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IODP Expedition 323 Bering Sea drilling: paleoceanographic and biogenic opal changes during the past 5 Myrs

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With the aim to reveal the climate and oceanographic history of the Bering Sea over the past 5 My, IODP Expedition 323 cored a total of 5741 m of sediment (97% recovery) at seven sites covering three different areas: Umnak Plateau, proximal to the modern Alaskan Stream entry, Bowers Ridge proximal to the glacial Alaskan Stream entry, and the Bering Sea Shelf region proximal to the modern sea-ice extent. Four deep holes range from 600 m to 745 m spanning 1.9 Ma to 5 Ma in age. The water depths range from 818 m to 3174 m in order to characterize past vertical water mass distribution such as the oxygen minimum zone (OMZ).

The highlights of our findings are: (1) Understanding of long term evolution of surface water mass distribution during the past 5 My. This includes past sea-ice distribution and warm and less eutrophic subarctic Pacific water mass entry into the Bering Sea. Temporal evolution of the sea-ice cover was reconstructed by sea-ice diatoms and sea-ice dinoflagellates and lesser extent by a radiolarian taxon. On the other hand, the history of surface water entry has been clearly visible by the geographic distribution and high abundance of pelagic diatoms. (2) Characterization of relatively stagnant intermediate water mass distribution imprinted as laminated sediment intervals that have been ubiquitously encountered. Today, the OMZ impinges upon the sediments at ~700-1600 m water depths. In the past, the OMZ appears to have occurred mainly during interglacial periods except at Site U1345 (water depth 1008 m) where glacial laminations were also observed. Changes in low oxygen-tolerant benthic foraminiferal faunas clearly concur with this observation. (3) Significant changes have also been noted in terrigenous sedimentary supply during glacials and diatom flux during interglacials.

Changes of %biogenic opal appear to correspond with the changes in warm-cold climate oscillations. This is attributed to the changes in diatom productivity, which can be partially governed by the ice cover at the sea surface. Percent biogenic opal values are generally higher at Bowers Ridge sites with less sea-ice impact than those at Bering Shelf Slope sites with greater sea-ice influence. The low values are also due to significant dilution by terrigenous material despite high biological productivity regime set, during the warm interval, as the Green Belt is located in the Slope region today. Percent biogenic opal oscillates typically within the range of 10-60% at Bowers Ridge sites and 5-25% at the Bering Slope sites. At Site U1344 the amplitude of % biogenic opal increased significantly at around 0.7 Ma compared to the period during 2.1-0.7 Ma.

Keywords: IODP Expedition 323, The Bering Sea, Bowers Ridge, Bering Shelf Slope, Biogenic opal, Sea-ice