Climate changes during the last few decades recorded in the continental shelf sediments in the Bering-Chukchi Seas

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Recent excessive climate changes in the Arctic region and those relations to the global warming have been widely discussed. It is critical to reconstruct past climate changes in the Arctic region, at least during the last decades or centuries, to examine the climate stability/instability in this region.

Detrital materials in the continental shelf sediments of the Bering-Chukchi Seas are considered to be composed of Ice Rafted Debris (IRD) from shores around the Seas, detrital materials discharged from rivers on Alaskan, northern Canada and Russia, and volcanic materials from the Aleutian Arc, and temporal variations in these spatial distributions may record past terrestrial-marine environmental changes. Then, we try to examine the spatial variations in grain size of detrital materials in Bering-Chukchi Sea sediments and estimate the provenance of detrital materials using Electron Spin Resonance (ESR) signal intensity and crystallinity index (CI) of quartz, and discuss these temporal changes.

We use multiple cores obtained from 7 sites in the continental shelf of the Chukchi Sea and 12 sites in continental shelf to the continental slope of the Bering Sea during research cruise MR06-04, Leg.2 by R/V Mirai. We conducted grain size analysis and X-ray powder diffraction (XRD) / ESR analyses for the provenance estimation using surface samples (0-1cmbsf) of all cores. In addition, we preliminary analyzed several samples sub-sampled along depth of two cores from the northern Bering Sea, which are estimated to cover last fifty years on the basis of the 210Pb and 137Cs values.

Reconstructed grain size distributions of the detrital materials in the surface samples are bi-modal or tri-modal with the peaks of fine silt, fine sand, and coarse sand sizes. Fine sand and coarse sand peaks tend to be dominant in the samples obtained from the continental shelf, whereas fine silt peak tends to be dominant in the samples obtained from the continental slope. ESR signal intensity of quartz in the surface samples show a wide variation from 1.2 to 13.6, and the values increase from the Bering Sea to the Chukchi Sea. CI of quartz in the surface samples shows a slight change from 8.8 to 9.3, and samples obtained from the sites close to the Aleutian Arc show lower values. The results of the ESR signal intensity and CI of quartz suggest that the detrital materials in the sediments of the Bering-Chukchi Seas are mixture of the following three end-members. The first end-member is the detrital materials originated from Paleozoic-Precambrian age rocks exposed in northern Alaska and northwestern Canada. The detrital materials of the samples from the Chukchi Sea, showing higher ESR signal intensity and moderate CI of quartz, are mainly composed of this end-member. The second end-member is the detrital materials originated from Mesozoic age rocks exposed in southwestern Alaska. These materials are possibly transported to the Bering Sea through the Yukon River. The detrital materials in the samples from the northern Bering Sea and the Bering Strait region, showing moderate ESR signal intensity and higher CI of quartz, are mainly composed of this end-member. The third end-member is the volcanic materials from the Aleutian Arc. The detrital materials in samples from the southern Bering Sea, showing lower ESR signal intensity and lower CI of quartz, are mainly composed of this end-member.

In addition, our preliminary result show decadal-scale changes in the provenance of detrital materials in the samples from the northern Bering Sea, suggesting that ocean current and/or river discharge changed in this time-scale. In our presentation, detailed temporal change in the provenance of the detrital materials and its relations to the grain size variations will be shown and the cause of the provenance changes will be discussed.