

Melt generation during continental breakup: observations and models

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Geophysical observations indicate that continental breakup is accompanied by varying degrees of magmatism prior to full development of seafloor spreading. A paradigm developed in the 1980s links the volume of magmatism to the underlying mantle temperature. This paradigm, which was based largely on observations in the North Atlantic has stood the test of time well, but as the global dataset of rifted margin observations has expanded and the resolution of these observations has improved, contributions from a range of other factors have been highlighted. In the North Atlantic, the observed voluminous magmatism appears to require a prior episode of extension to thin the lithosphere. In the northwest Indian Ocean, voluminous magmatism during early rifting is followed by very limited magmatism during final breakup. At some margins, evidence for widespread exhumation of mantle rocks without associated magmatism is difficult to reconcile with simple one- or two-dimensional models of decompression melting. Dense geophysical sampling of some margins has shown that there may be abrupt along-strike variations between regions of voluminous syn-rift magmatism and regions where such magmatism is absent, on length scales that are shorter than those expected for mantle temperature variations. I present a synthesis of the relevant observations, with emphasis on recent observations from the northwest Indian Ocean and the Black Sea, and some insights derived from numerical models of melt generation.