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Full-fit Reconstruction of North America-Greenland conjugate margins and implications for reconstructing the North Atlantic

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Many reconstruction models for opening of the Labrador Sea and Baffin Bay between North America and Greenland incorporate poles of rotation derived using identifications of magnetic anomalies C28-C33 in the Labrador Sea. However, recent seismic and geological data suggest the crust in which these spreading anomalies have been interpreted is not oceanic crust; the magnetic anomalies may instead delineate igneous penetrations into thinned and fragmented crust within the continent-ocean transition zone. These data suggest a more seaward extension of extended continental material in the Greenland margin near the Davis Strait than assumed in previous full-fit reconstructions. These uncertainties are an important consideration for deriving full-fit reconstruction of this region and adjacent plates.

Our study focuses on the full-fit configuration of Greenland and North America using an approach that considers continental deformation in a quantitative manner, in contrast to traditional models that treat continents as rigid blocks. We redefined the continent-ocean boundary by assimilating observations from available seismic profiles and potential field anomaly maps. A limit was then set between stretched and un-stretched continental crust using the crustal thickness map derived from the gravity inversion method, constrained by crustal thickness estimates from available seismic refraction and receiver functions. The COBs were restored to their pre-stretched locations by generating small circle motion paths between these crustal boundaries. Restored COBs were matched together using the quantitative least-squares methodology of Hellinger (1981), and correlating Precambrian bedrock units and fracture zones in both margins, to compute the total-fit Euler pole of rotation. A preferred full-fit model was chosen based on the strongest compatibility with geological and geophysical data.

Changing relative plate motions between North America and Greenland before the start of seafloor spreading has a knock-on affect for reconstruction of neighboring plates during the opening of North Atlantic. In particular, we also investigate the implications of our analysis for relative motion of Greenland and Eurasia