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# Millennial scale ice rafting and productivity changes in the Bering Sea during Marine Isotope Stage 22 (∼900 ka), Mid-Pleistocene Transition

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We present the first multi-proxy geochemical, sedimentological and micropalaeontological records of palaeoclimatic and palaeoceanographic changes in the Bering Sea during Marine Isotope Stages (MIS) 22 and 21 (∼850-900 ka), from newly collected sediment cores at Site U1343 (∼2000 m water depth) during IODP Expedition 323. MIS22/21 is set within the mid-Pleistocene Transition (MPT, ∼1200-600 ka), which encompasses the gradual evolution from 41 ka to quasi-periodic 100 ka glacial cycles. As there is no known change in orbital insolation to account for this climatic change, leading hypotheses for the MPT include changes to the dynamics of proximal North American ice sheets. MIS 22 is the first glacial cycle within the MPT similar in global deep water oxygen isotopic form and duration to the 100 ka cycles of the late Pleistocene. We compare millennial scale climate variability at this time with published records from the last glacial period, in order to gain insight into long term changes in ice sheet dynamics and climate.

The Bering Sea is the third largest marginal sea in the world after the Mediterranean and South China Seas, but before IODP Exp. 323 very little was known of its palaeoceanographic past. As extensive North American ice sheets were located proximate to the Bering Sea, this is an ideal location to monitor their instability back through time. Site U1343 is situated near the continental slope, and its high latitude location makes it sensitive to changes in sea ice and glacial meltwater input, which caused large fluctuations in stratification, primary productivity and deep water properties. Although there is very little deep water forming in the Bering Sea today, potential intermediate/deep water formation in the past may also have affected deep water properties. In addition, the Bering Sea has open connections to the North Pacific making it an important location to monitor subarctic North Pacific palaeoceanography.

Our initial results show significant millennial scale climate variability in the subarctic North Pacific during the MPT. High resolution (∼350 yr) benthic foraminiferal oxygen isotopic results record the detailed transition from glacial MIS 22 to interglacial MIS 21, and accompanying changes in bottom water carbon isotopes indicate that productivity may have increased during warming episodes. Sedimentological results show significant pulses of coarse rock fragments and minerals that may represent down-slope deposition, or more likely ice rafting events. These rapid events (<1 ka) peak during the maximum extent of glaciation, superficially resembling North Atlantic Heinrich Events during the last glacial period. Short term peaks in productivity (<1 ka), that do not correlate with the coarse fraction events, are indicated by reduced bottom water oxygen levels from benthic foraminiferal faunas, and may occur at times of peak melting. Assemblage records of planktonic dinoflagellate cysts indicate that the largest changes in sea surface conditions occurred during the de-glaciation (∼870 ka), where sea ice extent became less extensive and sea surface temperatures warmed. Interglacial MIS 21 appears to have been far more heavily affected by sea ice, and had lower sea surface temperatures, than the present day interglacial.