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Submarine glacigenic debris flows - a review

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Trough-mouth fans or prograding wedges are large depocenters of glacigenic sediments on high-latitude continental slopes in front of shelf troughs representing important archives of former glaciations. Unlike low-latitude and river-fed fans the trough-mouth fans and wedges are dominated by debris flow deposits. Individual deposits have a lobe-formed geometry and lobes up to 24 km wide and 50 m thick can be followed for up to $\sim$200 km on slopes of very low gradient (< 1 degree). Stacked sets of lobes, separated by glacimarine and hemipelagic sediments, have been deposited during glacial maxima when the ice front reached the shelf break, these are short periods of very high input of glacigenic sediments from fast-flowing ice streams. As no trough-mouth fans and wedges are presently active, reconstructing the paleo-environment during the release of these flows, their properties, flow mechanics and behavior can only be inferred from the depositional record, supported by laboratory experiments and modeling. Because of this many aspects of the debris flows and their paleoenvironmental setting is still poorly known. This includes their release near the shelf edge, the velocity of the flows and its spatial and temporal variations and their extremely long run-out. So far, most attention has been paid to the latter aspect. Our ability to explain their run-out is a prerequisite for prediction of future events and thus their potential impact on sea-floor infrastructure. Here the characteristics and location of the debris flow deposits will be summarized before we review aspects of the origin and behavior of these flows including: 1) the processes of glacigenic sediment transportation to the shelf edge, 2) the origin of the glacigenic sediments, 3) the processes at the ice front/uppermost fan/wedge, 4) their flow behavior and run-out distance, and 5) the depositional phase.