Consideration of Cape Darnley Bottom Water inflow-index based on Grain Size and Mineral Composition of deep-sea sediments in Cape Darnley, East Antarctica

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Prydz Bay in East Antarctica is one of the most important regions in global climate change because of the largest iceberg outflow in the world and high sea ice production that results in the formation of Antarctic Bottom Water. In this bay, the area from Mac. Robertson shelf to Wild Canyon is the most suitable for the examination of the bottom water evolution around East Antarctica due to the formation of the Cape Danley Bottom Water (CDBW) which flows directly into the deep sea through the canyon without being trapped on the continental shelf. For the reconstruction of the CDBW processes from geological records, the mineral and grain-size compositions of the sediments can be important indicators. Previous studies in the Southern Ocean have used heavy and clay minerals for the examination of sediment sources, and grain size composition for the identifications of depositional environments, respectively. As the result, it has been reported that the mineral compositions of the Mac. Robertson shelf is significantly different from that of the East Antarctic continental slope, which is dominated by hornblende and illite and is homogenized by the Antarctic Slope Current (ASC). However, studies of marine sediments have been mainly from the central and the eastern part of Prydz Bay, and studies in the western region where the CDBW flows have yet to be presented. This study used the Mac. Robertson shelf and Wild Canyon sediments to examine the CDBW inflow index based on grain size and mineral composition.
In this research, we used the Wild Canyon sediments collected by the *R/V Hakuho-maru* during the KH-20-1 cruise (channel: MC01, MC02, levee: WIC-6PC, CAD-4PC) and the Mac. Robertson shelf sediments (CD1_KG, CD4_KG) collected by the 61st Japanese Antarctic Research Expedition. From the deep-sea camera attached to the multiple-corer, a sandy wave ripple was observed in the downstream region (MC02), suggesting the formation of the present-day seafloor topography by the CDBW. On the other hand, the lower layer of MC02 is characterized by the massive sandy silt that shows fining-upward sequence (D_{50}: 108 μm to 4.2 μm) and reversal in ^{14}C ages (bulk OM) possibly due to the erosion of the underlying sediments. These features are interpreted as the deposition by turbidity currents. Heavy minerals in the Mac. Robertson shelf and Wild Canyon sediments are dominated by garnet and sillimanite. Clay mineral composition shows that biotitic illite is dominant in sediments derived by CDBW, while kaolinite content increases in sediments derived by turbidity currents. In the Lambert Glacier basin of Mac. Robertson Land, garnet and sillimanite containing tillite and pelitic metasediments are distributed, and kaolinite matrix is included partly in metasediments. No similar sedimentary rocks have been identified around Prydz Bay, suggesting that the Mac. Robertson shelf and the Wild Canyon sediments mainly come from the Mac. Robertson Land. This observation further suggests that garnet and sillimanite are the unique minerals in this region of western Prydz Bay. Therefore, the existence of these minerals in marine sediments around Antarctica can be an indicator of the presence of active grain transportation through the Wild Canyon. In the future, it will be necessary to confirm the usefulness of the index using piston cores and to consider mineral compositions with a wider spatial range.

Keywords: Antarctic bottom water, Grain size analysis, Mineral composition

