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# Seismic investigation of Arctic seafloor methane seepage systems aided by tectonic modelling

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Methane seepage from the seafloor at continental margins is a widespread phenomenon with potential implications for global climate and seabed ecology. The mechanisms controlling seepage over geological time remain poorly understood. Interpretation of field data from active seepage sites often provides a biased perspective of the problem. Here we integrate observations from high resolution 2D and 3D seismic data from an active seepage site in Fram Strait with tectonic modelling due to oblique mid-ocean ridge spreading, to investigate if seafloor seepage can be coupled to regional stress field variations. Our modelling approach is simplified such that it only deals with the stress field generated by oblique spreading between mid-ocean ridges, excluding the effect of topography and other regional factors contributing to the actual stress field in the region. Our model reveals a zone of tensile stress that extends northward from the Knipovich Ridge and encompasses a zone of active seepage and extensional faulting. A zone of past seepage is presently located in a strike-slip regime. Our modelling results suggest that seepage is promoted by opening of faults and fractures in a tensile regime. We develop a conceptual model to describe how seepage may be controlled by an interplay between tectonic stresses and pore fluid pressure within shallow gas reservoirs.