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Global Climate Change Driven by Marine Methane Hydrate Dissociation: Reality or Fiction? - 2022 Clarke Medal Talk

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Methane hydrate dissociation has long been considered as a mechanism for global carbon cycle perturbations, climate change and even mass extinctions in Earth's history. However, direct evidence of hydrate destabilization and methane release that coincides with such events is scarce.

We use diagnostic lipid biomarkers directly linked to methanotrophic microorganisms to track the dissociation of gas hydrates in Earth's Cenozoic history. For example, we show that “Methane Index” based on archaeal lipids called GDGTs, is not only indicative of past methane but also quantitatively related to sedimentary methane flux. These archaeal and bacterial lipids and their compound-specific carbon isotopes were used to document methane release and oxidation at several major climate change events, including the Oligocene – Miocene boundary (~23 Ma) and Paleocene – Eocene boundary (~56 Ma). These new results suggest that even if the released methane from seafloor did not reach the atmosphere, aerobic oxidation of methane in seawater which consumes oxygen and acidifies the ocean is important in driving climatic and environmental changes.