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Degradation of hydrocarbons under methanogenic conditions in different geosystems

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With increasing energy demand the search for new resources is becoming increasingly important for the future energy supply. Therefore the knowledge about fossil fuels like oil or natural gas and their extraction should be expanded. Biodegraded oil is found in many reservoirs worldwide. Consequently, it is very important to get insight in the microbial communities and metabolic processes involved in hydrocarbon degradation. Due to the lack of alternative electron acceptors in hydrocarbon-rich geosystems, degradation often takes place under methanogenic conditions.

The aim of the present study is to identify the microorganisms and mechanisms involved in the degradation of complex hydrocarbons, like BTEX and polycyclic aromatic hydrocarbons, using culture dependent and independent techniques. For this purpose enrichment cultures from marine sediments, shales, coal and oil reservoirs are monitored for their capability to degrade alkanes and aromatic compounds. Moreover the environmental samples of these different geosystems analysed for evidence for the in situ occurrence of methanogenic oil degradation. The gas geochemical data provided in several cases hints for a recent biological origin of the methane present.

First results of the microbial community analysis showed in environmental samples and enrichment cultures the existence of Bacteria known to degrade hydrocarbons. Also a diverse community of methanogenic Archaea could be found in the clone libraries. Additionally, in oil and coal reservoir samples the degradation of model hydrocarbons, e.g. methylnaphthalene, hexadecane and BTEX, to CH4 was confirmed by 13C-labeling. To explore the mechanisms involved in biodegradation, the enrichments as well as the original environmental samples are further analysed for the presence of respective functional genes.