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Lithospheric flexure across an extremely stretched and detached transform margin: Example from the East Greenland Ridge and Greenland FZ in the Norwegian-Greenland Sea.

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The 250 km long East Greenland Ridge (EGR) is located along the Greenland Fracture Zone (GFZ), which is part of a first-order plate tectonic feature in the Norwegian-Greenland Sea that formed when Eocene seafloor spreading was translated along the De Geer megashear region between Greenland and Svalbard to the Arctic Ocean. The EGR rises abruptly about 250 km west from the Mohns-Knipovich Ridge axis in Chron 13 (33.3 Ma) crust and continues to Chron 24 (54.4 Ma) crust. Results of recently acquired wide-angle and MCS seismic data have shown that the EGR and an adjacent faulted basin province to the north of the ridge represent a continental sliver detached from the incipient NE Greenland and SW Barents Sea margins. Crustal thicknesses were found to be around 10 km (Døssing et al., 2008). The EGR-GFZ tectonic setting can therefore be rendered as an extremely stretched transform margin.
A strong asymmetry is observed across the GFZ going from south to north with (i) a long wave-length downwards deflection of the oceanic crust, (ii) a steep southern flank of the EGR reaching more than 4 km above the predicted lithospheric thermal contraction level, and (iii) a gentle northern flank of the ridge dipping towards the faulted basin province. Hence, the ridge resembles the characteristics of other anomalously shallow, FZ parallel, transverse ridges. We propose a model in which flexural response of the lithosphere to normal faulting is responsible for the formation of the ridge. Interpretations of three, $\sim$250 km long, seismic profiles normal to the GFZ are used to model the across-strike basement geometry. The results indicate that the observed lithospheric flexure was formed due to $\sim$20 km extension normal to the GFZ along low-angle faults.
Ref: Døssing, A., T. Dahl-Jensen, H. Thybo, R. Mjelde, and Y. Nishimura (2008), East Greenland Ridge in the North Atlantic Ocean: An integrated geophysical study of a continental sliver in a boundary transform fault setting, J. Geophys. Res., 113, B10107, doi: 10.1029/2007 JB005536.