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The Complexity of Oblique Rifts: The Preservation of the Davis Strait

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Mesozoic-Cenozoic rifting between Greenland and Canada created the Labrador Sea and Baffin Bay, while leaving preserved continental lithosphere in the Davis Strait which lies between them. Inherited crustal structures have been hypothesized to account for the tectonic features of the rift system. However, due to limited imaging of the region, the role of mantle lithosphere heterogeneities of continental suturing has not been fully explored.

Our study uses three-dimensional numerical models to analyze the role of crustal and sub-crustal heterogeneities in generating deformation. We implement continental extension in the presence of mantle lithosphere suture zones and deformed crustal structures and present a suite of models analyzing the role of local inherited structures related to the region. In particular, we investigate the respective roles of crust and mantle lithospheric scarring during an evolving stress regime in keeping with reconstructions of the Davis Strait.

Numerical simulations, for the first time, can reproduce first order features that resemble the Labrador Sea, Davis Strait, Baffin Bay continental margins and ocean basins. The positioning of a mantle lithosphere suture, hypothesized to exist from ancient orogenic activity, produces a more appropriate tectonic evolution of the region than the previously proposed crustal inheritance. Indeed, the obliquity of the continental mantle suture with respect to extension direction is shown here to be important in the preservation of the Davis Strait. Mantle lithosphere heterogeneities are often overlooked as a generator of crustal-scale deformation. Here, we highlight the sub-crust as an avenue of exploration in the understanding of rift system evolution.

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