Onshore deformation associated with the opening of the Labrador Sea from the Aillik Domain of the Makkovik Province, Labrador, Canada

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Continental rifting between Greenland and Canada began in the Early Cretaceous or possibly earlier and culminated in the production of oceanic crust in the Paleocene, and ultimately the formation of the Labrador Sea. The onshore exposures adjacent to modern, offshore passive continental margins, including Labrador, often preserve evidence of deformation from the pre-, syn- and post-rift phases of continental breakup. Here, brittle deformation from onshore Labrador is characterized in the Paleoproterozoic Aillik Domain of the Makkovik Province alongside measurements of the pre-rift basement metamorphic mineral fabric. Stress inversion was performed twice on the field data obtained from brittle deformation, firstly on all data with kinematic indicators (A), and secondly only on deformation associated with abundant epidote mineralization that also displayed kinematic indicators (B). Both inversions show well-constrained, extensional deformation (near vertical σ1) with σ3 orientated 276° and 254° for A and B, respectively. Field observations indicate that the epidote mineralization is likely to be a localized effect, possibly due to fluid leaching from mafic dykes, and thus all the deformation may be related to the same event. The fault-containing dykes have been dated as ca. 590–555 Ma, and the most significant extensional event post this age is the rifting prior to the opening of the Labrador Sea. Furthermore, the results show similar extension directions to the first of two extensional phases related to the opening of the Labrador Sea identified by previous studies in West Greenland. It is therefore concluded that an onshore record of brittle deformation related to the opening of the Labrador Sea is exposed in the Aillik Domain. Furthermore, analysis of the orientation of the basement fabric with respect to calculated rifting direction indicated that basement structures may have been orientated such that they were particularly susceptible to rift propagation.

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