

North Atlantic topographic and geoid anomalies: The result of a narrow ocean basin and cratonic roots?

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ABSTRACT

There are anomalous, long-wavelength swells in the geoid and topography over the north Atlantic. The north Atlantic geoid swell is one of three prominent features in the global geoid after removing the effects of subducted slabs and glacial rebound. The swell is a 25- to 40-m peak-amplitude high and covers an area greater than 3000 × 3000 km. The north Atlantic ocean basin is anomalously shallow—by as much as 1500 m—compared to similarly aged ocean floors on the rest of the world's ocean basins. I use a series of calculations to investigate whether the geoid and topographic anomalies in the north Atlantic are consistent with the edge-driven convection hypothesis, with small-scale flow driven by the Greenland and Scandinavian cratons. I find that the small-scale convection pattern driven by the edge of a deep cratonic root can extend from the craton as far as 1000 km and upwell along a passive spreading ridge. However, the north Atlantic geoid and topographic anomalies are difficult to reconcile with either a plume or an edge-driven convection mechanism.