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High-frequency paleoceanographic fluctuation of the Bering Sea: scientific results of the IODP Expedition 323.

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The IODP Expedition 323 in the Bering Sea was the first expedition to recover continuous marine sediment sections to investigate high-resolution paleoceanography at the most northern region of the North Pacific during 5 Ma. Drill sites explored in the Bowers Ridge region (Sites U1340 and U1341) provide complete sequences for the last 5 myrs, including Northern Hemisphere Glaciation (NHG), and drill sites at the continental slope of the Aleutian Basin (Sites U1343 and U1344) provide complete sequences for the last 2 myrs, including the Mid Pleistocene Transition (MPT) with drastic changes in the character of glacial-interglacial cycles.

Post cruise age models of the drilled sequences are constructed using oxygen isotope stratigraphy, tephrachronology, and optically stimulated luminescence (OSL) dating, along with onboard bio- and magneto-stratigraphy. Astronomical calibration of high-resolution non-destructive core measurement data provides additional age control, and shows that sedimentation rates during interglacials are two to three times higher than that of glacials.

Marine primary productivity changes dramatically during the Plio-Pleistocene. Si /Al ratio measured using non-destructive XRF scanning by TATSCAN-F2 is consistent with discrete biogenic silica content, and exhibits large glacial-interglacial cycles. The productivity is relatively high, similar to that of the present Green-belt, during the interglacial periods with increasing glacial-interglacial variability after NHG, and even larger amplitude variations during last 500 kyrs. Significant large peaks of biogenic carbonate detected by TATSCAN-F2 occur during every deglaciation period (in the early stage of warming) during the Pleistocene. The increase in biogenic carbonate is related to enhanced terrigenous nutrient supply mainly from the continental shelf exposed during the glacial periods. During the middle and later part of the interglacial, carbonate content becomes significant low due to restoration of ocean circulation to a state similar to the present.

Sea-ice history was reconstructed by the ice-rafted debris (IRD). IRD is defined by counts of coarse (>1mm) grains using transparent X-ray images (TATSCAN-X1), and by counts of coarse fraction (0.160?0.900 mm) using grain-size analysis; IRD has a positive correlation with the abundance of diatom ice-algae. Time series data of the IRD abundance shows significant changes, relating to sea-ice expansion, Alaskan glacier discharge, and sea level changes in the last glacial cycle.

Marine primary productivity, ocean circulation, sea-ice expansion of the Bering Sea may play an important role during the MPT and NHG, especially through its impact on surface and bottom water circulation in the Arctic and the Pacific oceans.