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Implications of the transition from magma-poor to volcanic margin for the understanding of early spreading and break-up of the southern South Atlantic

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The South Atlantic has been generally recognized as a prime example for continental break-up with accompanying volcanic activity reflected today in massive seaward dipping reflector sequences (SDRS) in reflection as well as high velocity lower crust in refraction seismic data.

The southern South Atlantic conjugated margins of Uruguay / Argentina and Namibia / South Africa have been previously investigated with the volcanic segments receiving most of the attention and less focus on the magma-poor margin segments in the southernmost South Atlantic. In our study we show that the southernmost segments on either side of the South Atlantic are indeed magma-poor, with a sharp transition to a volcanic margin type northwards.

As the Atlantic opened from South to North, the magma-poor segments of the southernmost South Atlantic are also the oldest segments of the Ocean. Therefore, the magma-poor segments on the conjugated margins must be considered crucial in the understanding of the initial phase of spreading and rifting concluding in the opening of the South Atlantic. Understanding what led to the magma-poor beginning of the spreading phase and what triggered the subsequent change towards the volcanic margin type is therefore the aim of our research.

Reflection, refraction seismic and potential field data show that while the two conjugated margins share much of their structural features such as segmentation and abundant volcanism, they are by no means perfectly symmetrical. This is for example shown in shelf width, strength of the magnetic anomalies or orientation of break-up related sedimentary basins. From our data, we suggest changes in spreading and later rifting direction to be the cause of for these asymmetries. This directional change is also suggested to be responsible for the change in margin character from magma-poor to volcanic rather than solely a spontaneous change in crustal melt-generation. The change from south to north is not only reflected in the lack of volcanic extrusives in the more southerly, older segments on either side of the Atlantic, but also in a steeper basement slope more characteristic to sheared passive margins.