GAS HYDRATE STABILITY AND DISTRIBUTION IN THE FJORDS OF WESTERN SPITSBERGEN, SVALBARD ARCHIPELAGO. AN ASSESSMENT BASED ON INDIRECT HYDRATE INDICATORS

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This study evaluates the spatial and temporal variability of seepage detected in the main fjords of western Spitsbergen, Svalbard archipelago, as indirect hydrate indicators (geophysical attributes to the presence of gas or seepage) of the natural gas hydrate (NGH) distribution.

While methane seepage and NGH distribution in the offshore provinces of Vestnesa Ridge on the continental slope west of Svalbard and Prins Karls Forland are extensively studied, their potential distribution in the Isfjorden and Van Mijenfjorden fjords is poorly constrained.

2D seismic interpretation enabled mapping the major stratigraphic units and structural elements of the fjords and further identifying the distribution of potential source rocks. We also recognized different migration pathways such as faults and igneous intrusions, presumably transporting the gas to the seabed.

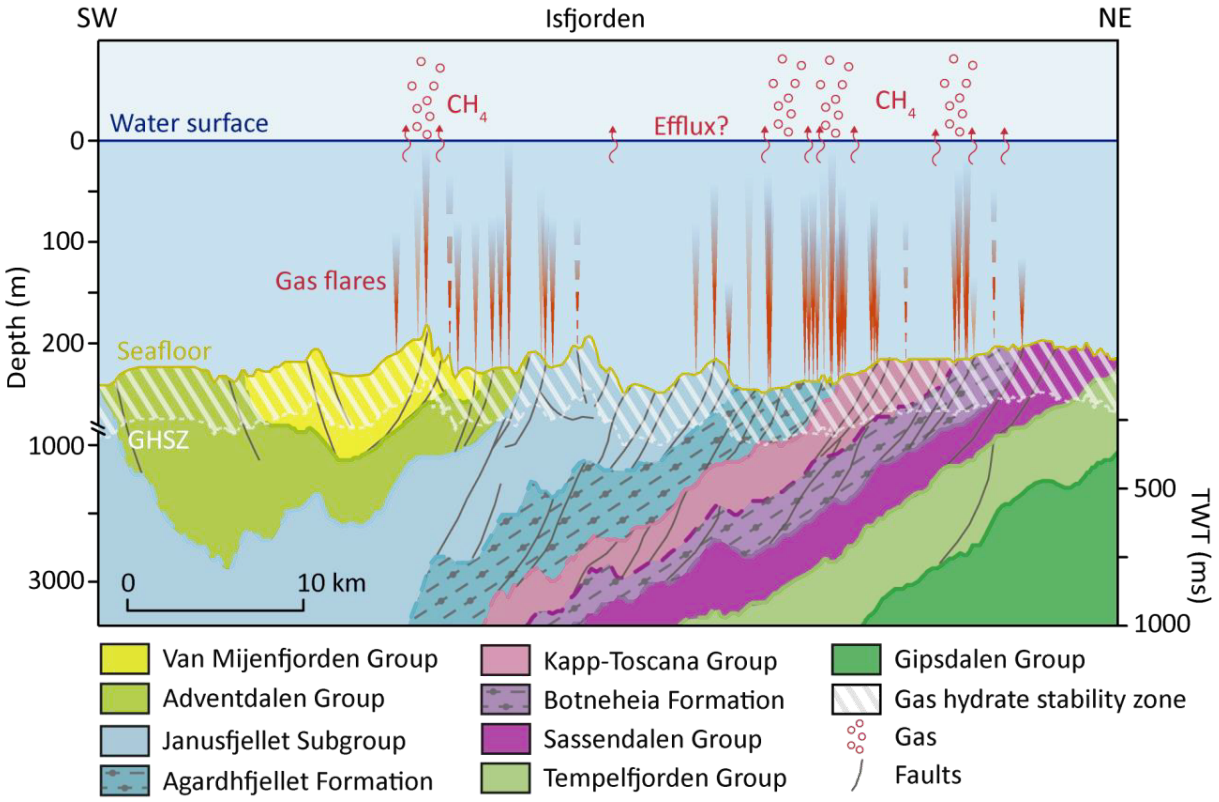
In addition, analysis of hydrographic datasets acquired in August 2015 and June 2021 allowed the quantification and description of gas flares in the fjords and the comparison of the gas system characteristics over the late spring and early autumn seasons.

Overall, 796 flares (668 in Isfjorden and 115 in Van Mijenfjorden) have been identified in the echograms acquired in 2015, and 152 flares have been identified in Isfjorden in 2021.

The observations revealed an active fluid flow system in the fjords with an evident spatio-temporal variability of the seepage. Furthermore, different morphologic expressions at the seafloor, such as pockmarks, have been spatially correlated with the flares, unveiling no direct association with the present-day seepage.

Despite the achievements of this work, further efforts are needed to finally prove the presence of NGH in the fjords of the Svalbard archipelago.

Besides, more work is needed to understand the relation between high flare activity areas and the atmospheric methane concentration anomalies to assess potential methane efflux (diffusion between the surface waters and the atmosphere), contributing to the atmospheric carbon pool.



Graphical abstract. Conceptual model of the fluid flow system in Isfjorden from the source rocks to the atmosphere. It shows the major stratigraphical features presumably transporting the gas to the seafloor, which is further detected as acoustic flares in the water column. Potential efflux remains uncertain.