



Ecological significance of microbial endokarst communities in groundwater from alpine karst aquifers

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Spring water from two alpine karst aquifers differing in their hydrogeology but with nearby catchment areas were investigated for their bacterial community dynamics. DKAS1 shows high average water residence time and relative constant flow, whereas LKAS2 represents a dynamic hydrological regime and discharge. DKAS1 and LKAS2 show differences in cell counts, biomass and the distribution of morphotypes. Bacterial 16S-rDNA profiles reveal a remarkable stability of the community, with specific clusters for each of the two groundwater aquifers. Furthermore bacterial partial and full length 16S ribosomal sequences from DKAS1 spring water reveal the presence of so far unknown bacterial species. These results provide first evidence for the occurrence of autochthonous microbial endokarst communities (AMEC). For further characterization of AMEC, catalysed reporter deposition fluorescence in situ hybridisation (CARD-FISH) and microautoradiography (MAR) were optimized for this ultra-oligotrophic environment in order to detect and quantify specific prokaryotes. Besides Bacteria, Euryarchaea are a significant component of the active microbial community. By combination with bacterial secondary production measurement, it became possible to evaluate the ecological relevance of AMEC in the considered systems. Principal component analysis, including hydrological, chemical, physical and biological key parameters, monitored during two annual cycles, indicate different controlling mechanisms on bacterial communities in both groundwater systems. Ecological coherences in the dynamic LKAS2 are strongly governed by a dynamic-hydrological component, whereas spring water from the DKAS1 environment reveals a complex relationship

between intrinsic-metabolism components. Furthermore, biofilms were grown directly at the spring outlet to monitor attachment and growth mechanisms. The results indicate that AMEC are one determining factor for biogeochemistry and the resulting water quality. This knowledge is of practical interest as many alpine karst springs are very important water resources throughout the world.