



Using blue-ice moraines to constrain elevation changes of the West Antarctic Ice Sheet in the southern Ellsworth Mountains

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Observations in the Weddell Sea sector of the Antarctic Ice Sheet have not yet allowed the dating of elevated glacier trimlines and associated deposits in the Ellsworth Mountains. This uncertainty limits the value of models of changing ice-sheet configuration, volume and, by extension, sea level during glacial cycles and earlier. Here we present the emerging results of a study into the origin and evolution of blue-ice moraines in the Heritage Range, southern Ellsworth Mountains, and begin to unravel the long record of ice-sheet history they hold. Our findings so far are: (a) Ground Penetrating Radar shows that the blue-ice moraines are equilibrium forms bringing basal debris to the ice surface; the compressive ice flow is caused by enhanced ablation at the mountain foot. (b) Moraines are concentrated in embayments that focus katabatic winds and their location is largely controlled by topography. (c) The elevated blue-ice moraines in the southern Ellsworth Mountains hold a continuous record of West Antarctic Ice Sheet history going back 600,000 years; so far we have not found evidence of de-glacial intervals. (d) Thinning since the LGM (\sim 40 ka?) is < 450 m and agrees with views of modest changes in the Weddell Sea sector during glacial cycles; most thinning occurred in the Holocene (6-3 ka). (e) Downslope flow of debris-covered ice in embayments follows ice surface lowering; it transports old clasts downslope and exposes fresh clasts, thus complicating the interpretation of exposure ages. We hope that a second field season in 2014 to re-measure 90 stakes for horizontal movement and ablation will help quantify the rate of blue-ice moraine formation.