

EP15A-02 - Development of Glacial Topography over a Hot Geotherm: Insights from Low-Temperature Thermochronology and Thermo-Kinematic Modeling in Marie Byrd Land, West Antarctica



Monday, 13 December 2021



15:07 - 15:12



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Abstract

West Antarctica hosts an unusually high geothermal gradient supported by hot, low-viscosity mantle which likely enhanced the lithospheric response to West Antarctic Ice Sheet [WAIS] cycles of growth and increased the sensitivity of thermochronometers to landscape evolution. Thus a valuable record of glacial landscape change might be recovered from apatite fission track [AFT 80-130°C range] and (U-Th)/He [AHe; 50-90°C] dating, provided that landscape evolution can be distinguished from tectonic signals, including the effects of faults. This study utilizes AFT-AHe thermochronology and thermo-kinematic Pecube modeling to investigate interactions between the hot geotherm, glacial erosion, and inferred crustal structures in the Ford Ranges and the DeVicq Glacier trough in Marie Byrd Land (MBL).

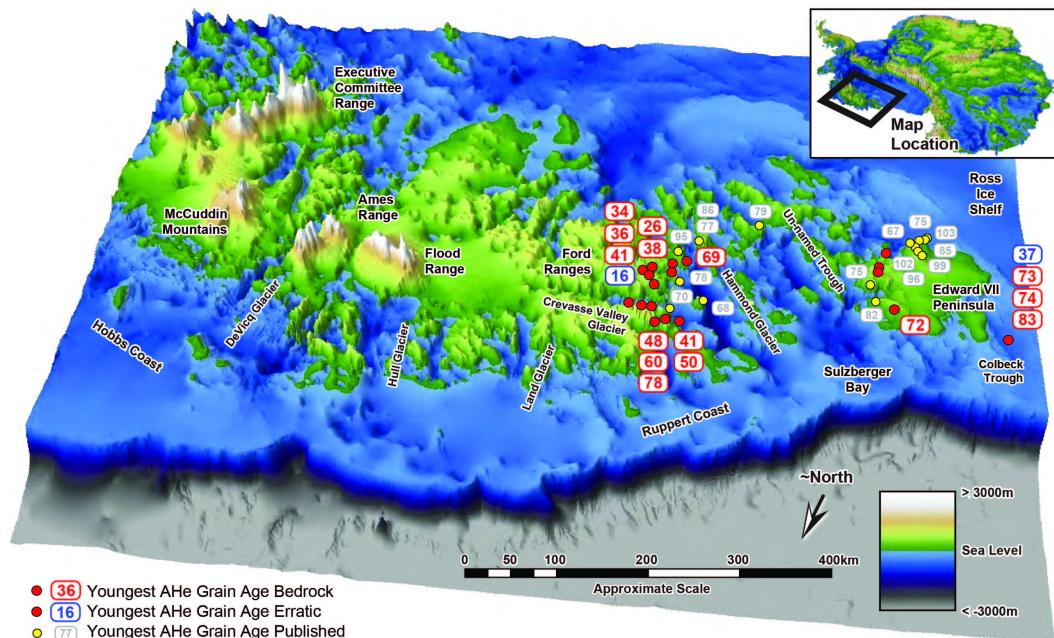
The Ford Ranges host glacial troughs (up to 3km relief) dissecting a low-relief erosional surface. Previous work suggests a majority of bedrock exhumation and cooling occurred at/by 80 Ma. However, new data hint at renewed exhumation linked to glacial incision since WAIS formation at 34 or 20 Ma. Prior (U-Th)/He zircon dates from exposures of crystalline bedrock span 90 – 67 Ma. New AHe bedrock dates are 41 to 26 Ma, while two glacial erratics (presumed to be eroded from walls or floor of glacial troughs) yielded AHe dates of 37 Ma and 16 Ma.

The DeVicq Glacier trough (>3.5km relief) likely coincides with a regional fault but lacks temperature-time information compared to other regions. The structure may have accommodated motion between elevated central MBL and the subdued crust of the Ford Ranges. We are acquiring AHe and AFT for onshore and offshore samples to compare uplift and exhumation rates for bedrock flanking DeVicq trough.

Our new Pecube models test a series of thermal, tectonic, and landscape evolution scenarios against a suite of thermochronologic data, allowing us to assess the timing of glacial incision and WAIS initiation in the Ford Ranges, and to seek evidence of an inferred tectonic boundary at DeVicq Trough. Modeling efforts will be aided by new AHe analyses from ongoing work. These models combine topographic, tectonic, thermal, and key thermochronologic datasets to produce new insight into the unique cryosphere-lithosphere interactions

affecting landscape change in West Antarctica.

3D bed topography of the western Marie Byrd Land study area (using the 500m resolution BedMachine version 2 DEM) showing location of samples, and youngest apatite (U-Th)/He grain ages from each sample acquired so far (Summer 2021).



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