Microstructure and sedimentation processes interpreted from muddy turbidites along the Antarctic continental rise

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Ocean floor drill cores collected from the Amundsen Sea, West Antarctica during International Ocean Discovery Program (IODP) Expedition 379 recovered sediments of Holocene to late Miocene age within a sediment drift located on the continental rise. The dominant lithofacies assemblages are cyclic and alternate between planar thinly laminated grey silty clay and massive and bioturbated greenish-grey silty clay. The grey laminated lithofacies is interpreted as a distal silty mud turbidite deposit corresponding to glacials and periods of West Antarctic Ice Sheet (WAIS) growth while the massive bioturbated lithofacies may correspond to interglacial periods and WAIS shrinkage. Laminations consist primarily of terrigenous detritus likely sourced from ice advance towards the continental shelf edge and then transported by both gravity-driven and bottom current processes on the continental slope and rise. The interpretation of deep-water depositional processes of fine-grained sediments in such settings remains controversial but few studies of the microstructure of these types of turbidites exist. In order to use these sedimentary archives as a record of WAIS behaviour back through time, sedimentation processes at the drill site need to be identified. Results are presented from a micromorphological investigation of the laminated distal glaciomarine facies recovered at the drift site. Grading patterns as well as other textural and structural data suggest sediment was sourced from turbidity currents which then formed thinly laminated normally graded lithofacies. Laminations often display different types of heterolithic bedding indicating pulsed sediment supply. In addition, deformed laminations along with load structures, water escape structures, lonestones and “traction carpets” indicate subtle changes in prevalence of sedimentation corresponding to traction and fallout from lofting plumes. The relative rarity of reverse grading suggests limited contouritic deposition during late Miocene to Pleistocene glacials along the continental rise of the Amundsen Sea.