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New high-resolution record of Holocene marine variability in the Weddell Sea from biomarker analysis of the Patriot Hills blue ice record

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Here we report preliminary analysis of biomarkers (including dissolved organic matter (DOM) and DNA) from the Patriot Hills blue ice area (BIA), from the Ellsworth Mountains in the Weddell Sea Embayment. Preliminary isotopic and multiple gas analysis (CO_2, CH4, N2O and CO) demonstrate that the Holocene comprises more than 50% of this unique 800m long BIA record, and in combination isotopic and biomarker analysis reveals a remarkable record of centennial variability through the Holocene in this sector of the Weddell Sea.
Analysis using a Horiba Aqualog - which measures the fluorescence of DOM by producing a map of the fluorescence through an excitation-emission matrix (EEM) - identifies tryptophan and tyrosine-like components of an inferred marine origin, in both modern snow pit samples and within the Holocene part of Patriot Hills BIA transect.

Intriguingly, the modern seasonal trends in DOM, recorded in contemporary snow pits, have relatively low signals compared to those recorded in the mid-Holocene record, suggesting a possible reduction in DOM signal in contemporary times. Given that the source of precipitation has remained constant through the Holocene, the biomarker signal most likely relates to multi-year marine productivity signals from the Weddell Sea. The marked variability in DOM between the mid-Holocene and contemporary times can only relate to periods of sustained, enhanced biological productivity in the Weddell Sea associated with shifts in SAM, sea ice variability or ventilation and polynya activity. Here we discuss possible drivers of these changes and describe how this approach could benefit conventional ice and snow core records regionally.