Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02677, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02677
EGU General Assembly 2008

Fluid distribution within the Nyegga area, northern flank of the Storegga slide, inferred from P-wave velocity anomalies.

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The Nyegga area lays at around 750 m water depth between the Vøring Basin to the north, and the Møre Basin to the south, on the mid-Norwegian margin. Abundant vertical fluid migration features (VFMF) are recognized by acoustic scattering in the seismic profiles. The formation mechanism of the VFMF, their dynamics, the distribution of such structures and the origin of the fluids (gas and/or water) remain largely unknown. Our objective is to infer the distribution of fluids and possibly overpressurized layers in sediments of the sub-seafloor through the investigation of the local p-wave velocity field and its relation with laterally confined high amplitude zones (HAZ) observed in the seismic profiles.

A multi-component reflection seismic survey was conducted in the area of Nyegga on board R/V Jan Mayen, University of Tromsø. Three multi-component Ocean Bottom Seismic recorders (OBS) were deployed above the Helland Hansen Dome (system 1) and three OBS stations were deployed at $\sim$2 km north from the northern flank of the Storegga slide (system 2).

The implemented methodology in a first stage of the investigation provided five 1-D P-wave velocity profiles. Travel time inversion and direct modelling were applied in combination. The models were optimized analysing the travel time residuals and root mean square (RMS) errors given by the inversion algorithm (ZS92). Two levels of fluid (water and/or gas) accumulation are inferred from the simultaneous occurrence of low velocities zones (LVZ) in the models and high amplitudes zones (HAZ) in the seismic data. A first velocity inversion of $\sim$250 m/s appears at a depth of about 250

mbsf; a second velocity inversion of ∼260 m/s appears at about 450 mbsf. Anomalous high P-wave velocities in the models have been associated with glacigenic debris flows that have lower permeability and such provide a seal for the migration of fluids which accumulate at the shallower LVZ/HAZ. RMS amplitudes and dip attribute maps together with the projection of the 1D velocity profiles into a 3D seismic block available from the industry provides a good overview of the spatial distribution of the fluids in the region and demonstrate the different characteristics between the fluid system located above the Helland Hansen arc (system 1) and the second system associated with contourite body and glacigenic debris flow close to the northern flank of the Storegga slide (system 2). A major vertical migration path for deep sources of fluids is observed right below the water-gas charged contourite body in system 2.