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Evolution of the elevated passive margin of northwest Greenland

Cornelia Spiegel (1), Wolfgang Reiter (1), Frank Lisker (1), and Volkmar Damm (2)

(1) Department of Geosciences, University of Bremen, Germany (cornelia.spiegel@uni-bremen.de), (2) Federal Institute for Geosciences and Natural Resources, Hannover, Germany

The geomorphic evolution of high-standing passive continental margins is still controversially discussed. This is particularly true for the elevated margins of Greenland. They have alternatively been explained by resulting from prolonged very slow erosion following Paleozoic orogeny, resulting from rifting and opening of ocean basins adjacent to the Greenland continental margins, or as young geomorphic features only formed during the Cenozoic. This study focuses on the northwestern margin of Greenland, north of the Melville Bugt at the northern end of Baffin Bay, using a combination of apatite fission track and (U-Th-Sm)/He thermochronology. Opening and formation of oceanic crust of Baffin Bay took place during the Late Cretaceous. The study area is also situated at the southern termination of the postulated Wegener Fault, a controversially discussed large-scale strike-slip fault system supposedly active during the Paleogene, which has been described as one of the last problems of global plate tectonic reconstructions. Our data show that several normal faults dissecting the northwest Greenland margin were active during or after the Cretaceous, presumably related to extension associated with the opening of Baffin Bay. Also, our data show a clear – although not very pronounced – cooling signal at the end of the Cretaceous, which we interpret as reflecting initial formation of an elevated margin during and after continental breakup. Margin formation was followed by subsidence, with maximum burial at c. 30 Ma, again followed by a period of relatively rapid exhumation associated with net denudation of 2 – 3 km. This post-30 Ma denudation period may be related to tectonic activity associated with ongoing northward movement of Greenland, or to climatic changes such as early glaciation of the Arctic realm. In any case, our data imply that the present morphologic expression of the northwest Greenland margin results from young Cenozoic processes unrelated to earlier orogenies or continental breakup.