Geophysical Research Abstracts,
Vol. 11, EGU2009-253, 2009
EGU General Assembly 2009

Gas hydrate systems of the Norwegian and Barents Seas and their response to glaciations

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Gas hydrates have gained considerable attention in recent years due to their link to the global carbon budget and the possible impact of methane on global climate change. Worldwide escalations of natural methane release as for example documented from Siberian shelf regions may influence the climatic system. Our present study area, the Barents Sea and the northern part of the Norwegian Sea shelf is one of the key regions for such study. This area was covered by glaciers during glacial times, and during interglacial, when the ice sheet retreated, the shelf was under the influence of Atlantic water masses. The changes in pressure due to the waxing and waning of ice masses, and in temperature due to the warmer Atlantic water masses must have influenced the gas hydrate stability zone. The Barents Sea shelf region is not only affected by huge amounts of sediment erosion by glaciers but also by the potential release of methane due to changes in gas hydrate stability conditions through various glaciation cycles. Our study area in the Barents Sea is covered by vast amounts of 2D/3D seismic data acquired by the hydrocarbon industry. Parts of the area of the northern Norwegian Sea and the south-western Barents Sea close to the coast is also mapped by swath bathymetry as a part of the MAREANO programme giving a detailed picture of the seafloor. Here, we use these multi-parameter datasets as a tool to document sediment systems that influenced the gas hydrate stability field. The analysis shows the geologic controls on methane emissions, and allows us to assess the pathways of fluid flow through geologic formations and their seabed expressions. Critical analyses of acoustic anomalies in seismic sections including their geological controls give an overview of the fluid flow/gas hydrate system from the present stage to the past. We will show that the migration of fluid from the sub-seabed to the seabed is not only controlled by the stratigraphic and structural architecture of the formation, but also by the gas hydrate stability condition. Finally, seafloor features such as pockmarks are critically analysed for their character to establish the dynamics of the processes involved.