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# Deglacial Subarctic Pacific Oxygenation Changes: Causes and Links to Northern Hemisphere Climate

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We use a comprehensive suite of partially laminated high-resolution sediment cores from the Bering Sea, covering a depth transect from 1100 m to 2700 m to study deglacial surface ocean warming patterns, associated changes in biological productivity, oxygen minimum zone dynamics and continent-ocean links through Yukon river runoff. We apply a combination of planktic and benthic isotopes, x-ray fluorescence (XRF)-derived elemental ratios and a multi-proxy assessment of changes in upper ocean temperatures. Severe oxygen depletions occurred during the Bølling/Allerød (B/A) and early Holocene, which is in accordance with other locations in the North Pacific, especially the Alaska margin. Detailed analysis of the timing of lamination occurrence between the different sediment cores revealed that the onset of severe anoxia at the beginning of the B/A and early Holocene is a near-synchronous event, while the disappearance of laminations is a diachronic process. The deglacial Oxygen Minimum Zone(OMZ) strengthening is mainly driven by increased export production, visible in XRF-derived elemental ratios, and corresponding high accumulation rates of biogenic components. The export production in turn is a response to rising sea surface temperatures, decreased sea ice cover and increased thermal stratification, while a major nutrient source was the eastern continental shelf, which was flooded during the deglacial global sea level rise. It is discussed controversially whether oxygenation variations in the deglacial subarctic Pacific were coupled to changes in mid-depth water chemistry, or rather a response to physical processes like deep-intermediate ocean or mixed layer warming, or stratification changes. However, knowledge of the driving forcing mechanism for OMZ strengthening is of particular importance, as these are tightly coupled to the regional marine carbon budget, e.g. via the strength and efficiency of the biological pump. Here, our laminated sediments provided the opportunity to study ocean dynamics in exceptional detail, possible on decadal to annual timescales. Due to the correlation patterns of our records to the NGRIP oxygen isotope record through layer counts we presume that (i) the presence of laminations is tightly coupled to submillennial, short-term warm phases, especially during the Bølling-Allerød (B/A), (ii) that the laminations represent annual layered sediments (varves). The latter point in conjunction with our geochemical proxies strongly supports an atmospheric teleconnection between SE Asia, the North Atlantic and the North Pacific, with observed changes in mid-depth ocean dynamics occurring on fast, nearly decadal timescales. Thus, the Bering Sea OMZ is a highly sensitive system reacting almost instantaneously to small temperature changes and therefore has the potential to influence the global carbon budget on short timescales, in particular during episodes of rapidly warming climate.