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How lively are volcanic hot spring environments? In situ field analysis from Kamchatka, Russia

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Volcanic environments have long been known to harbor microbial life of great diversity. This information was usually obtained from samples returned to laboratories, analysis of field sites for their microbiology in the field remained difficult. With planetary exploration missions dedicated to carry out in situ life detection experiments, the capability for first order assessment for microbial activity has gain increased relevance. We have deployed molecular tools including ATP luminometry, LPS detection unit and antibody microarray technology in volcanic environments of the Kamchatka peninsula, Russia. The field site described here is a young (< 2 years) hydrothermal spring in the active crate of the Mutnowsky volcano.

Initial results from ATP measurements of samples from a hot spring pool in Mutnowsky crater showed that there was no detectable microbial activity in the pool water ($> 90^{\circ}$C). In contrast, high activity was found on the edges of the pool ($\sim 60^{\circ}$C). PTS measurements showed that high microbial activity corresponded well with high cell concentrations and vice versa. Microarray analysis of these samples confirmed this observation as DNA was found to be present on the edge of the pool yet not in the pool water. These measurements further indicated the presence of melanoidins in the pool water, yet not at the edges.

These studies, carried out on site, showed that microbial life is present and active at the edge of this young hydrothermal pool, and the breakdown products of microbes in form of melanoidins are recycled in the water of the pool.

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