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Factors Controlling Symmetry, Width, and Degree of Magmatism at Passive Rifted Margins

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Contrasting end members of volcanic and non-volcanic passive margin formation show a large variability in structural style and associated subsidence history that imply strong variability in the underlying thermo-mechanical conditions at the time of rifting. For instance the Iberia-Newfoundland non-volcanic conjugate margin system has evolved from initial wide to late stage narrow, most probably asymmetric rift, leading to exhumation of mantle lithosphere and sub-lithospheric mantle in a wide ocean-continent transition zone under essentially cold conditions. In contrast rifting in for instance the North or the Central South Atlantic conjugate passive margins resulted in very wide (> 250 km) strongly thinned crustal conjugates. Volcanic rifted margins such as in the North and South Atlantic show excess magmatic activity and shallow water conditions at the rift-drift transition implying even higher geothermal gradients. Here thermo-mechanical finite element model experiments are used to investigate factors that are potentially important controls during volcanic and non-volcanic passive margin formation, which may explain these characteristic differences. Focus is on factors that control the degree of magmatism and structural style during lithosphere extension and passive margin formation.