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Mega-scale transverse subglacial bedforms in the Keewatin sector of the Laurentide Ice Sheet

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Assemblages of glacial landforms of extreme size – considerably larger than previously reported – are here identified from the bed of the Keewatin sector of the Laurentide Ice Sheet. Large till 'belts' or 'ridges' form extensive and coherent patterns throughout the Keewatin region, and lie beneath the classic geomorphology (drumlins, ribbed moraine) of the known regional glacial landform record. Planform and crestline mapping from remotely sensed imagery yields a mapped population of >2500 individual till belts, whose dimensions are on average ∼10 km long (up to 50 km) and ∼1.5 km wide (up to 5 km). Based on analysis of their morphology and morphometry, their spatial arrangement and pattern, and comparison with analogues and reference populations of glacial landform types, we interpret 3 morphological groups of different genetic origin. Two of these groups can be explained as overprinted and degraded examples of mega-scale glacial lineations, and ice-marginal (terminal) moraines. A significant number of the Keewatin population, however, does not fit any existing category of glacial landforms. These till belts display strong morphological similarity to ribbed moraine fields, and are spatially closely integrated with the Keewatin ribbed moraine population. We interpret these belts as subglacial bedforms, of a mega-scale, transverse to the palaeo-ice flow direction. Transverse bedforms of such scale have not been previously reported from any palaeo- (or contemporary) ice sheet. Here we explore how such landforms may relate to, or be explained by, existing theories for subglacial bedform genesis. The Keewatin landforms indicate that there is a fundamental transverse organisation of till at a scale beyond that which is typically manifest as subglacial bedforms, beyond that which has hitherto been realised, and which must logically have implications for the processes of ice-bed coupling and ice sheet motion.