Copper exportation from glaciarised catchments

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Glacial streams are remarkable ecosystems and have been studied since the last thirty years because of their unique and interesting features. First, they are the simplest way of understanding subglacial hydrology and the chemical and physical weathering taking place beneath glaciers (1,2). Water quality studies allow assessing the contribution of these systems to global geochemical cycling of elements, their influence on aquatic environments (3) and even on global climate changes (4). Finally, it should be borne in mind that glaciers and their meltwaters are the chief water reservoirs in mountainous, temperate areas, which makes their characterisation important for both human consumption and industrial exploitation.

Regarding the characterisation of ice stream components, early studies focused their attention on major ions and tried to evaluate the extent of chemical weathering taking place below glaciers (see the review by Brown for a collection of these papers (5)). Only in the last decade (3) were the first papers published regarding trace metal concentrations and fluxes in glaciarised catchments. Apart from total metal fluxes, particular importance was given to the form in which trace metals are transported. Their fractionation between suspended matter and solution was assessed: moreover, their inorganic speciation in the latter phase was computed by a speciation software. Organic speciation has to be taken into account until recently, when the presence of strong organic ligands for copper in one Alpine ice stream was demonstrated (6), opening the possibility to better understand trace metal behaviour in glacier meltwaters. Competitive ligand equilibration with cathodic stripping determination of the labile fraction (CLE-CSV) was used as the speciation method. Aim of this poster presentation is to portray the results obtained from the analysis of four more Alpine glaciated catchments, with a four year record of one catchment. This study highlighted the presence of very strong natural ligands for copper in all of the investigated glaciarised basins. The presence of these ligands in ice streams completely changes the copper speciation and suggests that this metal is completely complexed in these ecosystems. This feature is common to other remote ecosystems, like open ocean waters and high altitude and latitude lakes. The origin of these complexants could be due to the biological activity at the ice-bedrock interface. If this hypothesis is correct, biota plays a major role in favouring exporting copper ions (and possibly other trace metals) from glaciarised catchments, preventing the scavenging of copper ions. In the absence of such ligands, copper ions could be adsorbed onto suspended particles and removed by sedimentation.

References

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