



Assessing the stability of marine clathrates during the last deglacial period with a D/H record of atmospheric methane from the GISP II ice core

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Numerous factors control atmospheric methane levels on different timescales. One explanation for the abrupt increases in atmospheric CH_4 recorded in ice cores involves clathrate destabilization events. Due to the distinct D/H isotope signature of marine clathrates, any such destabilization event should cause the D/H ratio of atmospheric CH_4 ($\delta\text{D}_{\text{CH}_4}$) to increase. High-resolution sampling during the end of the Older and Younger Dryas and one interstadial period show stable/decreasing $\delta\text{D}_{\text{CH}_4}$ values suggesting marine clathrates were stable during these abrupt warming episodes.

The overall $\delta\text{D}_{\text{CH}_4}$ record exhibits a 20‰ shift from higher values during the last glacial period that is driven by larger contributions of CH_4 with elevated D/H ratios. The elevated LGM $\delta\text{D}_{\text{CH}_4}$ values are likely to be related to a number of factors with the most important being decreased net/gross ratios for wetland CH_4 emissions and an increase in petroleum based CH_4 during the glacial period. Further insight into these factors will derive from future measurements of $\delta^{13}\text{C}_{\text{CH}_4}$ that are in progress.