Calcareous nannofossil assemblages as evidence of shifts in the Arctic/Polar Fronts during the past 24 kyr BP along the West Spitsbergen margin

Laura Bronzo

University of Florence, Earth Sciences Department, Florence, Italy; laura.bronzo@unifi.it

Fernando Sergio Gois Smith

University of Florence, Earth Sciences Department, Florence, Italy; fernandosergio.goissmith@unifi.it

Caterina Morigi

University of Pisa, Earth Sciences Department, Pisa, Italy; caterina.morigi@unipi.it

Antonio Cascella, Chiara Caricchi, Leonardo Sagnotti

National Institute of Geophysics and Volcanology (INGV) Pisa, Rome, Italy;
antonio.cascella@ingv.it; chiara.caricchi@ingv.it; leonardo.sagnotti@ingv.it

Renata Giulia Lucchi

National Institute of Oceanography and Experimental Geophysics (INOGS), Trieste, Italy; rglucchi@inogs.it

https://doi.org/10.58998/jnr3215

The study of well-preserved Arctic marine sedimentary deposits is pivotal to understanding the impact of climate changes on ecological and sedimentary scales. From the Last Glacial Maximum to the onset of the Holocene, the climate underwent abrupt changes that caused Heinrich events and episodes of rapid sea level rise known as meltwater pulses (MWPs). To unravel the effects of these events on thermohaline ocean circulation in the Arctic region, a multiproxy-based approach is essential. Here, we investigated calcareous nannofossil assemblages, and coupled the results with X-ray fluorescence (XRF) and Greenland ice core $\delta^{18}O$ data.

The piston core IRIDYA-02PC was collected on the Bellsund Drift crest along the West Spitsbergen margin. The core was sampled at a water depth of 1724 m, and it recovered 4.87 m of sediments that are distinguished by bioturbated and laminated sediments with sparse to massive ice-rafted debris and oxidized layers. The age model is based on three radiocarbon ages and on the reconstruction of a high-resolution relative paleointensity and paleosecular variation of the geomagnetic field record for the last 24 kyr BP. The calcareous nannofossil content of the IRIDYA-02PC core was investigated with a 240 yr/sample resolution.

Oscillations in total nannofossil abundance and reworked coccoliths (both expressed as number of nannofossils per gram of sediment) were compared with Ca/Ti and Zr/Rb, indicating oscillations in marine biogenic carbonate content and sediment grain size, respectively. The logarithmic ratio between the warm-water group (*Emiliania huxleyi*, *Gephyrocapsa oceanica*, small *Gephyrocapsa*, and *Calcidiscus leptoporus*) and the cold-water group (*E. huxleyi* >4 μm, *Gephyrocapsa muellerae*, and *Coccolithus pelagicus pelagicus*) (log[WWG/CWG]) was calculated to evidence shifts in the Polar Front along the West Spitsbergen margin.

During the Late Pleistocene, a decrease in abundance of both total and reworked coccoliths highlights Heinrich-like (H2, H1), Younger Dryas, and MWP-1A abrupt events that correspond to peaks in Zr/Rb values. In contrast, their slight increase in abundance is evidence of the Last Glacial Maximum and the Allerød episode with the log(WWG/CWG), suggesting the formation of a seasonal sea-ice cover over the study site. From 11.2 kyr BP, a sharp increase in total nannofossil abundance indicates the development of Holocene warmer conditions as evidenced by the log(WWG/CWG), which points to a prominent retreat of the Polar Front.

Acknowledgements:

This study is financially supported by IRIDYA (PRA2021-0012) project and MUR (University of Florence) PhD.