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# Magma at rifted margins: when, where and how much?

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Rifted margins are either classified as volcanic vs. non-volcanic or magma-rich vs. magma-poor. While such classifications are essentially based on the magmatic budget observed at rifted margins, they do not take into account the relative timing of magmatic activity with respect to tectonic activity, i.e. when and where first magma forms. High-quality reflection and refraction seismic surveys combined with drill hole data and field observations show that such a binary classification is unable to satisfactorily describe the magmatic processes related to rifting and lithospheric breakup.

Our results show that the magmatic evolution of rifted margins is complex and cannot be characterized based on the volume of observed magma alone. On one hand, so-called “non-volcanic” margins are not amagmatic, as shown by the results of ODP drilling along the Iberia-Newfoundland rifted margins and field observations in fossil analogues. On the other hand, magma-rich margins, such as the Norwegian, NW Australian or the Namibia rifted margins show evidence for hyper-extension prior to magmatic activity. These observations suggest that the magmatic budget and the timing of magma production do not only depend on the amount of crustal/lithospheric extension but also on the composition and temperature of the decompressing mantle and the occurrence of mantle plumes. However, the fact that the magmatic budget may change very abruptly along strike is difficult to reconcile with the occurrence of plumes or other deep-seated, large-scale mantle phenomena only. These observations prompted us to re-examine the magmatic and tectonic processes and their interactions during rifting and lithospheric breakup and how far inheritance, rifting rates and plume-related activity may control the magmatic budget during rifting.

In our presentation we will review results from the global margins and will discuss the structural and magmatic evolution of so-called magma-rich, magma-poor and -intermediate rifted margins. In particular, we will try to examine when, where and how much magma forms during rifting and lithospheric breakup. The key questions that we aim to address are: 1) to what extent is melting

directly related to decompression and extension , 2) how far is the magmatic budget controlled by inherited mantle composition, and 3) how important is magma storage in the mantle lithosphere during initial stages of magma production. Answering to these questions will allow to discuss to what extent the magmatic evolution of rift systems reflect the interplay between inheritance (innate/"genetic code"), actual physical processes (acquired/external factors) and plume induced processes.