



Subglacial conditions beneath a numerically-simulated LGM Antarctic Ice Sheet, and implications for geological interpretations

Nick Golledge (1,2)

(1) Antarctic Research Centre, Victoria University of Wellington, Wellington 6140, New Zealand (nick.golledge@vuw.ac.nz),
(2) GNS Science, Avalon, Lower Hutt 5011, New Zealand

Subglacial erosion and deposition is a well-studied topic yet one whose details remain poorly constrained, largely as a consequence of the inaccessibility of glacier and ice sheet beds, and the diversity of processes involved. An understanding of conditions that give rise to bedrock erosion, subglacial sediment transport and eventual deposition is, however, of central importance to the interpretation of geological sequences evident in marine and terrestrial drill cores or in seismically-identified sequences. Here we use an heuristic approach to predict the pattern of subglacial erosion potential and resultant sediment flux beneath a modelled LGM Antarctic Ice Sheet, in an attempt to identify aspects that may help interpret geological archives. Using time-dependent experiments we also explore how potential erosion rates may have varied through entire glacial cycles. Our results indicate that greatest subglacial erosion and till mobilization occur where high driving stresses combine with high velocities, such as in deep continental-shelf troughs occupied by fast-flowing ice (Amundsen Sea, eastern Weddell, outer Ross and Amery embayments) and beneath steep and fast-flowing terrestrial outlet glaciers, such as those in the Transantarctic Mountains (especially Byrd, Nimrod, Mulock, Beardmore). In our Antarctic LGM ice sheet, highest cumulative sediment fluxes occur at the down-stream grounding lines of the Amery, Byrd, Pine Island / Thwaites, and Thiel Trough ice streams. Using a 1-dimensional column model to simulate subglacial erosion, till mobilization and deposition through successive glacial cycles, we find that these processes are most prevalent during initial phases of an ice-sheet's response to environmental perturbations, rather than coincident with ice-sheet maxima. Consequently, erosional and depositional glacial geological archives most probably record subglacial processes taking places during these early stages of glacial transitions, rather than processes occurring under equilibrium conditions.