Retreat of the West Antarctic Ice Sheet in the Ross Sea After Last Glacial Maximum

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After the Last Glacial Maximum (LGM:22ka-19ka : Yokoyama et al., 2000), global sea-level rise that reached to about 135 m occurred(Yokoyama et al., 2000.). Sea-level had not risen continuously and there are several stages that global sea-level had risen rapidly over short periods (post-LGM-meltwater pulse : 19ka-MWP : about 19ka: Yokoyama et al., 2000., meltwaterpulse-1a :MWP-1a:about 14ka: Fairbanks et al.,1989). The origin of these sea-level rise events, are changes in the Laurentide ice sheet and Scandinavian ice sheet in the Northern Hemisphere and the Antarctic ice sheet in the Southern Hemisphere(Yokoyama et al 2002.).The contributions of Laurentide ice sheet and Scandinavian ice sheet to the sea-level rise have been estimated and that is suggested to be contributed by the Antarctic ice sheet has yet been estimated at about 10-15m(Yokoyama et al 2002.).Although it is not demonstrated that the Antarctic ice sheet had actually contributed to the sea-level rise, of the Antarctic ice sheet, West Antarctic Ice Sheet (WAIS) ,in particular, had been capable of rapid ice sheet retreat which could have influenced the global sea level, because the WAIS is grounded below sea level.

In Western Antactica, the Ross Sea and Weddell Sea have the largest ice shelves, which are suggested to have mainly contributed to the global sea-level rise mainly. In this study, Ice Sheet retreat history of West Antarctic Ross Sea is investigated by studying the sedimentary transition at 6 location in the Ross Sea. This is the lagest ice shelf in Antarctica, and it is considered wether the Ross ice shelf had been strongly linked to global sea level.

In this study, analysis of the major element contents of 6 sediment cores, water content, Loss on Ignition (LOI), intervals between CS{14}ˆC and TOC{14}ˆC and lithology are used to estimate when the Ross ice selves had begun retreating.

Major element contents of 6 sediments cores were measured by X-ray Fluorescence Analysis (XRF).These XRF data allowed us to determine the sedimentary history of the 6 cores. Of the major elements, Al,Fe,Ti,etc are particularly major in the sediments originating from the continent, on the other hand, Si ,etc is particularly major in the sediments originating from ocean. At the site beneath the ice shelf (sub-ice), elements originating from the continent are abundant. At the site far from the grounding line(open ocean), elements originating from ocean are abundant. And at the date when the terrestrial elements rapidly decreased or when the ocean elements rapidly increased, it is suggested that the ice sheet have retreated.

The result suggests that the Ross ice shelf had not begun retreating at about the time of the 19ka-MWP and the MWP-1a (about 19 ka and about 14 ka). Alley et al.(2007) states that sedimentation filling space beneath ice shelves helps to stabilize ice sheets against grounding-line retreat in response to a rise in relative sea level of at least several meters but large sea-level rise such as the 100-meter rise may overwhelm the stabilizing feedback from sedimentation. This suggestion also supports that the Ross ice shelves suggested to be not strongly linked to global sea-level rise and by contrast the Ross ice shelves had begun retreating after global sea-level rise.