New insights from a laminated high sedimentation rate Holocene record from the East Antarctic margin (IODP Site U1357).

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Traditionally the East Antarctic ice sheet has been considered as particularly stable to global warming despite its evolution and impact on global climate over the Holocene remains poorly know. In order to increase this knowledge the study of past sea ice conditions around Antartic margin is of primary importance. During last IODP Expedition 318 "Wilkes Land" a site was drilled (Site U1357) and yielded a 185.6 m section of Holocene continuously laminated diatom ooze as well as a portion of an underlying Last Glacial Maximum diamict. This is an unprecedented record that potentially can allow us to directly correlated Antartic ice and marine records. We present sedimentological and geochemical data of the time of the last deglaciation and the entire Holocene. The transition between the Last Glacial Maximum (LGM) and the Holocene is recorded by laminated sediments deposited above diamicton during a period of high primary production in fjord-like setting.

A robust age model is essential for site U1357 if likely this site become an important reference section for marine-ice correlations and the study of sub-decadal climate variability. Nevertheless, Antarctic ^{14}C ages in marine sediment cores show variations by several hundred to over 1000 years because various sources contribute to the carbon in the sediment such as atmospheric CO_2, young organic matter, old carbon from upwelling ocean water, old and young material from erosion and relocation of carbon particles. Many studies have yielded an estimate for an Antarctic marine reservoir age of 1300 +/- 200 year, and offset assumed to be constant along the entire Holocene (Hall et al., 2010). In order to avoid these difficulties more than 170 absolute dates has been obtained following different methods and protocols, including compound-specific ^{14}C dating (Yamane et al., 2014), cosmogenic radioisotope Silicon-32 (^{32}Si), paleomagnetic intensity, and bulk carbon analyses. The combination of these dating techniques, that are not subject to same uncertainties, helped us to calibrate and refine ^{14}C chronostratigraphies.

In addition, the use of CT-scanner has allowed us to characterize in detail sedimentary facies dominated by iceberg rafted debris, silt layers, and biogenic laminations. Larger terrigenous input is observed at the onset of glacier recession and subsequently decreases up-section during glacier grounding-line retreat and stabilization. Comparison between CT-Scan images and X-Ray Fluorescence scanning images at ultra-high (seasonal to decadal) resolution, show that biogenic laminations with poor detrital concentrations are characterized high Ba/Al and Si/Al, allowing to use these ratios along the entire core as detrital/paleoproductivity proxies. Detrital proxies (e.g., Zr content) anticorrelate with bottom redox conditions proxies (U/Th) pointing to well oxygenated deep waters as generator for silt layers. In addition, CT-scanner data shows two events of highly terrigenous input with high IRD concentrations, suggesting two events of effective grounding-line recession off Adélie Land.

The obtained age model will allow us to conduct a cyclostratigraphic analysis where paleoclimate cycles under decadal scale will be identified.

References

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