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Rapid flux of gas from overpressured gas reservoirs underneath hydrate-bearing sediments on the mid-Norwegian margin

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Gas hydrates, mainly consisting of the greenhouse gas methane, contain more carbon than does any other global reservoir and are abundant on continental margins worldwide. Methane is a powerful greenhouse gas believed to have modulated the earth climate through its release in gaseous form from solid hydrate reservoirs in response to natural changes. We are only at the beginning of understanding how hydrates may function in the methane-carbon-dioxide systems of the geo-biosphere, and how it interacts with changes of pressure and temperature to shape the seabed of continental margins. Particularly on the Norwegian margin, the recognition of inferred gas hydrate occurrence in close proximity to giant submarine landslides has stimulated renewed interest in the role of gas hydrates in slope stability and their potential environmental impact through the release of large quantities of methane into the ocean and atmosphere. Recent studies using mechanical approaches indicate that the free-gas zone underneath hydrate-bearing sediments may be critically pressured. Overpressure formation may cause focused gas release through pipes and/or sediment failure and the subsequent release of gas. A combined analysis of P-and S-wave velocities of ocean-bottom cable data allows assessing the pore pressure distribution within the free-gas zone beneath hydrate-bearing sediments on the mid-Norwegian margin. The seismic data provides evidence for over-pressured gas zones that drive the flow of gas-laden fluids. The formation of blow-out pipes that occur widespread above the zone of hydrate-bearing sediments may be the result of this overpressure formation. This mechanism may enable the methane to rapidly bypass hydrate formation in the hydrate stability zone and hence discharge through the seafloor.