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Submarine Glacial Geomorphology of the Continental Shelf East of the Antarctic Peninsula: Variable Feature-Scales and Overprinting Patterns

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During the last glacial maximum (LGM), grounded ice from the expanded Antarctic Peninsula Ice Sheet extended across the continental shelf. Grounded ice carved a distinctive array of glacial geomorphic features on the seafloor that have been gradually exposed as the ice sheet retreated. Under the umbrella of the LARISSA program, a recent multibeam swath bathymetry data compilation (Lavoie et al., in press) has been augmented by new high-resolution data collected from the R/V Araon. High-resolution seismic data (3.5 kHz CHIRP) was used in conjunction with the bathymetric data. Together, these datasets allow detailed mapping of the geomorphic features formed during past times of extended ice, and estimates of the rock- and sediment-types that make up the features. The study area includes the flow path of three major paleo-ice streams. A general pattern of features is apparent that is quite consistent with various models, including features that are increasingly elongated with distance from the current grounding line. ArcGIS has been used to measure width, length, and orientation of thousands of individual features. Drumlins in the study area are both significantly wider and longer than those published from many other glacial environments. Mega-scale glacial lineations are slightly larger than in other areas. Both drumlins and mega-scale glacial lineations have high elongation ratios. In Bombardier Bay, on the north side of the Larsen A embayment, we describe a "nested drumlin," which is characterized by a series of irregular concentric drumlins decreasing in size towards the interior; this feature is interpreted to have formed at the confluence of three glaciers and represent incomplete erosional smoothing in an area of alternating dominant flow directions. In two areas, distinct crosscutting patterns are observed. One, on the outer shelf, has previously been published as representing four crosscutting sets of mega-scale glacial lineations. By creating bathymetric profiles across each of these sets of features, we highlight that only two sets are actually mega-scale glacial lineations. The other two are actually sets of sub parallel iceberg furrows that are interpreted to have come from calving at a nearby grounding line. Additional crosscutting flow patterns are observed in the area of the Seal Nunataks, between the Larsen A and B embayments. Flow indicators are oriented directly offshore ($\sim$E-W), parallel to the Nunataks; this flow pattern is interpreted to be from LGM time. Additional flow indicators go from the Nunataks to the northeast, into the Larsen A embayment; however, a similar flow pattern is not observed on the south side of the Seal Nunataks. This pattern is interpreted as more recent flow and thus reorganization of the flow pattern as the grounding line retreated.