Pleistocene cyclostratigraphy of sedimentary manganese in the western Arctic Ocean and implications for the North American glacial history

KWANGKYU PARK[1, 2], SEUNG-IL NAM[1], HIROFUMI ASAHI[1], JUNGHYUN KIM[1], BOO-KEUN KHIM[2], LEONID POLYAK[3], MICHAEL SCHRECK[1, 4], FRANK NIESSEN[5], GEE SOO KONG[6]

[1] Division of Polar Paleoenvironment, Korea Polar Research Institute, Korea
[2] Department of Oceanography, Pusan National University, Korea
[3] Byrd Polar and Climate Research Center, Ohio State University, USA
[4] The Arctic University of Tromsø, Norway
[5] Alfred Wegener Institute for Polar and Marine Research, Germany
[6] Korea Institute of Geoscience and Mineral Resources, Daejoen, Korea

Quaternary paleoenvironmental history of the Arctic Ocean remains uncertain largely because of the limited chronologic constraints, especially beyond the late Pleistocene (last ~0.1 Ma). Difficulties in establishing reliable chronostratigraphy are mainly related to low sedimentation rates and diagenetic sedimentary changes, resulting in the poor preservation of microfossils and altered paleomagnetic record. In the absence of independent chronostratigraphic data, the age model for Arctic Ocean Pleistocene sediments is largely based on cyclostratigraphy tied to orbital-scale climate changes. To refine this approach, we use manganese (Mn) fluctuations in a sediment core ARA03B-41GC from the Makarov Basin in the western Arctic Ocean.

Mn cyclicity in ARA03B-41GC was matched to the LR04 global benthic oxygen-isotope stack under diverse constraints, including visual and computational correlations. The age models obtained from computational correlations show similar age-depth relationships between each other and older ages for the core bottom in comparison with the visual approach, ca. 1.4 and 1.0 Ma, respectively. In particular, the computational age model was used to date the peak occurrences of elemental calcium (Ca) known as a proxy for detrital inputs from the Laurentide Ice Sheet. Higher inputs of Ca since the Mid-Pleistocene Transition, ca. 0.8 Ma indicate more extensive glaciations in the northern North America, consistent with earlier suggestions. Further refinement of the cyclostratigraphic approach and its verification by independent chronostratigraphic constraints is required for the development of a comprehensive and accurate age model for the Arctic Ocean sedimentary record.