4-9 - DIFFERENTIAL EXHUMATION IN WESTERN MARIE BYRD LAND, WEST ANTARCTICA, EXPOSED THROUGH LOW-TEMPERATURE THERMOCHRONOLOGY AND THERMO-KINEMATIC MODELING

Sunday, September 22, 2024

10:10 AM - 10:25 AM

212B (Anaheim Convention Center)

Abstract

The Cenozoic tectonic history of Marie Byrd Land (MBL), West Antarctica, is dominated by uplift of the MBL dome, a ~800 by ~300 km topographic swell thought to be supported by a hot mantle anomaly, and normal faulting accompanying extension of the West Antarctic rift system (WARS). Additionally, glaciation beginning at 34 – 20 Ma resulted in deeply incised glacial troughs with up to 5km of relief. This study investigates the timing, magnitude, and spatial relationships of these tectonic and erosional events by determining a regional exhumation history of western MBL through thermo-kinematic modeling of low-temperature thermochronologic data. New apatite (U-Th)/He (AHe) analyses include ages between 46 – 63 Ma, significantly younger than previously determined ages between 80 – 100 Ma. 3D thermo-kinematic modeling reveals focused glacial incision alone is incapable of producing this young population of AHe ages, indicating additional exhumation processes have been at work since ~80 Ma. Differential exhumation across western MBL is required to produce the range of observed AHe ages, with laterally variable exhumation ranging from little to none on the Edward VII Peninsula to ~0.04 km/myr in the eastern Ford Ranges. This spatial pattern is consistent with enhanced exhumation related to uplift of the MBL dome in the eastern Ford Ranges, with this effect diminishing westward to the Edward VII Peninsula. A sharp change in exhumation rate in the western Ford Ranges suggests recent motion on inferred normal faults consistent with WARS extension and down-dropping of the Edward VII Peninsula. Models based on available bedrock data provide little insight into the timing and magnitude of glacial incision due to the present inability to directly sample bedrock in deep glacial troughs. However, model predictions of bedrock low-temperature age distributions within glacial troughs are useful as a point of comparison for detrital age distributions. New detrital AHe ages from Sulzberger Bay, offshore western MBL, range from 49 – >100 Ma and are consistent with model age distributions. These model results support a complex, spatially heterogeneous exhumation history for western MBL tied to its position between the MBL dome and the WARS and provide insight into the impact of glacial incision across the regional landscape.

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Author

T

Jennifer Taylor
University of Tennessee at Chattanooga

Authors

S

Christine Siddoway
Colorado College

T

Stuart N. Thomson
University of Arizona

T
Christian Teyssier
University of Minnesota

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