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Stable autochthonous microbial endokarst communities in spring water of two different alpine karst aquifers

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Spring water of two alpine karst aquifers differing in hydrogeology but of nearby catchments were investigated for their bacterial population dynamics. The DKAS1 represents a dolomitic-limestone karst aquifer spring consisting of a high average water residence time and relative constant flow. The LKAS2 constitutes a typical limestone karst aquifer spring showing a dynamic hydrological regime and discharge. DKAS1 yielded constantly lower cell counts and biomasses (median of 15×10^6 cells L^{-1} and 0.22 μg C L^{-1}) as LKAS2 (median of 63×10^6 cells $L^{-1}$and 1.1 μg C L^{-1}) and distribution of rods and coccus shaped cells was also significantly different between the considered systems indicating that hydrogeology exerts a strong influence on microbial parameters. Molecular eubacterial 16S-rDNA profiles revealed remarkable constancy within each spring resulting in significant DKAS1 and LKAS2 clusters. Analysis of a flood event by eubacterial 16S-rDNA profiles in the dynamic LKAS2 system indicated that the bacterial community corresponded well, irrespectively whether spring water samples were taken. Furthermore eubacterial partial and full length 16S ribosomal sequences gained by PCR, cloning and sequencing from the DKAS1 spring water suggest the presence of so far undiscovered bacterial species. For further characterization of the microbial communities, catalysed reporter deposition fluorescence in situ hybridisation (CARD-FISH) and microautoradiography (MAR) were optimized for this ultra-oligotrophic environment, in order to achieve direct detection and quantification of prokaryotic cells. By combination with bacterial secondary production it became possible to evaluate the ecological relevance of AMEC

in the considered systems. These methods will also be applied on aquifer sediments, mobilised during flood events, and on biofilms growing within this systems, to evaluate the significance of attached versus suspended microbes. The presented results provide first evidence for the occurrence of autochthonous microbial endokarst communities (AMEC). AMEC may be considered of relevance for the understanding of alpine karst aquifer ecology, biogeochemistry and resulting water quality as microbes usually mediate the nutrient and energy fluxes in aquatic systems. This is relevant as many alpine karst springs are important water resources throughout the world.