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Lithospheric failure and intra-plate volcanism in response to intense yielding: An example from the Greenland Fracture Zone, North Atlantic

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The Greenland Fracture Zone (GFZ) in the northern NE Atlantic outlines a 200 km long boundary between oceanic crust in the Greenland Basin and highly thinned, continental crust beneath the East Greenland Ridge (EGR). Seismic reflection, refraction and Bouguer anomaly data show evidence of significant crustal flexure across the GFZ. We argue that the flexure is caused by mechanical loading/unloading on a normal fault that dips towards the Greenland Basin. Simple 2D flexure modeling show that the best fit elastic thickness for 50 Ma crust in the Greenland Basin is only 10 km. We interpret the low elastic thickness as the result of intense yielding and a possible break in the oceanic lithosphere. This interpretation is supported by indications of a buried volcano of possible middle Miocene age, which is located above the point of greatest crustal curvature and at a site of abrupt changes in geometry of post-middle Miocene sedimentary seismic sequences. We associate the failure and associated intra-plate volcanism with multiple vertical tectonic events at the GFZ throughout the Cenozoic. Finally, seismic evidence is shown of pervasive bending-related faulting along the entire fracture-zone trench slope, some of which penetrate several kilometers into the upper mantle.