Supporting Information for

Evidence for a highly dynamic West Antarctic Ice Sheet during the Pliocene

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Introduction

This Supporting Information contains four figures that support the text of the article. Details are described in the figure captions.

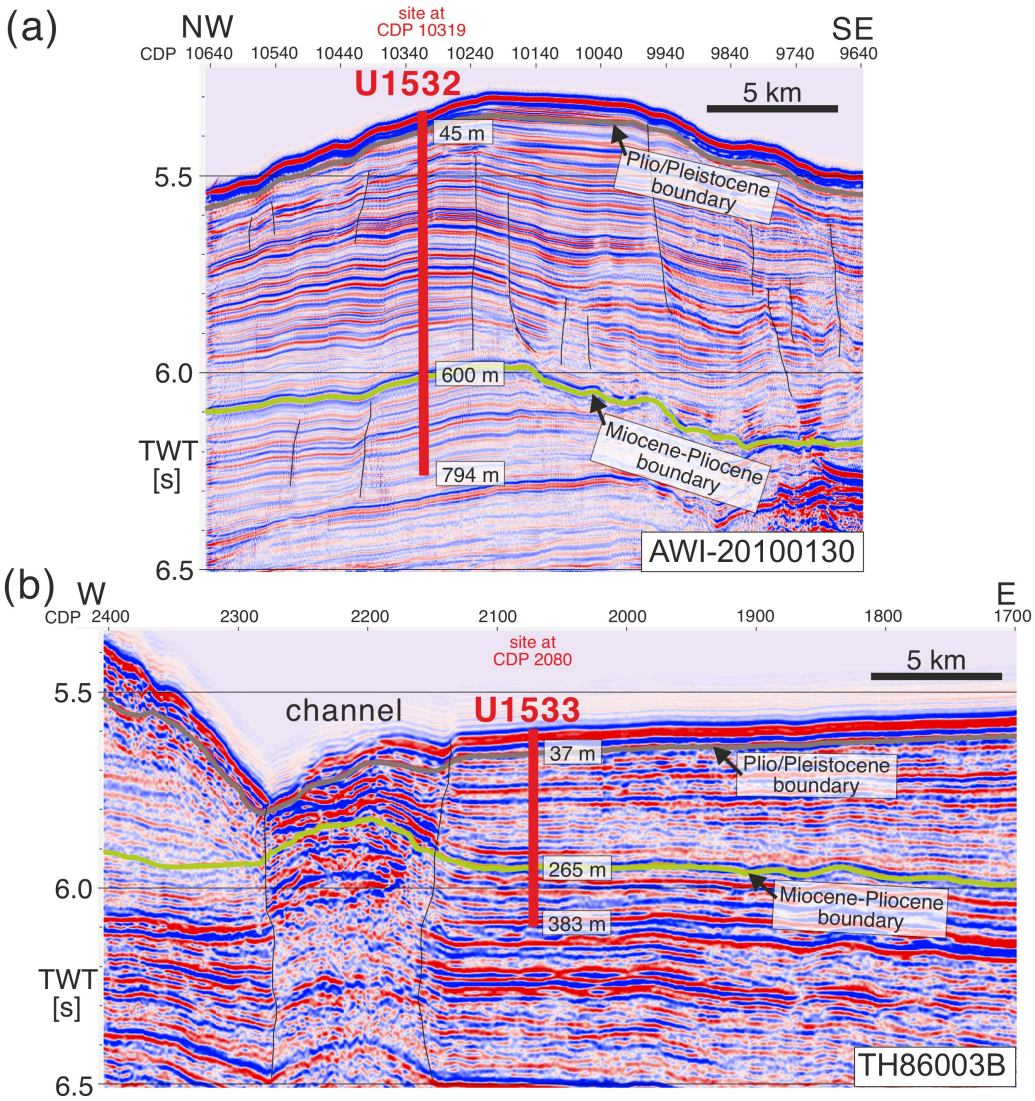

Figure S1. IODP Expedition 379 Sites U1532 (a) and U1533 (b) in their proximal seismic stratigraphic settings at seismic lines AWI-20100130 (Uenzelmann-Neben and Gohl, 2014) and TH86003B (Yamaguchi et al., 1988), respectively. Black thin near-vertical lines in (a) mark some of the faults mostly caused by differential compaction. Black thin near-vertical lines in (b) show limits of a deep-sea channel that extends from the foot of the slope (Fig. S2). TWT is two-way travel-time.

