

Methane at abandoned wells in the German North Sea – Results of two research cruises in 2019 and 2021

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Understanding and reducing emissions of the greenhouse gas methane is an important factor in limiting anthropogenic climate change. As part of oil and natural gas exploration and production, there are around 100 abandoned wells in Germany's exclusive economic zone (EEZ) and coastal regions while around 20,000 old wells have been drilled throughout the North Sea. Difficulties with well integrity may lead to methane leaking from the sediments and through a shallow water-column into the atmosphere and thus contribute to the total atmospheric methane emissions. In a multidisciplinary research cooperation we conducted studies on methane emissions from the oil and natural gas sector and investigated possible methane emissions at a total of 18 abandoned wells in the German EEZ. In addition to our focus on abandoned wells, particularly on those that have penetrated shallow gas pockets (Müller et al., 2018; MPGJ), we also studied natural seep sites in the vicinity of the wells (Römer et al., 2021). Gas geochemical analyses of water and sediment samples and, for the first time, free gas samples obtained from the German EEZ have enabled conclusions on the biogenic origin of the light hydrocarbons seeping from natural gas seeps. No methane emissions were detected at any of the investigated wells. The temporary occurrence of dissolved thermogenic gases in the entire water column of the study area over several days in winter 2021 (dryness ratio ~ 10; Heeschen et al., in review) indicate allochthonous gases being transported into the study area overprinting local methane fluxes. This widespread phenomenon disappeared from the working area after a few days, and its origin remains unclear.

Reference:

Heeschen K., Schloemer S., Kopte R., Römer M. and Blumenberg M. (in review) Sedimentary gas ebullition into non-stratified shallow waters of the German Dogger Bank, Central North Sea.

Müller S., Reinhardt L., Franke D., Gaedicke C. and Winsemann J. (2018) Shallow gas accumulations in the German North Sea. *Mar. Petrol. Geol.* 91, 139–151.

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