PP45A-02 - Pliocene Glacial-Interglacial Cyclicity in Sedimentation Offshore the Amundsen Sea, West Antarctica

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15:57 - 16:07

S405a (South, Level 4, McCormick Place)

Abstract

Pliocene sediments were recovered during IODP Expedition 379 within the Resolution Drift offshore the Amundsen Sea. Site U1533 was drilled on the margin of a submarine channel extending landward to the continental margin, and Site U1532 was drilled in a more distal position on the thicker portion of the drift. We present new data collected on both sites. Facies assemblages consist of greenish gray clast-bearing mud with a biosiliceous component, interbedded with dark brownish gray laminated silty clay. Due to the close proximity of Sites U1532 and U1533 and the continuous sedimentation in the early Pliocene, individual beds of each facies can be correlated between sites. The red-green channel (a*) in shipboard reflectance spectroscopy and colorimetry data for Site U1533 covaries with the facies descriptions, Ba/Rb and Br in XRF data, ICP-MS bulk elemental ratios such as Sm/Zr, and clay mineralogy. This suggests that a more greenish color of the facies is partially attributed to a larger biogenic component in the sediment relative to the terrigenous supply, and a different provenance from the gray facies. Terrigenous particle size distributions (0-2000 mu) of Site U1533 show that the gray facies are relatively uniform silty clay, whereas greenish gray units show more variability, and a sand component. Sand-rich beds are present in both facies between the top of the greenish units and the bottom of the overlying gray units, and these have a uniform fine-sand mode. Greenish gray units are tentatively interpreted as deposition during ice retreat, with reduced terrigenous supply and higher primary productivity. Although these greenish grey facies can be interpreted as interglacial units, beds with this character do not occur evenly spaced throughout the stratigraphy. Greenish grey facies coincide with low Al/Ti ratios in XRF data for Site U1533. However, Al/Ti ratios change over evenly spaced intervals with orbital frequency and likely record a more complete record of glacial-interglacial cyclicity in sediment delivery than the irregular occurrence of greenish grey facies. This would suggest that some early Pliocene

interglacials did not yield suitable conditions for the deposition of the greenish gray facies, and highlights the complex interactions between the ice sheet and the ocean embedded within these paleoarchives.

Plain-language Summary

Layers of sediment extracted via deep-sea drilling from beneath the seafloor off the Amundsen Sea, Antarctica, were stacked up over millions of years. The layers were built by pulses of sediment supplied from land ice and biogenic blooms, with distribution of material by ocean currents. The changing color and composition of the layers is an indication of the dominant imprint of ice-related processes versus ocean processes on the sediments that were raining down on the seafloor at any given time. Sedimentation related to the ice and the ocean follows different rhythms related to distribution of heat over time at different latitudes on Earth. The climate archive studied here records how the interference of these rhythms produces ice ages in Antarctica in a previous warm period about 3 to 5 million years ago with atmospheric greenhouse conditions that were like those of today. Investigations of these polar geological climate archives help provide context for the current ice mass loss observed in this same area of Antarctica and its potential sea-level effects.

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