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The rift to drift transition at non-volcanic margins: insights form numerical modelling.

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"Non-volcanic" rifted margins exhibit very little evidence for synrift magmatism, even where the continental crust has been thinned by such an extent that the subcontinental mantle has been unroofed along a wide (∼100 km), transitional zone, the continent-ocean transition (COT). We numerically model the dynamics of rifting to explore how this might occur and compare them to observations at the Iberia Abyssal Plain margin (IAP) and the ancient margins of the Liguria-Piemonte ocean now exposed in the Alps. We explore the effects that extension velocity, composition of the continental lithosphere and mantle potential temperature have on the nature and geometry of the COT. Extension velocity controls whether mantle exhumation occurs before or after the onset of melting. For very slow extension velocities, (< 6 mm/yr - slower than appropriate for the IAP), mantle unroofing begins before melting, so that when melting starts at the rift centre the area of unroofed mantle has moved sideways creating a COT, whose width increases with decreasing velocities. At 10 mm/yr, the velocity appropriate for the IAP, the amount of melt generated at the COT is greater than observed but can be reduced considerably if the mantle potential temperature (Tp) is low or slightly if the base of the continental lithosphere is depleted. A wide (∼100 km) COT with little syn-rift magmatism might be generated if the base of the continental lithosphere is depleted in basaltic components by ∼>10% and 25 % of the melt produced stagnates within the mantle (as hypothesized for slow spreading oceanic ridges), or the Tp is lower than normal (1200 C). Spatially variable potential mantle temperature has been deduced from petrological and geophysical data beneath continents as well as oceans and as such is a plausible alternative.