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Sea-level and surface-water change in the western North Atlantic across the Oligocene–Miocene Transition: a palynological perspective from IODP Site U1406 (Newfoundland margin)

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The Oligocene-Miocene Transition (OMT, ∼23 Ma) is characterized by a large expansion of the Antarctic ice sheet, which can be traced by a ∼1 ‰ positive shift in benthic foraminiferal δ18O values, commonly referred to as the 'Mi-1 isotope event'. Whereas the causes for the glacial maximum at the OMT are intrinsically connected to Southern Hemisphere ice-sheet dynamics, the behavior of the surface ocean in the Northern Hemisphere during this time is poorly known. To contribute to a better understanding of the paleoceanographic evolution in the higher-latitude North Atlantic, we have analyzed both marine and terrestrial palynomorphs from IODP Site U1406 offshore Newfoundland.

Our palynological samples span the OMT interval from 23.3 to 22.5 Ma and have a mean temporal resolution of 11.9 kyrs. The age calibration is based on magnetostratigraphy and shipboard biostratigraphical data and allows a comparison between our record and the benthic foraminiferal δ18O record from ODP Site 1264. In total, 63 samples have been examined and yield well preserved and diverse palynomorph assemblages, consisting of dinoflagellate cysts (dinocysts), and terrigeneous pollen and spores.

The data show strong ∼110-kyr eccentricity-paced oscillations during the earliest Miocene, being in phase with previously published benthic foraminiferal oxygen-isotope records. More specifically, a pronounced sea-level variability is documented by the abundances of neritic dinocysts and terrigenous palynomorphs, which both reach maxima during peak glacial intervals reflecting Antarctic ice sheet variability. A decline in the abundance of warmer-water dinocysts from the latest Oligocene onwards suggests surface-water cooling offshore Newfoundland. Surface-water productivity (as derived from dinocysts) remained generally low throughout the studied interval, showing no correlation with changes in surface-water temperature. This lack of correlation between temperature and productivity suggests, that the observed long-term temperature decrease is not reflecting a southward migration of the Arctic Front in this region of the Northwest Atlantic. Therefore, we rather suggest a southward extension of the (Proto-) Labrador Current or a suppressed influence of the Gulf Stream during the earliest Miocene, possibly modulated by high-latitude sea-ice expansion.