SURVIVAL AND LIVING IN ICE: CULTIVATION-INDEPENDENT IDENTIFICATION AND PHYLOGENETIC RELATIONS OF MICROORGANSIMS FROM YOUNG GLACIER ICE

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Cells which survive in ice at temperatures well below freezing shut off their metabolism and simply rest as inactive stages. These can quickly return to active life as soon as liquid water becomes available. As a result of the search for life on Mars and on the Jupiter moon Europa, interest is again being focused on microbes living and surviving at the low side of temperature extremes. Our investigation has revealed an astonishing diversity of life near and below freezing temperatures and the relation of some species to organisms found in polar ice caps.

We have examined the presence of indicators for microbial life in recently formed glacial ice. The sampling took place on the Jungfraufirn glacier in November 2003. Ice cores (1 m long, diameter 90 mm) were recovered from granular ice-layers below a snow cover of approx. 1.3m and pieces of 20 cm length were packed into sterile water tight bags for transport and storage.

The identification of "ice organsims" was based on rRNA-gene analysis. After DNA had been extracted from melted ice the templates were amplified with archaeal, bacterial and universal primer pairs employing the Polymerase Chain Reaction (PCR). PCR products were cloned in order to separate the different rRNA genes. Restriction enzymes HaeIII and Hinfl were used to fragment the DNA (RFLP) and clones with different RFLP patterns were selected for sequencing. Different prokaryote and eukaryote specific sequences were compared using cluster analysis employing the Phylip program. The results are presented in the form of a phylogenetic tree based on the 16S rRNA gene library offered by the RDP databank.

The origin and the ecological role of organisms whose rRNA-genes have been found in the ice samples is still controversial. It has not been determined whether the DNA stems from organsims which are actually endemic to the ice layers or whether they have accidentially been transported into the remote mountain area and been conserved for a number of years.

Cultivation of the individual species is needed if one intends to assign metabolic functions under the extremes of this habitat to the phylogenetic groups we describe.