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Segmentation and volcanic cycles: their relationship and evolution at the southern Reykjanes Ridge, Mid-Atlantic Ridge

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The southern part of the Reykjanes Ridge, around 58N, is characterised by well-defined en echelon axial volcanic ridges (AVRs) and oblique spreading. Previous studies have shown both the presence of a substantial crustal magma body beneath one of these AVRs, and strong evidence for cyclic accretion involving relatively rare magmatic episodes separated by longer periods of amagmatic, tectonic extension. More recent work based on the 'RAMESSES II' programme has allowed us to investigate how the cycles are related to ridge segmentation, and how the pattern of cycles and segmentation evolves through time. The study is based on extensive multi-channel seismic data, which allows us to investigate both axial melt bodies and variation in layer 2a thickness; and interpretations of gravity, magnetic, swath bathymetry and deep-towed side scan sonar data. We conclude that AVRs are organised into second-order segments, each comprising several AVRs, with a characteristic pattern of synchronicity in their tectono-magmatic cycles. Further, we are able to identify old - now-extinct - AVRs from the layer 2a data, and this reveals a longer-term cycle in which AVRs are formed, pass through several distinct magmatic episodes, and then are rafted off-axis - to be replaced by new AVRs which commonly form in the offset zones between AVRs of the previous generation.