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High preindustrial δ13C in the deep Arctic Ocean: Implications for the interpretation of abrupt benthic δ13C excursions during the last glaciation

A. Mackensen
Alfred Wegener Institute, Bremerhaven, Germany (andreas.mackensen@awi.de)

Only recently a strong air-sea signature of δ13C, i.e. δ13Cas, in modern bottom waters of the Atlantic sector of the Antarctic Ocean was revealed (Mackensen, 2012). This high southern δ13Cas may have been reduced in the Last Glacial Maximum, and parts of an ocean wide deep-water δ13CDIC lowering may be attributed to sea-ice formation with low-δ13Cas brine rejection and diminished air-sea gas exchange in the southern ocean. Low benthic δ13C values from the Nordic seas in cold stadials of the last glaciation have been attributed to brine formation, but little is known about the carbon isotopic composition of Arctic Ocean brines and deep-water masses. Here I show that today dissolved inorganic carbon (DIC) of bottom water in the deep Arctic Ocean is 13C enriched with mean δ13CDIC values of 1.2 ‰ whereas bottom waters bathing most of the continental margins with mean δ13CDIC values of about 0.8 ‰. This difference is also recorded in Recent epibenthic foraminiferal δ13C from the deep Arctic versus Greenland and Svalbard continental margins. It is in contrast, however, to the continental slope of the Laptev and East Siberian seas, where epibenthic δ13C is as high as in the deep basins. I conclude that (i) most of the shelves contributing to Arctic bottom water by brine rejection produce high-δ13Cas brine, and (ii) a strong δ13Cas signal from brine formation in polynyas today is masked by anthropogenically lowered atmospheric δ13CCO$_2$. I then hypothesize that during stadials, when most of the Arctic Ocean was perennially sea-ice covered, less brine was produced, and that this cessation of brine rejection would have lowered bottom-water δ13C values in the Arctic Ocean and subsequently in the Nordic seas.