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Biogeochemical characterisation of geothermally used groundwater systems

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One future challenge of human mankind is the exploration and installation of new energy resources being independent of fossil fuels. Therefore, the investigation of alternative energy resources such as deep geothermal energy and energy storage in aquifer systems attracts increasing interest in today geosciences.

The multidisciplinary research project “AquiScreen” investigates the working reliability of geothermal utilization of aquifers, especially, considering microbial activity as well as particle transport and relocation. Of specific interest is the impact of microbial populations on aquifer systems. Therefore, the project integrates microbiological, biogeochemical, mineralogical and petrologic investigations to qualify and quantify the variability of subsurface microbial communities in the fluid and solid phases of geothermal systems. In this presentation we would like to focus on the biogeochemical investigations of different geothermally used shallow and deep groundwater systems.

To examine the microbial communities in such groundwater systems we used specific molecular compounds indicating microbial biomass. Especially, intact membrane phospholipids (PLs) are utilized, because they are only stable in viable intact cells over longer geological time periods and, therefore, can be used as indicators for living microorganisms[1]. We studied the composition and concentration of these membrane lipids being present in filter material of different geothermal plants to document their microbial variability depending on different locations and environmental conditions.

Furthermore, dissolved organic compounds (DOC) being a potential feedstock for microbial life, will be investigated in terms of composition, concentration and carbon

isotopic composition to specify the origin and fate of these compounds in the investigated geothermal systems. Our first preliminary results provide indication of active and diverse microbial communities within the investigated systems.

References:

[1] Zink, K.-G., Wilkes, H., Disko, U., Elvert, M., Horsfield, B. (2003): Intact phospholipids - microbial "life markers" in marine deep subsurface sediments, *Org. Geochem.* 34, 755-769.