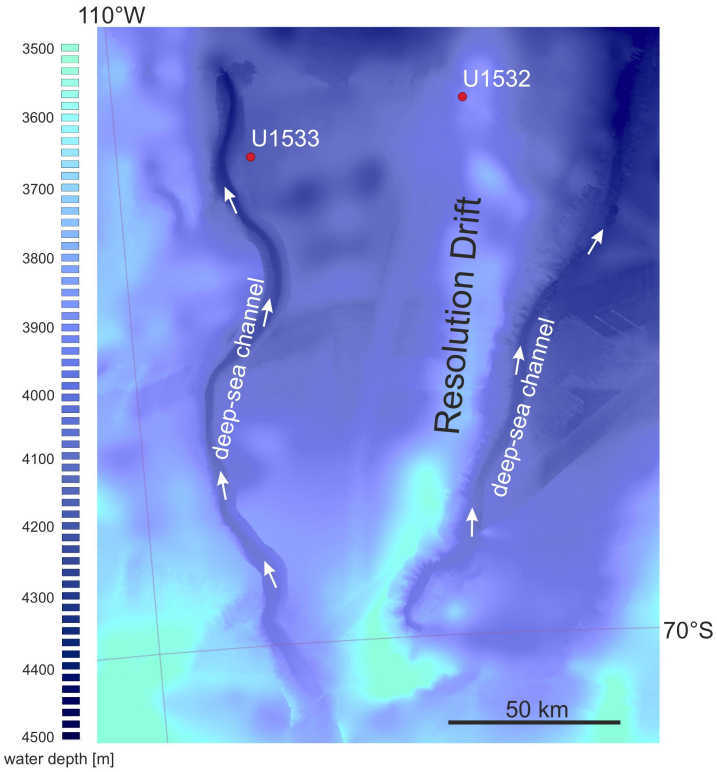

Figure S2. Bathymetric map of area at and near Resolution Drift with IODP Expedition 379 Sites U1532 and U1533. The background bathymetry of IBCSO (Arndt et al., 2013) is of relatively low multibeam coverage in this region, causing some gridding artefacts. The meandering deep-sea channels west and east of Resolution Drift were surveyed each with single multibeam swaths during RRS *James Clark Ross* cruise JR179 in 2008 (eastern channel) and RV *Akademik Alexander Karpinsky* Expedition RAE64 in early 2019 (western channel). These channels have been acting as the main transport paths (white arrows) for suspended downslope sediments supplying most of the drift deposits.

