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Interannual lamination in sediments from the last glacial maximum, southeastern Wedell Sea: stratigraphic evaluation and paleoceanographic implication

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We will present high-resolution data from several gravity cores from the continental slope of the southeastern Weddell Sea, Antarctica. There, fine-grained terrigenous sediment accumulated on contourite ridges at extremely high glacial sedimentation rates (up to 4 m/ka!). Sediments are laminated, comprising coarse (silty) and fine (muddy) layers of detrital composition. According to AMS^{14}C dating, the records cover a period from 25 to 19 ka and thus represent the last glacial maximum (LGM).

The first topic we addressed was whether or not the lamination represents interannual stratification and could hence be used as high-resolution chronology. Therefore, we developed two tools. First, we extracted gray values at pixel resolution (i.e., 12 measurements/mm) from scans of x-radiographs by implementing the so-called BMPix tool. Then, we used the PEAK tool for semi-automated layer counting from the gray curves. In core PS1789, for instance, we counted 2430 peaks over 2690 AMS-dated years (= 90 %). Accordingly, there is strong evidence that the lamination represents interannual variability and therefore, the sites from the contourite ridges contain an extremely valuable climate archive for ultrahigh-resolution studies of glacial climate variability in high southern latitudes.

The second topic concerns the paleoceanographic interpretation. High accumulation

rates combined with grain-size induced lamination points to seasonally variable current strength. We favor a scenario where, during glacial winter, intense catabatic winds in front of the grounding ice sheet led to enhanced brine formation above the upper continental slope. This initiated a thermohaline circulation and the resulting intensified currents deposited a coarser winter layer on the ridge. Vice versa, during glacial summer, winds, brine formation, and thermohaline circulation diminished, and a fine-grained layer deposited. Since these processes require no areas of open water, we assign them to stadial intervals. A few sections show intercalated bioturbated intervals with higher biogenic contents. These intervals are indicative for higher surface-water productivity and required open water areas. Accordingly, we interpret them as to represent interstadials.

Although our results are preliminary, they point to enhanced bottom-water production in Antarctica during stadial times and reduced bottom-water production during interstadial times. Further studies will have to unravel how these findings compare to the reconstruction of variable glacial NADW production in the northern hemisphere and the associated global thermohaline circulation. Interestingly, the high accumulation rates on the contourite ridges ceased around 19.5 ka, indicative for a retreat of the grounded ice sheet. The timing coincides with the first isotopic change observed in the Vostok and Byrd ice cores. However, most climate models currently argue for a much later retreat of the ice sheet around 15 ka or even later.