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Crescentic scours on palaeo-ice stream beds

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Crescentic scours are a surprisingly widespread morphological feature on palaeo-ice stream beds in cross-shelf troughs on glaciated continental margins. These curved channels or moats most often occur around the heads of drumlins or other streamlined bedforms or as linear to curvilinear channels on the upstream side of bedrock protuberances. In planform they occur as classic crescent-shaped hollows, asymmetric hairpins with either one or two downstream “arms”, or more sinuous channels. Here we present a morphometric analysis and comparison of crescentic scours from Arctic and Antarctic palaeo-ice stream beds, with examples from the Norwegian and Canadian margins in the north to the Amundsen Sea sector of Antarctica in the south. Overall, dimensions vary greatly with lengths of 200-3000 m; widths of 60-500 m, and depths of 5 to >60 m. The scours are semi-circular to u-shaped in cross-section and can be flat-bottomed. These features are most often found where bedrock crops out at the seafloor and sediment cover is thin, i.e. in inner to middle shelf locations. The negative-relief scours are most often interpreted as having been incised by meltwater during deglaciation (when meltwater was more available), although alternative formation mechanisms may include erosion by a saturated till slurry or the direct action of mobile basal ice. The near-absence of surface melting at present in Antarctica may favour incision by till or ice in this environment, but the interconnectivity of scours to form longer channels points to a meltwater origin on some palaeo-ice stream beds. In addition, the prevalence of features on the upstream side of bedrock obstacles suggests that localised melting at the contact between ice and the obstacles may be a relatively common mechanism for formation. The intimate association of crescentic scours with subglacial bedforms (drumlins/lineations/crag and tails) suggests that, regardless of their mechanism of formation, they may play an important role in understanding processes at the ice-bed interface.