Late Cenozoic Climate change on the Greenland Ice Sheet: Implications to future climate change

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Background: Recent studies have highlighted the sensitivity of the Greenland Ice Sheet (GrIS) to future climate warming with significant implications for global sea-level rise and impacts on the Atlantic Meridional Overturning Circulation. Understanding the past evolution of the GrIS and the interaction with broader climate changes is key to improving our understanding of the potential future response of the GrIS to ongoing climate change. Yet, there are significant gaps in our knowledge in respect to the evolution of the GrIS associated with past climate changes. For example, the detailed evolution and cycles of growth and decay of the GrIS during the time period covering the Pliocene through the Pleistocene (the last 4 – 5 million years) that encompasses numerous fluctuations between warmer and cooler climates.

Aims and Method: This project will contribute to the IODP 400 program that was drilled 2023. Investigating the sediment cores from IODP 400 the research will principally involve geochemical analyses (osmium isotopes) but will also include additional sedimentological and microfossil analyses (e.g. foraminiferal analysis, total organic carbon (TOC), XRF scanning, x-rays and multi-sensor core logging). Osmium data will be compared to the well-established proxies collected from the same cores (in collaboration with international partners on IODP 400) and used to reconstruct environmental changes. Specifically, the osmium isotopes will be used to investigate sediment delivery from the Greenland landmass via glacial erosion and track the development and evolution of the northern GrIS into a tidewater environment onto and across the continental shelf. The sensitivity of the osmium isotope signature to terrestrial-sourced vs open ocean sourced material will provide a detailed understanding of the more subtle changes in sediment provenance linked to past climate changes and, ultimately, the sensitivity of northern GrIS to climate change.

Scientific benefits: Development of a technique to reconsturct relative ice sheet advance and retreat to aid in the interpretation of sites that have limited/poor preservation of microfossils or other paleo proxies.

Training: Training in core analysis and in sediment core description (Durham and GEUS), state-of-the-art osmium isotope geochemical analyses at the world leading laboratory in the Department of Earth Sciences, Durham, and in additional proxy techniques (microfossil, sedimentological and geochemical techniques) in state-of-the-art laboratories in the Department of Geography, Durham and GEUS.