Geophysical Research Abstracts
Vol. 14, EGU2012-8960, 2012
EGU General Assembly 2012

Pockmarks in the fjords of western Svalbard and their implications on gas hydrate dissociation

S. Roy (1,2), K. Senger (1,2,4), R. Noormets (1), and M. Hovland (3)

(1) The University Centre in Svalbard, Longyearbyen-9171, Norway, (2) Department of Earth Science, University of Bergen, Allégaten 41, N-5007 Bergen, Norway, (3) Statoil ASA, Forusbeen 50, 4035 Stavanger, Norway, (4) Centre for Integrated Petroleum Research, Allegaten 41, N-5007 Bergen, Norway

Shallow gas hydrate deposits in the Arctic regions can undergo rapid dissociation as a result of rising temperatures and/or decreasing pressure due to thawing permafrost seal releasing large amounts of methane into the water column and to the atmosphere.
Svalbard is located within the zone of continuous permafrost. Periglacial and permafrost-related terrain features are widespread in areas not covered by glaciers. According to published data the thickness of permafrost at the coast is about 10-40 m, increasing to more than 450 m in the highlands.
High resolution swath bathymetry data were used to systematically map the glacial landforms and pockmarks in the Isfjorden region. The pockmarks comprise randomly distributed circular and elliptical depressions. Their diameters range from 30 m to 242 m and the maximum depth is 11 m. Raised rims occur locally. Pockmark strings are located within glacial lineations formed during the Late Weichselian glaciation.
The maximum water depth of the Isfjorden is 428 m and sea-bottom temperatures range from -2 to 5 °C. The extent and thickness of possible methane hydrate in Isfjorden has been calculated and the overlapping zones with potential pockmarks and glacial landforms in the fjord seafloor have been analysed in this study. Phase diagrams show that the stability field of methane hydrate is dependent on temperature, pressure and the composition of the hydrate-forming gas. Thermo-baric modeling indicates that 280 m of water depth is required for pure methane to potentially form a hydrate at 0 °C. The presence of NMHC (non-methane hydrocarbons: C1 to C5 alkanes) would require shallower water depths to form gas hydrates. Glacial ice cover would increase the load to the sedimentary column, increasing pressure on the underlying sediments. The temperature in the underlying sediments would also be lower due to the base of the ice which is at around 0-2 °C thereby increasing the potential for formation of gas hydrates.
The preliminary mapping and modelling results suggest that, in addition to the potential deep sources for the past seabed seeps, the distribution of pockmarks in Isfjorden could result partly from the dissociation of gas hydrates due to warming fjord waters. Another potential cause may be the release of methane associated with the thawing permafrost in the coastal areas.
Further exploration of gas hydrates and monitoring of methane release are needed to quantify the likely magnitude of future emissions and their possible implications on the regional and global climate.