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IODP Expedition 379: Development and sensitivity of the West Antarctic Ice Sheet tested from drill records of the Amundsen Sea Embayment

Karsten Gohl (1), Julia Wellner (2), and Adam Klaus (3)

(1) Alfred Wegener Institute, Helmholtz-Centre for Polar and Marine Research, Department of Geosciences, Bremerhaven, Germany (karsten.gohl@awi.de), (2) Dept. of Earth and Atmospheric Sciences, University of Houston, TX, USA (jswellne@central.uh.edu), (3) IODP, Texas A&M University, College Station, TX, USA (aklaus@iodp.tamu.edu)

Its submarine base and exposure to warm shelf waters makes the West Antarctic Ice Sheet (WAIS) highly vulnerable to climatic and oceanographic changes. Modelling infers that the WAIS has likely had a very dynamic history throughout the Neogene to the present. A complete collapse of the WAIS would result in a global sea level rise of 3.3 to 4.3 m, yet there is large uncertainty on predicting its future behavior and its role in sea level rise. Geological data on the past behavior of the WAIS are relatively sparsely and unequally distributed, in particular records of time intervals with climatic conditions similar to those expected for the near and distant future. Reconstructions and quantifications of partial or complete WAIS collapses in the past are therefore urgently needed for constraining and testing ice sheet models that aim to project future WAIS behavior.
JOIDES Resolution departed from Punta Arenas in mid-January 2019 for IODP Expedition 379 to drill sites on the continental shelf and rise of the Amundsen Sea Embayment (ASE), where records are expected to represent dynamical advance and retreat processes of the central part of the WAIS. This embayment is of particular significance for studying WAIS dynamics as this sector currently experiences the largest ice mass loss in Antarctica, driven by ocean heat transport to the cavities of the main outlet glaciers. The plan was to drill a series of sites on the shelf where seismic data reveal seaward-dipping sedimentary sequences that span from the preglacial depositional phase to the most recent glacial periods. Deep-water sites on the continental rise were selected for recovering continuous records of glacially transported sediments and detailed archives of climatic and oceanographic changes throughout glacial–interglacial cycles.
In this presentation, we will provide on-hand information of the recently completed drilling operation in a notoriously ice-infested environment as well as first preliminary drilling results with regard to our objectives of reconstructing the onset of glaciation in the greenhouse to icehouse transition, processes of dynamic ice sheet behavior during the Neogene and Quaternary, and ocean conditions associated with the glacial cycles.