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Glacial geomorphology of the Anvers-Hugo Trough palaeo-ice stream, Antarctic Peninsula: Something old and something new

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Collection of new multibeam swath bathymetry and acoustic sub-bottom profiler data over the Anvers-Hugo Trough to the west of the Antarctic Peninsula in January 2014 makes it one of the most completely surveyed palaeo-ice stream pathways in Antarctica. The new data extend from the inner continental shelf to the shelf break and span the full width of the trough on the middle shelf. The same trough system was an early focus of Antarctic palaeo-ice stream studies in the 1980s and 1990s, and extensive multichannel seismic, deep-tow boomer and sidescan sonar data are available from these previous investigations. The combined datasets show strong influence of geological substrate on bedform morphology. For example, a downflow transition to smoother bed topography and more elongated bedforms is observed across the southeastern margin of a mid-shelf sedimentary basin, and crag and tail bedforms are associated with outcrops of older strata over the structural high that forms the northwestern flank of the basin. The new data show the full extent and form of two grounding zone wedges (GZWs) that were identified previously, and reveal additional GZWs on the middle shelf, indicating a step-wise grounding zone retreat. It can now be seen that one of the previously identified GZWs is associated with a constriction of the trough on the middle shelf. The multibeam data reveal mega-scale glacial lineations within 10 km of the shelf break in a small area seaward of the most distal GZW, confirming that the grounding zone advanced to the shelf break during the late Quaternary. It has previously been hypothesized that meltwater evacuated from a subglacial lake in the 1400 m-deep Palmer Deep basin on the inner shelf significantly influenced the dynamic behaviour of the ice stream in the Anvers-Hugo Trough. Directly downstream of the morphological transition over the southeastern margin of the mid-shelf sedimentary basin, multibeam data reveal a set of northward shoaling and narrowing canyons. Individual canyons are up to 300 m wide. Their location and morphology is consistent with the hypothesis that large fluxes of meltwater derived from the inner shelf flowed into the bed of the palaeo-ice stream, probably episodically.