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Sedimentology of mega-scale glacial lineations on the Dubawnt Lake Palaeo-Ice Stream bed, Canada and implications for lineation genesis

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Mega-scale glacial lineations (MSGLs) are highly elongate, subglacial landforms produced beneath zones of fast-flowing ice. While qualitative data on their morphology have existed for several decades, studies of their composition and sedimentology are comparatively rare. Sediment exposures along the course of the Finnie River in Nunavut, northern Canada, provide a window into the internal stratigraphy and sedimentology of MSGLs formed by the Dubawnt Lake Palaeo-Ice Stream during regional deglaciation of the Laurentide Ice Sheet. Stratigraphic sections record evidence for an initial advance of ice into the study area followed by ice sheet recession and deposition of glacifluvial and glacilacustrine outwash. Subsequently, the Dubawnt Lake Palaeo-Ice Stream overrode and reworked this outwash subglacially forming an 'MSGL till'. This till comprises a sandy, red diamicton facies, forming the core of the MSGL ridges and containing variably deformed lenses, stringers and rafts of outwash. The sedimentology of this diamicton is consistent with an origin as a glacitectonite and hybrid till formed by a combination of non-pervasive subglacial sediment deformation and lodgement. Facies variations from stratified to massive diamicton reflect, in turn, variations in strain and subglacial transport distance. The occurrence of stratified glacifluvial sediments within these ridges and the well-preserved nature of many of the sandy inclusions within the diamicton imply relatively short transport distances and incomplete mixing. MSGLs under the Dubawnt Lake Palaeo-Ice Stream formed through a combination of subglacial erosion and deposition. This included non-pervasive, subglacial sediment deformation and the reworking of pre-existing sediment depocentres during streaming flow. These results highlight the importance of sediment supply to MSGL formation with the presence of abundant pre-existing sediments which were subsequently overridden being critical to lineation formation.