Geophysical Research Abstracts
Vol. 16, EGU2014-14407, 2014
EGU General Assembly 2014

An exhumation history of Hall Peninsula, Baffin Island, Canada derived from low-temperature thermochronology and 3D thermokinematic modeling

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The eastern Canadian Arctic Rim (eCAR) is a rugged, high-relief terrain, spanning from southeastern Ellesmere Island to northern Labrador. While much of the relief along the eCAR may be related to rift-flank uplift and incision during and after rifting between Canada and Greenland, there has recently been much debate over our understanding of passive margin evolution and the processes responsible for the development of their modern landscape. Furthermore, thermal histories derived from previous thermochronologic studies from the northern and southern regions of the eCAR, as well as in West Greenland, are incompatible with a single, continuous exhumation history for the eCAR. This study aims to characterize the long-term exhumation history of Hall Peninsula, and, by linking together previous thermochronologic studies in the eCAR, we will test various models of tectonic and climate-driven landscape evolution of Baffin Island.

In total, 33 samples have been analyzed by low-temperature (U-Th)/He thermochronometry (26 apatite-He (AHe), 7 zircon-He (ZHe); 5 aliquots each) to help define the cooling history of the rocks on Hall Peninsula. Results from these samples reveal cooling ages that are heavily influenced by the effects of radiation damage, with strong positive or negative correlations between effective U concentration (eU = U + 0.235Th) and He age for AHe and ZHe, respectively. Preliminary modeling of the t-T path of individual samples using thermal modeling program HeFTy suggests a history of protracted, slow cooling across Hall Peninsula, with cooling events initiating from middle Paleozoic to late Mesozoic. However, many samples cannot be modeled using HeFTy, likely due to the large dispersion in the age data. Thus, to aid the thermal model in adjusting the cooling ages for the effects of radiation damage, select samples will also be analyzed using apatite fission track thermochronometry. A three-dimensional thermokinematic finite-element modeling code, Pecube, will also be used to determine the collective t-T history of the rocks on Hall Peninsula, and test whether the spatial distribution of adjusted cooling ages can be explained through a simple (vertical) exhumation mostly by erosional processes, or if it requires a more complex exhumational history (e.g., faulting).