Geophysical Research Abstracts
Vol. 20, EGU2018-9843, 2018
EGU General Assembly 2018

The role of rift-jumps in the transition from magma-rich rifting to seafloor spreading: Insights from the Orange Basin

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Seaward Dipping Reflectors (SDRs) are a characteristic feature of magma-rich margins and represent the generation of large volumes of flood basalts during continental breakup. A number of recent studies provide new insights into the emplacement and tilting of SDRs and conclude that they are mostly contained within new magmatic crust that has a close affinity to oceanic crust. Yet, the process by which these initial magmatic systems evolve into a fully established seafloor spreading centre remains poorly understood. Particularly uncertain is role of rift-jumps in structuring the continent-ocean transition. Here we use a closely spaced 2D seismic reflection grid from the Orange Basin, offshore South Africa, to map the continent-ocean transition in 3D. This allows us to test if, where and why such rift-jumps occur. It is demonstrated that in the south of the study area there is a continuous SDR belt with no evidence of a rift-jump. Meanwhile, in the north of the study area the SDR belt is disrupted by the occurrence of a volcanic-stratigraphic package not previously identified on a rifted margin. We define this package as the Laterally Confined Volcanic Succession (LCVS) and interpret it as a magmatic spreading centre, which was abandoned by a subsequent rift-jump. Identification of LCVSs is important for two reasons. First, we argue that it is a pre-cursor to SDR formation and provides a unique example of SDR geometry prior to separation onto conjugate plates. Second, as we can map out their 3D geometry and evolution, the spatial relationship between LCVSs and SDRs demonstrate how magmatism becomes progressively localised on an incipient magmatic spreading centre.