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Millennial-scale variation of intermediate water intensity in the Bering Sea during the last glacial-interglacial cycle

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Knowledge on past deep and intermediate water circulations in the North Pacific is important to understand the dynamics of climate changes and feedback processes. Yet, ventilation changes in the North Pacific basin are still poorly understood.

It is widely accepted that at present North Pacific Intermediate Water (NPIW) forms in the Okhotsk Sea. However, according to studies on radiolarian assemblage, the Bering Sea might have been the dominant site of NPIW production during the glacial period. It is therefore critical to identify intermediate water flow and reconstruct its variations in the Bering Sea. During Mirai cruise MR06-04 Leg2, three pairs of piston cores, each is approximately 18m in length, have been recovered along a depth transect at the northeastern part of the Bering Sea continental slope. Preliminary studies on lithology and age model (based on last occurrences of radiolarian species) suggest that the two deeper cores (1002m and 1158m water depth) preserve continuous climatic records covering deglaciation and MIS 2-4, while the shallowest core (852m water depth) seems to preserve a record back into the last interglacial.

We conducted lithological observation utilizing soft-X ray radiographs and high resolution major element analysis by XRF micro-scanner to reconstruct changes in intermediate water circulation in the Bering Sea during the last glacial-interglacial cycle. The results advocate for a close relationship between grain size and compositional

variation of the detrital component, which is best represented by changes in Ti/Al and Si/Al ratios. The changes in these elemental ratios suggest millennial-scale variation in bottom current velocity, which probably reflects NPIW intensity changes. We also examined profiles of redox sensitive elements such as S and Mn. We assume S/Fe ratio to represent the degree of pyritization, which is commonly employed as a proxy for the bottom water oxygenation level. S/Fe ratio also shows millennial-scale changes with decreases in S/Fe associated with increases in Ti/Al and Si/Al, suggesting intensified intermediate water ventilation associated with intensified flow speed. The results support the idea that NPIW was present in the Bering Sea and featured millennial-scale variations during the last glacial to deglaciation period.