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Palaeo-ice stream pathways in the easternmost Amundsen Sea Embayment, West Antarctica

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Multibeam swath bathymetry datasets collected over the past two decades have been compiled to identify palaeo-ice stream pathways in the easternmost Amundsen Sea Embayment. We mapped 3010 glacial landforms to reconstruct palaeo-ice flow in the ∼250 km-long Abbot Glacial Trough that was occupied by a large palaeo-ice stream, fed by two tributaries (Cosgrove and Abbot) that reached the continental shelf edge during the last maximum ice-sheet advance. The mapping has enabled a clear differentiation between glacial landforms interpreted as indicative of wet- (e.g. mega-scale glacial lineations) and cold-based ice (e.g. hill-hole pairs) during the last glaciation of the continental shelf. Both the regions of fast palaeo-ice flow within the palaeo-ice stream troughs, and the regions of slow palaeo-ice flow on adjacent seafloor highs (referred to as inter-ice stream ridges) additionally record glacial landforms such as grounding-zone wedges and recessional moraines that indicate grounding line stillstands of the ice sheet during the last deglaciation from the shelf. As the palaeo-ice stream flowed along a trough with variable geometry and variable subglacial substrate, it appears that trough sections characterized by constrictions and outcropping hard substrate that changes the bed gradient, led the pace of grounding-line retreat to slow and subsequently pause, resulting in the deposition of grounding-zone wedges. The stepped retreat recorded within the Abbot Glacial Trough corresponds well to post-glacial stepped retreat interpreted for the neighbouring Pine Island-Thwaites Palaeo-Ice Stream trough, thus suggesting a uniform pattern of episodic retreat across the eastern Amundsen Sea Embayment. The correlation of episodic retreat features with geological boundaries further emphasises the significance of subglacial geology in steering ice stream flow. Our new geomorphological map of the easternmost Amundsen Sea Embayment resolves the pathways of palaeo-ice streams that were probably all active during the last maximum extent of the ice sheet on this part of the shelf, and reveals the style of post-glacial grounding-line retreat. Both are important input variables in ice sheet models and therefore can be used for validating the reliability of these models.