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Tracking paleo-SMT positions using a magnetic susceptibility proxy approach from sediments on the Arctic Vestnesa Ridge, offshore western Svalbard

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Methane in marine sediments, often existing ephemerally as gas hydrate, constitutes one of the largest reservoirs of natural gas on Earth and fluxes of methane in marine sediments are an important component in the global carbon cycle. Tracking changes in past methane flux, however, remains difficult and there are few available proxies that persist through geologic time. CAGE - Centre for Arctic Gas Hydrate, Environment, and Climate initiates a ten year interdisciplinary research and education program aimed at achieving a quantitative understanding of feedbacks between methane in sub-seabed reservoirs, the seabed and the ocean. In our recent work on the Indian continental margin we document that drawdowns in magnetic susceptibility, constrained by magnetic properties, and integrated with core sedimentology, XRF elemental data, authigenic mineralogy, and pore water geochemistry, can be used to track the paleo-positions of the SMT (sulfate-methane transition). Relative positions of the SMT in marine sediments are controlled by the balance of methane and sulfate fluxes. The products of the anaerobic oxidation of methane at the SMT, hydrogen sulfide and bicarbonate, allow for the dissolution of detrital magnetite, and the precipitation of authigenic carbonates and iron sulfides. We recently obtained 21 gravity cores in and between active and inactive pockmarks along the crest of the Vestnesa Ridge, an Arctic gas and gas hydrate bearing contourite sediment drift located offshore western Svalbard. Magnetic susceptibility records from reference cores outside of pockmarks show the stratigraphy across the ridge is quite uniform, whereas magnetic susceptibility records within the pockmarks, with and without observed water column gas flares, are significantly depleted. Integration of multiple data sets from these records and comparison with reconstructions of paleo-methane emissions at the seafloor from benthic foraminifera will allow us to interpret these drawdowns in magnetic susceptibility as a function of changes in the sulfate and/or methane fluxes through time at these sites. Details on the CAGE research plan and organization can be found on www.cage.uit.no to foster opportunities for cross-disciplinary collaboration. The Centre of Excellence is funded by the Norwegian Research Council (grant No. 223259) over a period of ten years.