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Deglacial methane events in the Arctic

Chiara Consolaro, Tine L. Rasmussen, Jurgen Mienert, and Kamila Sztybor
University of Tromsø, Department of Geology, Tromsø, Norway (chiara.consolaro@uit.no)

Methane hydrate provinces are common in Arctic regions, but their contribution of carbon to the atmosphere and their stability and longevity through time is unknown. It is therefore important to resolve the frequency of CH_4 emissions from the seafloor through time, in relation to past climate change with special focus on periods of climate warming.

Our study area is the pockmark-field of the Vestnesa Ridge ($\sim$79°N), a mounded and elongated sedimentary drift in the Eastern Fram Strait (NW Svalbard). The area represents one of the northernmost methane hydrate provinces and the second largest hydrate province off Europe. Here we present the results from a sediment core collected at the northwestern tip of the pockmark field, at a water depth of $\sim$1300 m. The core has been investigated for the distribution of planktonic and benthic foraminifera faunas, the stable isotope composition of their shells and detailed AMS ^{14}C dating. The site shows only intermittent methane emission today. Based on the δ^{13}C benthic record in the core we have reconstructed the past activity of methane seepage during the last 14,000 cal years BP.

According to the age model and data the site was active during the Allerød interstadial (event I) and during the early Holocene (event II). During event I the *C. neoteretis* δ^{13}C record shows values significantly lower than the average of -1.10‰ with two prominent peaks at 13,880 cal years BP (-2.87‰) and at 13,375 cal years BP (-4.37‰), and another less pronounced peak at 12,890 cal years BP (-2.21‰). Event II lasted from about 10,500 to about 10,000 cal years BP, and it is characterized by values in the benthic record lower than -2‰ with the most prominent peak at 10,270 cal years BP (-3.41‰).

Both δ^{13}C excursions occurred after a period of warming. Event I began about 600 years after the start of the Bølling interstadial, and event II began about 1200 years after the start of the Holocene interglacial. These isotopic excursions do not precisely match CH_4 peaks in the Greenland ice core record, but they occurred during periods of relatively high CH_4concentration in the atmosphere (Brook et al., 2000), therefore they might indicate methane ascending from the ocean floor through the hydrosphere to the atmosphere.