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# Pre-LGM ice dynamics of the Greenland Ice Sheet in Uummannaq Fjord West Greenland, revealed by blockfields, tors and till mantled surfaces

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The future response of the Greenland Ice Sheet has been the focus of much recent modelling work but in order to fully understand the dynamics of this ice mass it is also imperative that the past behaviour of the ice sheet is understood. Indeed it is only through successful hindcasts of past ice geometries and dynamics that confidence in predictions can be achieved. In most glaciated environments determining ice dynamics prior to the Last Glacial Maximum (LGM) and subsequent deglaciation are non-trivial. They rely on fortuitous preservation, more restricted ice cover at LGM than previously or protective cold based ice cover. Here results are presented from hypsometric surfaces in the Uummannaq Fjord region of West Greenland which can provide constrains on the dynamics of ice cover prior to and including the LGM.

Uummanaq Fjord is a classic landscape of selective linear erosion containing deeply incised troughs juxtaposed with high elevation plateau where relief approaches 3 km in places. Excavations were made in a number of summit blockfields with samples collected. Results from a morphometric landscape analyses a presented, using both landscape hypsometry and an elevation-range slope-map approach to identify hypsometric surfaces. The hypsometric surfaces are divided into those which are now denuded and classified as regions of areal scour, those with a blockfield cover and areas which are still ice covered. A number of sites have been visited and excavations were made into blockfields. Data are presented indicating minimum depths, granulometry and mineralogy of blockfields which allowed a further subdivision into allochthonous and autochotonous blockfields. Samples were also collected for cosmogenic nuclide exposure analyses and indicate that blockfield boulders and tors exhibit ages extending significantly beyond the LGM.

Based on equilibrium profile reconstructions of the LGM ice sheet (constrained by onshore and offshore geomorphology and cosmogenic and 14C ages) the history of the summits and thus ice dynamics through the last glacial cycle are inferred e.g. a maximum exposure age of 121 ka is determined for the inner fjord on the Nuussuaq at almost 1200 m while a maximum of 87 ka is determined for Ubekendt Ejland at 1150 m. Given the positive feedback towards summit isolation and landscape preservation associated with selective linear erosion implications for longer term ice dynamics and landscape evolution are discussed.