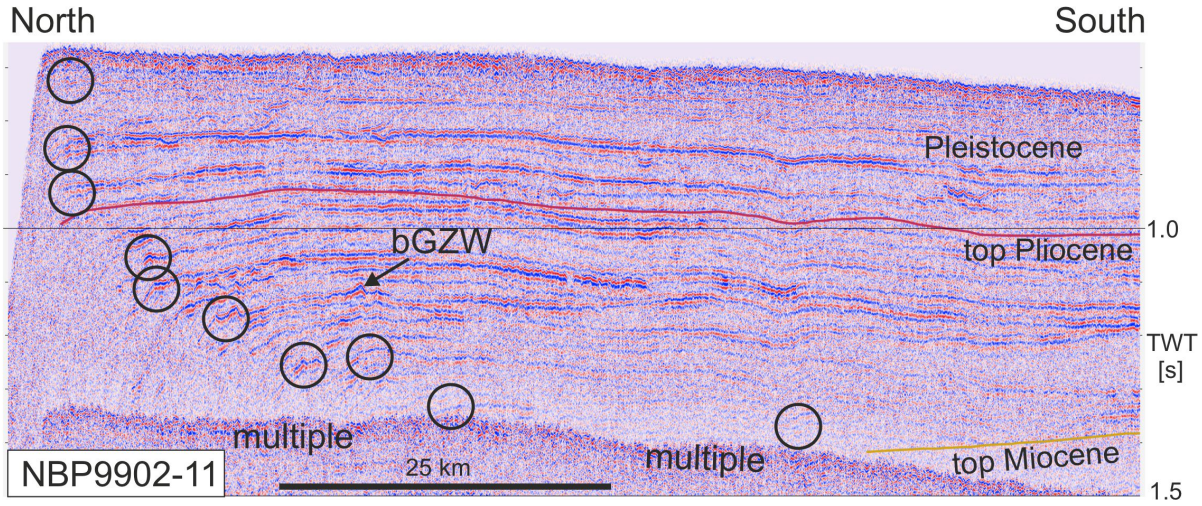

Figure S3. Single-channel seismic line NBP9902-11 (Lowe and Anderson, 2002) on prograding sequences of outer continental shelf (location in Fig. 1). Circles mark identified shelf breaks in the Pliocene and Pleistocene. bGZW annotates buried grounding zone wedge.

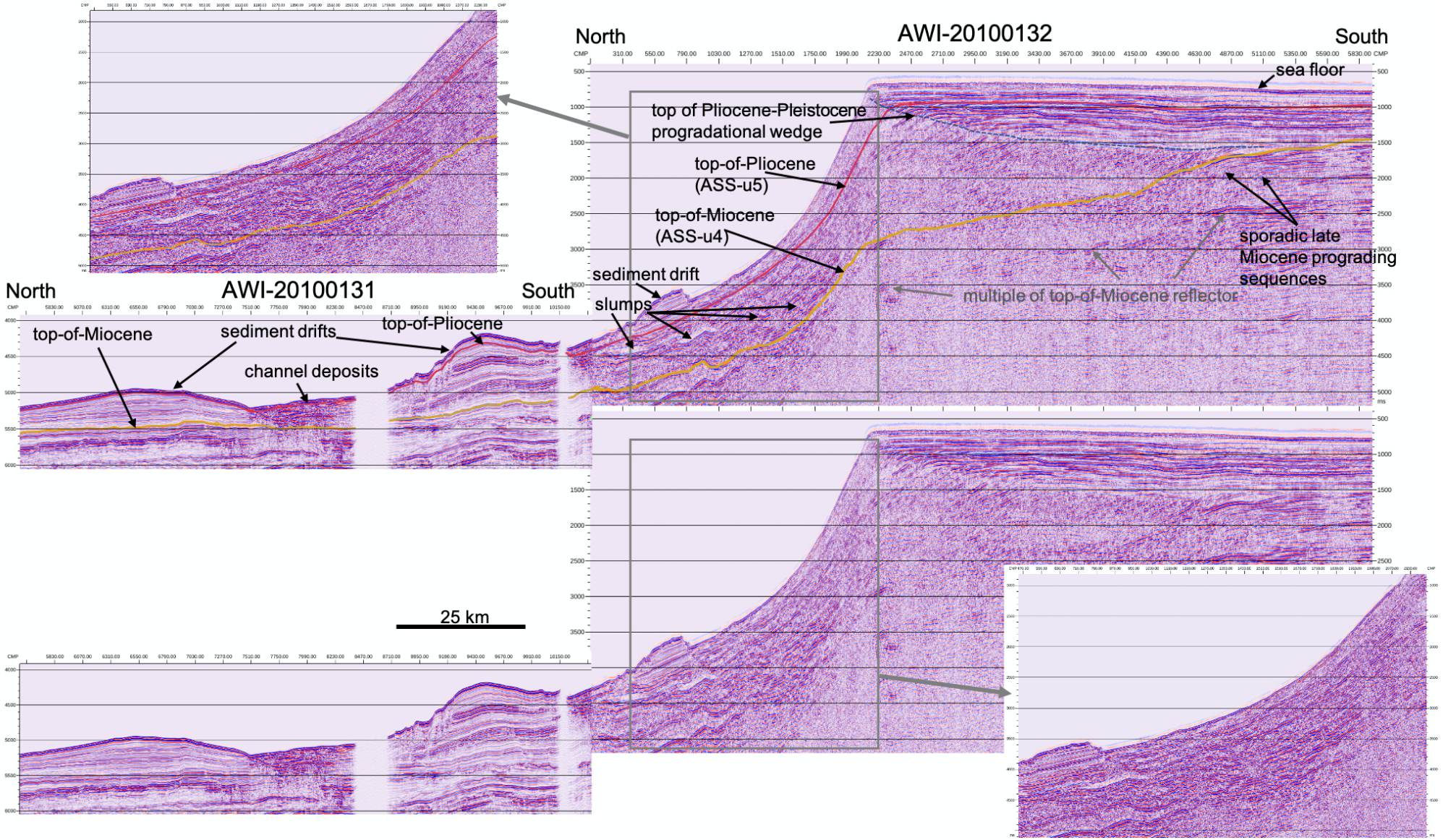
North
AWI-20100132
South
sea floor
top of Pliocene-Pleistocene
progradational wedge
top-of-Pliocene
(ASS-u5)
top-of-Miocene
(ASS-u4)
sporadic late
Miocene prograding
sequences
multiple of top-of-Miocene reflector
sediment drift
slumps
North
AWI-20100131
South
top-of-Miocene
sediment drifts
top-of-Pliocene
channel deposits
25 km

