

GAS HYDRATE SYSTEMS RESPOND SLOWLY TO SEAFLOOR WARMING

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In a marine environment, gas hydrates are stable at certain pressure (sea level) and temperature (bottom water temperature) conditions. Changes in these conditions may result in the destabilization of the gas hydrates. In this study we investigate the temporal response of a continental margin gas hydrate reservoir to changes in the pressure and/or temperature regime, considering the latent heat of hydrate dissociation and the long response times to conductive heat transport in submarine sediments.

Gas hydrates and the surrounding sediments do not instantly respond to changing environmental conditions. A vertical subsoil column without gas hydrates needs more than 5,000 years to adapt its temperature profile to an increase in seafloor temperature. A vertical subsoil column containing gas hydrates has the same response time if the stability of the hydrates is not affected. Although, when gas hydrates stability is affected due to changes in their environment, the response time to these changes is extended. Destabilized gas hydrates will dissociate into methane gas and water. The dissociation process happens at a constant temperature and requires a lot of energy (heat). Dissociation of gas hydrates thus delays the response time of the surrounding subsoil; up to 100,000 years may pass before the temperature profile completely adapted to the changed environmental parameters.

Because of this slow response to changes in environmental parameters, gas hydrate dissociation cannot be regarded as the trigger to global warming at the end of glacial and stadial periods and gas hydrate dissociation cannot be responsible for the high observed atmospheric methane concentrations in ice core records, as has been postulated in a number of high-profile publications.

References

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