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A Mid-Holocene Shift and Millennial-Scale Variations in Mesopelagic North Pacific Ventilation

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The modern subarctic North Pacific Ocean is one major region of the world ocean, where a halocline prevents the existence of a deep meridional overturning cell, and the formation of new deepwater masses in the North Pacific today. Only mid-depth water layers are ventilated by North Pacific Intermediate Water (NPIW) that receives its comparably high oxygen content from water masses formed by brine rejection in the Okhotsk Sea.
In this presentation, we report on multi-proxy sediment records from such intermediate water depths in the Okhotsk Sea. High primary productivity, sea ice dynamics and patterns, highly variable hydrographic conditions, and fluvial terrigenous sediment supply closely interact in these regions and precondition the formation and ventilation pattern of intermediate waters. Founded on a coherent, AMS 14C-derived regional stratigraphic framework, high sedimentation rates in select cores (20-200 cm/kyr enable us to decipher rapid changes in North Pacific Intermediate Water dynamics on interdecadal to millennial time scales over the Holocene. We provide the first high-resolution stable isotope datasets from epibenthic foraminifera combined with productivity proxies to reconstruct changes in paleohydrography and ventilation patterns. We maintain that the current ventilation pattern of the mid-depth North Pacific has only been prevalent for the last c. 2,000 years before present. We further provide evidence for a mid-Holocene shift in ventilation patterns, changing the natural baseline NPIW oxygen characteristics around 4,000 to 6,000 years before present.