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Ribbed bedforms on palaeo-ice stream beds resemble regular patterns of basal shear stress (‘traction ribs’) inferred from modern ice streams

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Rapidly-flowing ice streams are an important mechanism through which ice sheets lose mass, and much work has focussed on elucidating the processes that increase or decrease their velocity. Recent work using standard inverse methods has inferred previously-unrecognised regular patterns of high basal shear stress (‘sticky spots’ >200 kPa) beneath a number of ice streams in Antarctica and Greenland, termed ‘traction ribs’. They appear at a scale intermediate between smaller ribbed moraines and much larger mega-ribs observed on palaeo-ice sheet beds, but it is unclear whether they have a topographic expression at the bed. Here, we report observations of rib-like bedforms from Digital Elevation Models (DEMs) along palaeo-ice stream beds in western Canada that resemble both the pattern and dimensions of traction ribs. Their identification suggests that traction ribs may have a topographic expression that lies between, and partly overlaps with, ribbed moraines and much larger mega-ribs. These intermediate-sized bedforms support the notion of a ribbed bedform continuum. Their formation remains conjectural, but our observations from palaeo-ice streams, coupled with those from modern ice masses, suggest they are consistent with wave-like instabilities occurring in the coupled flow of ice and till and modulated by subglacial meltwater drainage. Their form and pattern may also involve glaciotectonism of subglacial sediments.