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Circum-Antarctic warming events between 3.5 and 3.7 Ma recorded in sediments from Prydz Bay (ODP Leg 188) and the Antarctic Peninsula (ODP Leg 178)

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The stability of Antarctic Ice Sheets during the Late Miocene and the Pliocene has been the subject of almost a continuous debate for more than two decades (e.g., Hardwood and Webb, 1998; Stroeven et al., 1998). A key question is if relatively short warm intervals can cause a loss in ice sheet volume once a stable ice sheet is thought to be in place (i.e., since the Middle-Late Miocene). The stable isotope record of the deep sea demonstrates that a mid-Miocene "climatic optimum", at $\sim$15 Ma, was followed by strong enrichment in oceanic δ^{18}O and climatic cooling over the next 6 Ma (e.g. Zachos et al., 2001). During this interval the EAIS is thought to have been a major and permanent ice sheet, although fluctuations in the size of EAIS may still have occurred (e.g. Westerhold et al., 2005). Marine sediments exposed in the Antarctic continent show evidence for a dynamic ice sheet during the Late Miocene-Early Pliocene as well as for Early Pliocene warming. The marine record from drilling in Prydz Bay, the Ross Sea and the Antarctic Peninsula, also shows evidence for repeated advances and retreats of the Antarctic Ice Sheet during the Late Miocene and Early Pliocene. For example, three intervals within the Pliocene (3.7 Ma, 4.3-4.4 Ma, and 4.6-4.8 Ma) when sea surface temperatures in the Southern Ocean were roughly 5ºC warmer than today have been reported based on the study of the silicoflagellate assemblages

at Site 1165 in Prydz Bay (Whitehead and Bohaty, 2003). In the Antarctic Peninsula a strong decrease in sea-ice coverage starting at 5.3 Ma and maintained during the early Pliocene is indicated by opal deposition (Gruetzner et al., 2005; Hillenbrand and Ehrmann, 2005, Hepp et al., 2006).

Here we present results on sedimentological and biostratigraphic analyses conducted in cores collected from the Prydz Bay and the Antarctic Peninsula continental rise during the Ocean Drilling Program (ODP) Legs 188 (Site 1165) Leg 178 (Sites 1095 and 1096), respectively. Our results confirm the 3.7Ma warming event in Prydz Bay (Whitehead and Bohaty, 2003) and show evidence for two additional warm events between 3.5 and 3.7Ma. The same warm events are recorded in sediments from the Antarctic Peninsula, which implies they are of continental-wide significance. Diatom total abundance and significant abundant IRD at Sites 1165 (Prydz Bay) and 1096 (Antarctic Peninsula), suggest the warming events resulted in significant sea-ice retreat with a likely collapse of the ice sheet front.