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Response of marine sedimentation to upper Holocene climate variability in Maxwell Bay, King George Island, West Antarctic Peninsula

Nina Wittenberg (1), Christian Hass (1), and Gerhard Kuhn (2)

(1) Alfred Wegener Institute for Polar and Marine Research, 25992 List, Germany (Nina.Wittenberg@awi.de), (2) Alfred Wegener Institute for Polar and Marine Research, 27568 Bremerhaven, Germany

The Western Antarctic Peninsula experiences a temperature increase that is higher than in other parts of Antarctica. Within the last 50 years the tidewater glaciers in the tributary fjords of Maxwell Bay (King George Island) have retreated landwards with increasing speed. Meltwaters mobilize fine-grained sediments and transport those in plumes out of the coves into Maxwell Bay.
Our hypothesis is that meltwater sediments characterize warmer climate periods of the Holocene. Marine sediment cores recovered along a profile of the eastern slope of Maxwell Bay were studied. The cores were taken in high-accumulation areas at the entrances of Collins Harbor, Marian and Potter coves.
We measured the grain-size distribution in 1-cm steps in each core with a Laser diffraction particle analyzer (range 0.04–2500 μm) in order to resolve shifts in grain size compositions in very high resolution. We undertook different approaches for reliable age determination of the sediments. Since marine biogenic carbonate suitable for radiocarbon age determination is sparse, radiocarbon dating of the extracted humic acid fraction of the bulk sediment was included. Unfortunately, these age determinations turned out to be not reliable, likely because they are overprinted by an unknown older radiocarbon source. Preliminary results suggest that the cores cover approximately the last 2000 years. The magnetic susceptibility (MS) parameter fluctuates throughout the cores. It is negatively correlated to the amount of total organic carbon (TOC) and biogenic opal, suggesting dilution of the MS signal through higher input of organic material.
Together with the bathymetry data, sub-bottom profiles reveal information on the interior of the topography and the geometry of the deposited sediments. The profiles obtained in Potter Cove show almost no sediment penetration suggesting either a very thin sediment cover and/or highly reworked unsorted sediments. The sub-bottom profiles from Maxwell Bay penetrate approximately 30 m beneath seafloor and show clearly stratified sediment layers in water depths >250 m.

In conclusion we observe fluctuations in grain size, MS, TOC and biogenic opal that are most likely the result of tidewater glacier and ice sheet dynamics, the presence or absence of meltwater sediments and the variations in bioproductivity. Thus the cores reveal the history of climate-controlled sedimentation in Maxwell Bay including the history of deglaciation from adjacent coves of the upper Holocene.