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Topographic Control on the Post-LGM Grounding Zone Locations of the West Antarctic Ice Sheet in the Whales Deep Basin, Ross Sea

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After the Last Glacial Maximum (LGM), the Antarctic Ice Sheet retreated several hundred kilometers from the outer continental shelf. An overall backstepping stratal pattern of grounding zone wedges (GZWs) indicates that the post-LGM retreat occurred in a step-wise fashion. Each GZW records a prior interval of ice-stream sedimentation during which the location of paleo-grounding zone (i.e. the former seaward limit of flowing ice grounded to the seafloor) was relatively stationary. Here we investigate whether the locations of post-LGM grounding-zone stillstands in the Whales Deep Basin (WDB) of the eastern Ross Sea were controlled by the antecedent topography. The Bindschadler Ice Stream formerly occupied the WDB. We used ~7500 km of seismic reflection data to create a depth-converted map of the LGM unconformity that was sub-glacially eroded when the WAIS was grounded at the continental shelf edge (i.e. prior to the deposition of the post-LGM GZWs). Our mapping shows that the first three paleo-grounding zones were located slightly downstream of relatively low-relief obstacles on the LGM unconformity. The subsequent four grounding zones were located above a low-relief saddle on the LGM unconformity at a bottleneck constriction in the width of the paleo-ice-stream basin. These observations support the general hypotheses that post-LGM grounding-zone locations were at least partly controlled by the antecedent subglacial topography. We cannot exclude the possibility that other factors may have also been important. However, the results suggest that models seeking to accurately predict the changing extent of grounded ice in response to ongoing climate changes should incorporate highly resolved maps of the existing subglacial topography as well as considerations as to how subglacial topography evolves in response to contemporaneous ice-stream erosion and sedimentation.