EGU2020-18572
https://doi.org/10.5194/egusphere-egu2020-18572
EGU General Assembly 2020

Soil Microbial Indicators of Alkane Flux around a Natural Gas Seep

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The UK has a legacy of onshore oil and gas wells. Aging extraction wells, with deteriorating cap engineering, may act as preferential pathways for gas seepage from the sub-surface. Seeps from hydrocarbon reservoirs are predominately composed of potent greenhouse gases, such as methane and carbon dioxide. Shifts in the soil microbial community are potential indicators of alkane gases rising from the sub-surface. Therefore, soil microbial community change could be used as a tool for monitoring aging, legacy wells, for gas seepage. An increased abundance in bacteria that metabolise methane (methanotrophs), or, C3-C4 alkanes (propanotrophs/butanotrophs) should be correlated with an increased flux of those gases, thereby indicating the presence of a seep.

In the South-East of the Auvergne-Rhône-Alpes region of France, there are several natural-gas analogue macro-seeps where the soil microbial community is potentially interacting with increased alkane fluxes. A well characterised natural gas seepage site was visited, and soil samples were collected for DNA analysis. Surface gas flux measurements and soil-pore gas concentrations (at 1 metre depth) were collected at the same sampling locations by BGRM involved in the ERA-ACT funded *Subsurface Evaluation of Carbon capture and storage and Unconventional Risk* (SECURe) project. The abundance of alkanotrophs within the bacterial community was explored using quantitative-PCR assays of the key genes used in alkane metabolism. DNA was used in qPCR assays to estimate the proportion of methane monooxygenase and butane/propane oxidising genes within the total bacterial community (using 16S as a proxy). The in-field measurements of gases were contrasted with the relative abundance of methanotrophs and propanotrophs/butanotrophs.

Preliminary results suggest an increased abundance of methanotrophs above soils with higher pore gas concentrations of methane. These methanotrophs have oxidised the rising methane producing small isolated anomalies of increased methane flux at the surface. This suggests that methanotrophs might be a tool for locating soils with an increased methane concentration.