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Present and past microbial life in continental salt pan sediments in Southern Africa

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The southwestern African region is characterized by strong climate variability. To get a better understanding on the climate evolution and environmental condition in Namibia and South Africa, terrestrial climate archives are investigated. Since there are almost no lakes, continental salt pans represent the only terrestrial geoarchives with the potential to preserve climate signals during sediment deposition. Climate has a strong impact on the salt pan ecosystem, causing adaptation of salt pan microorganisms to varying temperature, precipitation and salinity conditions. To reconstruct climate variability during the Holocene, the composition, diversity and abundance of indigenous microbial communities with depth and related to different soil parameters are investigated. We are using a combined approach of microbiological and lipid biomarker analyses to demonstrate the response of the microbial communities due to environmental changes. For microbiological analyses outcrops were conducted or short cores (0-100 cm) were drilled at four different salt pans in Aminuis, Koes and Witpan region having rather different geochemical properties. The current work focused on changes within the microbial communities due to the impact of long-term climate variation and the associated environmental changes and is part of the project “Signals of climate and landscape change preserved in southern African GeoArchives” in the scope of the SPACES program, which is funded by the German Federal Ministry of Education and Research (BMBF).

For a quantitative characterization of microbial communities molecular techniques such as polymerase chain reaction (PCR) and real-time quantitative PCR (qPCR) based on the 16S rRNA genes are used. Moreover, 454 sequencing technique is utilized to describe the diversity and abundance of microorganisms in detail. Soil parameters are described by standard soil scientific methods. Furthermore, microbial lipid biomarker analyses were done to characterize living and past microbial biomass in relation to climate change. The distribution of bacteria and archaea in salt pan sediments is strongly correlated to the abundance of total organic carbon (TOC), which varied between 0.2 and 1.5%. Gene copy numbers of bacteria and archaea decrease with depth. In the upper 10 cm of the different salt pan sediments 10^4 to 10^6copies g^{-1} soil are quantified, while gene copy numbers decrease with depth down to 10^3 copies g^{-1} soil. In general, gene copy numbers of bacteria are higher than those of archaea and they show a similar pattern in different salt pan sediments. TOC values increase due to higher terrestrial input and the increase coincides with a shift within the microbial community.