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Gas-hydrate occurrence on the W-Svalbard margin at the gateway to the Arctic Ocean

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Gas hydrates contain more carbon than does any other global reservoir and are abundant on continental margins worldwide. These two facts make gas hydrates important as a possible future energy resource, in submarine landsliding and in global climate change. With the ongoing global warming, there is a need for a better understanding of the distribution of gas hydrates and their sensitivity to environmental changes. Gas hydrate systems in polar latitudes may be of particular importance due to the fact that environmental changes will be felt here first and most likely are more extreme than elsewhere.
The gas-hydrate systems offshore western Svalbard are far more extensive (∼4000kmˆ2) than previously assumed and include the whole Vestnesa Ridge, an elongated sediment drift north of the Molloy Transform and just east of the Molloy Ridge, one of the shortest segments of the slow spreading North-Atlantic Ridge system. However, in this peculiar setting gas hydrates also occur within few km of a mid-oceanic ridge and transform fault, which makes this gas hydrate system unique on Earth. The close proximity to the spreading centre and its hydrothermal circulation system affects the dynamics of the gas hydrate system. A strong cross-cutting BSR is visible, especially in areas of dipping seafloor. Other places show a weak almost subtle BSR. The base of gas-hydrate stability varies with distance from the ridge system, suggesting a strong temperature-controlled subsurface depth as the underlying young oceanic crust cools off eastward. High amplitude reflections over a depth range of up to 150m underneath the BSR indicate the presence of a considerable amount of free gas. The free gas is focused laterally upwards by the less-permeable hydrated sediments as the only fluid-escape features occur at the crest of the Vestnesa Ridge. The fluid migration system and its active plumbing system at the crest provide an efficient mechanism for gas escape from the base of the hydrate stability zone.
The high heat flow together with the high tectonic activity of this region, a thick sedimentary cover, a shallow maturation window and an accelerated rate of biogenic and thermogenic gas production cause substantial disturbance to the gas hydrate system leading to high variability in gas hydrate build up and dissociation. This young and dynamic system allows studying gas hydrate formation in marine sediments, their governing parameters and their relationship with the fluid flow in great detail.