground water aquifers. Further changes to ground water dynamics include the effects of permafrost thaw upon ground water discharge into lowland rivers. It will be shown that there are significant aquifers lying beneath the permafrost which are already releasing highly mineralised, typically anoxic waters into valleys systems via a small number of discrete, perennial springs. However, establishing how the flux of sub-permafrost groundwater into surface waters might change in the near future is fraught with uncertainty. The Svalbard landscape is therefore ideal for addressing the challenges associated with trying to understand climate change impacts upon aquatic biogeochemical cycles in the Arctic.