



Rifted Continental Margins: The Case for Depth-Dependent Extension

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Uniform lithospheric extension predicts basic properties of non-volcanic rifted margins but fails to explain other important characteristics. Particularly significant discrepancies are observed at: 1) the Iberia-Newfoundland conjugate margins (Type I), where large tracts of continental mantle lithosphere are exposed at the seafloor, and; 2) ultra-wide South Atlantic margins (Type II) where thin continental crust spans wide regions below which it appears that lower crust and mantle lithosphere were removed. Neither corresponds to uniform extension where crust and mantle thin by the same factor. Instead, either crust or mantle lithosphere has been preferentially removed. Using dynamical models we demonstrate a conceptually simple result. These margins are opposite end members: in Type I depth-dependent extension results in crustal necking and breakup before mantle lithosphere breakup, whereas in Type II the converse is true. This two-layer two-stage breakup explains the discrepancies and has significant implications for the styles of the associated sedimentary basins.