Figure S4. Enlarged seismic section across the continental slope and outermost shelf with interpretation (top), and without any line drawings and interpreted features (bottom). A close-up of the slope segment itself is separately shown.

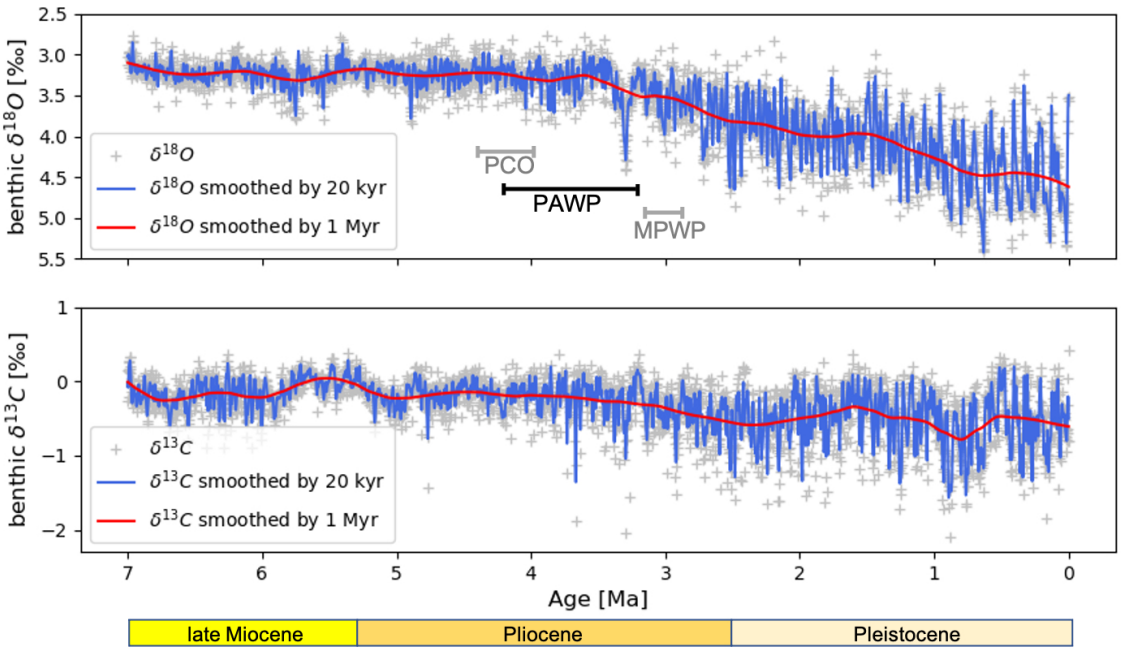

Figure S5. Global oxygen (top) and carbon isotope (bottom) records of deep-sea benthic foraminifera spanning the time frame of the cores recovered from IODP Expedition 379 drill sites from latest Miocene to Pleistocene (from CENOGRID dataset of Westerhold et al., 2020). PAWP is the Pliocene Amundsen Sea Warm Period from this study, MPWP is the so-called Mid-Pliocene or Mid-Piacenzian Warm Period (e.g., Dowsett et al., 2016; Raymo et al., 2018), and PCO is the Pliocene Climatic Optimum (e.g., Dumitru et al., 2019).