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Orbital control of productivity and of sea-ice production/drifting in the central Arctic Ocean during the late Quaternary

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The recently revised chronostratigraphy of the central Arctic Ocean sedimentary sequences (https://doi.org/10.1002/2017GC007050) provides the means to insert the Arctic paleoceanography into the Earth's global climate history. Based on magnetostratigraphy, 14C ages and 230Th-231Pa excess extinction ages in a series of sedimentary cores raised from the Mendeleev and Lomonosov ridges by the R/V Polarstern, Healy and MV Xue Long ice-breakers, with chronological complementary information from pre-2000 studies, we have been able to estimate sedimentation rates ranging from less than a few mm/ka to a few cm/ka along these ridges, with the highest accumulation rates eastward, near the ice-factories of the Russian shelf. On the central Arctic ridges, sediment supplies are essentially linked to sea ice rafting when the shelf areas are seasonally open, and iceberg rafting, during stadial intervals with streaming along the Fennocandian-Russian ice margin. It has been possible to outline specific features of these Arctic Ocean records combining sedimentological, mineralogical, geochemical (stable, radiogenic isotopes) and micropaleontological data. Sedimentation rates are highly variable, with hiatuses (for example during the last glacial maximum) and sporadic recordings of intervals with active ice-sheets or active sea ice production and transport through the Trans Polar Drift (TPD) and the Beaufort Gyre (BG). Layers with finer sediment are linked to the deposition of sediments uploaded on shelves, especially in the Laptev Sea area. They record relatively high sea-level intervals, when shelves were submerged. Such recent intervals, marked by high excesses in 230Th and 231Pa, match, at least partly, interglacials (Marine Isotopic Stages -MIS- 1, 5, 7, 9, 11) and some interstadials. One of these relatively high interstadial sea-level dated at ca. 40-50 ka (MIS 3), suggests that the sea-ice factories over shelves have operated when the global sea-level rose above $\sim$ 40 m below its present position. Maximum sea-ice rafting, productivity and biogenic carbonate fluxes are tightly linked, with delays of a few millennia, to maximum insolation peaks in the Northern Hemisphere. They seem thus linked to the orbital forcing of high sea levels and warm North Atlantic Water penetration into the Arctic Ocean. The corresponding sedimentary intervals do not record full interglacial intervals. The most illustrative example is that of the Holocene, recorded by a 1 to 2 cm-thick mixed-layer at core tops of the central Arctic ridges, with biogenic carbonates mean ages of ca. 8 ka. One immediate inference from these observations is that the Quaternary records from the central Arctic Ocean are highly discontinuous, and although orbitally-controlled, partly out of phase with paleoceanographic and paleoclimate records from other oceans and continental areas. The Arctic Ocean may have thus played an intermittent and complex role, nearly that of a jocker, in the high latitude climate-ocean system, either through atmospheric or thermohaline connections through the Bering and Fram strait gateways.