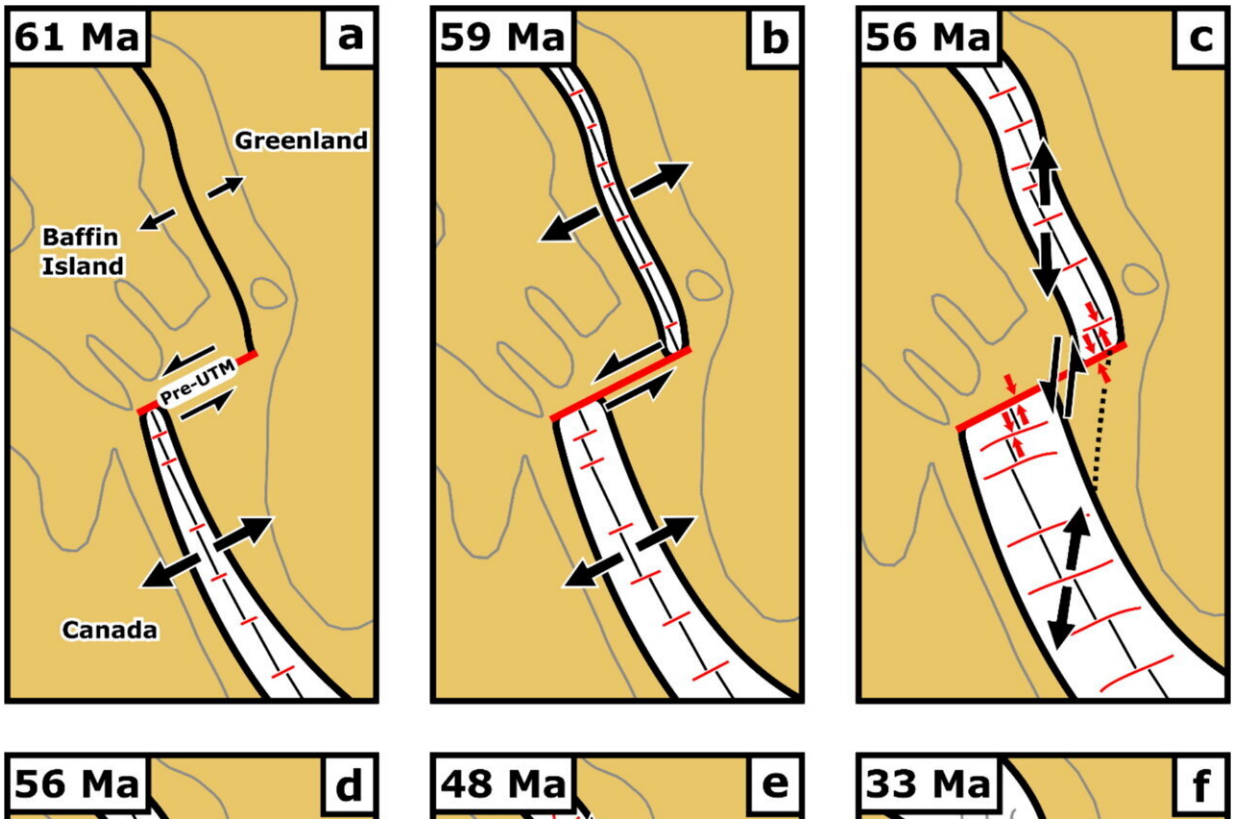
New incompletely rifted microcontinent identified between Greenland and Canada

July 10 2024, by Hannah Bird



Schematic representation of the evolution of the Labrador Sea, Baffin Bay and Davis Strait through the Paleogene. Abbreviations: Pre-Ungava Transform Margin (Pre-UTM), Davis Strait proto-microcontinent (DSPM), Ungava Fracture Zone (UFZ). Credit: Longley et al. 2024.

Plate tectonics are the driving force behind Earth's continental

configurations, with the lithosphere (oceanic and continental crusts and upper mantle) moving due to convection processes occurring in the softer underlying asthenospheric mantle. Many earthquakes, volcanic eruptions and mountain formations are direct consequences of the movements of these globe-spanning plates, particularly at their margins.

