DECADAL- TO MILLENNIAL-SCALE ICE-SHEET OSCILLATIONS IN SOUTHEASTERN WEDDELL SEA DURING THE LAST GLACIAL MAXIMUM

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Until now high-resolution sediment records from the Southern Ocean covering the Last Glacial Maximum (LGM) are very rare. Therefore there is limited knowledge about short-term regional climate fluctuations and their global correlations. To gain insight into annual to decadal-scale climate changes it is imperative to investigate varved archives. We present varved sediment records from the continental slope of the southeastern Weddell Sea. The cores originate from up to 300 m high and up to 100 km long sediment ridges, located on a terrace in 2000 – 3000 m water depth, and are accompanied by channels on their southeastern side.

During the LGM, when the grounded East Antarctic Ice Sheet margin had advanced to the shelf break, coastal polynyas formed, supported by intensified katabatic winds. This led to increased sea-ice formation, which induced brine rejection. The produced dense, high-salinity water masses sank down the continental slope, reworked sediments and drained as contour currents into the channels. Seasonally variable current velocities led to deposition of either a muddy or silty layer, forming an annual layer couplet, a siliciclastic varve. Accordingly, the varved sediment is indicative for ice-sheet advance. Occasional interruption by bioturbated sediments, which must have been deposited during open-water conditions with inactive thermohaline convection, points to ice-sheet retreat (Weber et al., 2011).

We used the BMPix and PEAK tools (Weber et al., 2010a) to distinguish and count the siliciclastic varves. Varve thickness varies quite strongly in time and between different core sites, with a mean thickness of 0.3 – 0.75 cm, hence a mean sedimentation rate of 3 – 7.5 m/kyr. Correlations of the sites using AMS 14C ages and varve counts show that the facies changes from bioturbated to laminated sediment occurred around the same time, i.e., 23 ka, 21.5 ka, 20 ka, and 19 ka. Although the sites only describe about five millennia during the LGM, the pacing of 1000 – 1500 years may correspond to the 1470-yr cycle (Bond et al., 1997) known from the Northern Hemisphere.

For further information on varve thickness variation we conducted bulk and evolutionary spectral analysis on laminated sections using the REDFIT (Schulz and Mudelsee, 2002) and ESALAB (Weber et al., 20b) programs. All varved sediment sections show similar decadal-scale cyclic thickness variations, with a dominant 50 –

85-yr cyclicity. Evolutionary spectral analysis shows, that the 50 – 85-yr cycle appears to have been a rather robust feature during the LGM. This frequency band could either relate to the Gleissberg cycle (Gleissberg, 1944) with an 87-yr cyclicity, and thus be of solar origin, or to the Atlantic Multidecadal Oscillation, a 55-80-yr cyclic North Atlantic sea surface temperature fluctuation, and thus relate to internal atmosphere-ocean interaction.