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Microbial processes and communities in sediment samples along a transect across the Lusi mud volcano, Indonesia

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The Lusi eruption represents one of the largest ongoing sedimentary hosted geothermal systems. This eruption started in 2006 following to a 6.3 M earthquake that stroke Java Island. Since then it has been spewing boiling mud from a central crater with peaks reaching 180.000 m3 per day. Today an area of about 8 km2 is covered by locally dried mud breccia where a network of hundreds of satellite seeping pools is active. Numerous investigations focused on the study of offshore microbial colonies that commonly thrive at offshore methane seeps and mud volcanoes, however very little has been done for onshore seeping structures. Lusi represents a unique opportunity to complete a comprehensive study of onshore microbial communities fed by the seepage of CH4 and CO_2 as well as of heavier liquid hydrocarbons originating from several km below the surface.
We conducted a sampling campaign at the Lusi site collecting samples of fresh mud close to the erupting crater using a remote controlled drone. In addition we completed a transect towards outer parts of the crater to collect older, weathered samples for comparison. In all samples active microorganisms were present. The highest activities for CO_2 and CH4 production as well as for CH4 oxidation and hydrocarbon degradation were observed in medium-age mud samples collected roughly in the middle of the transect. Rates for aerobic methane oxidation were high, as was the potential of the microbial communities to degrade hydrocarbons (oils, alkanes, BTEX tested). The data suggests a transition of microbial populations from an anaerobic, hydrocarbon-driven metabolism in fresher samples from center or from small seeps to more generalistic, aerobic microbial communities in older, more consolidated sediments. Currently, the microbial communities in the different sediment samples are analyzed using quantitative PCR and T-RFLP combined with MiSeq sequencing.
This study represents an initial step to better understand onshore seepage systems and provides an ideal analogue for comparison with the better investigated offshore structures.