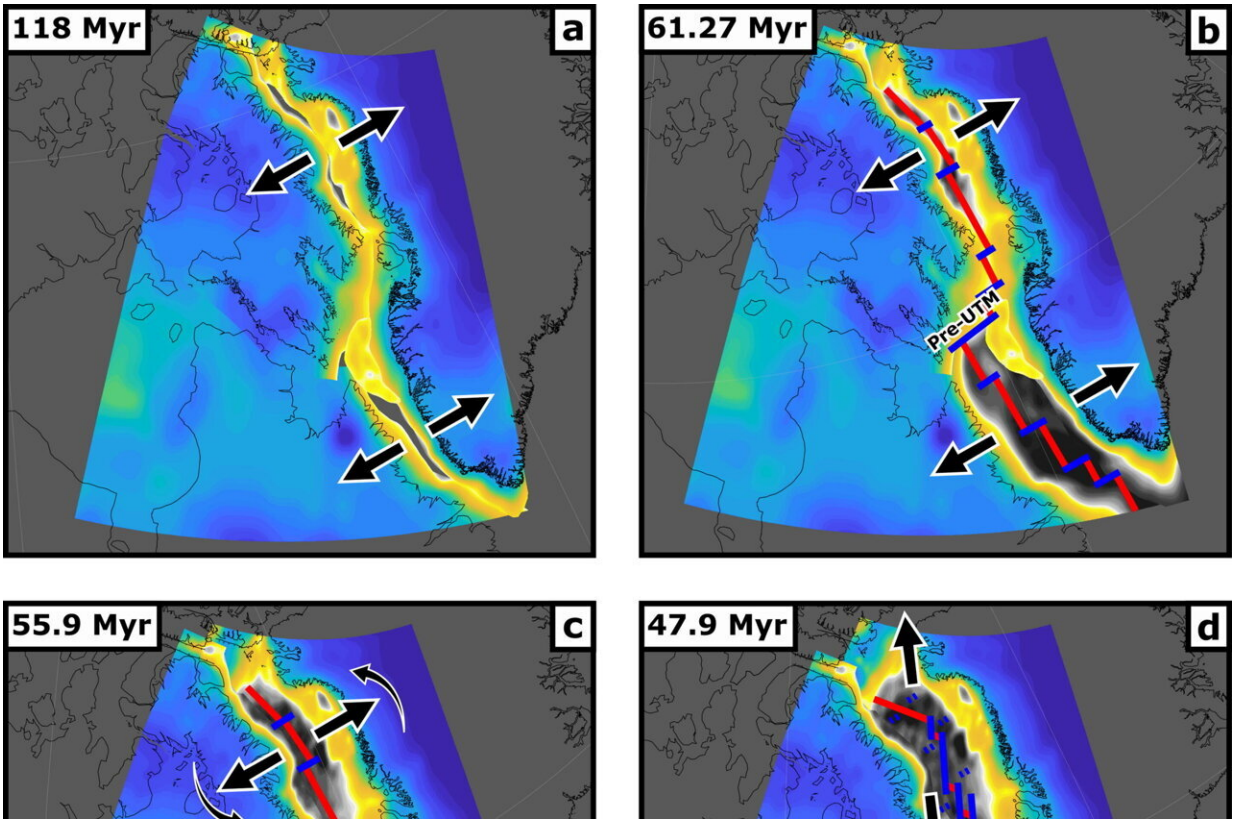
One such plate boundary occurs between Canada and Greenland, which has formed the Davis Strait seaway connecting two ocean basins, the Labrador Sea and Baffin Bay. The tectonic evolution of the Davis Strait is dated to ~33–61 million years ago (Ma) during the Paleogene, during which one particularly unusual feature formed—a thicker than normal (19–24 km) fragment of continental crust in the ocean.

This is now deemed to be a newly-recognized, incompletely rifted and submerged microcontinent offshore of west Greenland: the Davis Strait proto-microcontinent.

Understanding the mechanism and reason for this crustal anomaly is the focus of new research, published in *Gondwana Research*. Doctoral researcher Luke Longley and Dr. Jordan Phethean (University of Derby, UK) alongside Dr. Christian Schiffer (Uppsala University, Sweden) have generated a reconstruction of the plate tectonic movements spanning ~30 million years that resulted in the proto-microcontinent's formation. They define proto-microcontinents as "regions of relatively thick continental lithosphere separated from major continents by a zone of thinner continental lithosphere."

Dr. Phethean explains why this particular location is so important for this research and why looking at past microcontinent formation is vital for today. "The well-defined changes in plate motion that occur in the Labrador Sea and Baffin Bay, which have relatively limited external complications affecting them, make this area an ideal natural laboratory for studying microcontinent formation.

"Rifting and microcontinent formation are absolutely ongoing phenomena—with every earthquake we might be working towards the next microcontinent separation. The aim of our work is to understand their formation well enough to predict that very future evolution."



Model of plate tectonic evolution between Canada and Greenland, identifying the position of the Davis Strait proto-microcontinent (DSPM), as well as indicating the location of transform faults along the Mid-Atlantic mid-ocean ridge and continental crust thicknesses. Credit: Longley et al. 2024.

To explore this further, the research team used maps derived from gravity and seismic reflection data to identify the orientation and age of faults pertaining to rifting, the mid-ocean ridge (where Greenland rifted

apart from the North American plate), and associated transform faults (where two tectonic plates slide past each other).

The scientists identified initial rifting between Canada and Greenland began ~118 Ma during the Lower Cretaceous, with seafloor spreading commencing in the Labrador Sea and Baffin Bay at ~61 Ma.

Subsequently, the period ~49–58 Ma is noted as being key to the formation of this proto-microcontinent, with the orientation of seafloor spreading between Canada and Greenland altering from northeast-southwest along the Pre-Ungava Transform Margin, to north-south, rifting off the Davis Straight proto-microcontinent. By ~33 Ma, ocean spreading ceased as Greenland collided with Ellesmere Island, after which Greenland joined the North American plate.

In this model, the Davis Strait proto-microcontinent is identified based upon crustal thicknesses, where the microcontinent appears in the range of 19–24 km-thick thinned continental crust, surrounded by two narrow bands of thin (15–17 km) continental crust that separate it from mainland Greenland and Baffin Island.

This research has applicability to other microcontinents globally to understand their calving from continental crust, including the Jan Mayen microcontinent northeast of Iceland, East Tasman Rise southeast of Tasmania, and the Gulden Draak Knoll, offshore western Australia.

Dr. Phethean notes, "Better knowledge of how these microcontinents form allows researchers to understand how plate tectonics operates on Earth, with useful implications for the mitigation of plate tectonic hazards and discovering new resources."

More information: Luke Longley et al, The Davis Strait proto-microcontinent: The role of plate tectonic reorganization in continental

cleaving, *Gondwana Research* (2024). DOI: 10.1016/j.gr.2024.05.001