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Structure and degree of magmatism of North and South Atlantic rifted margins

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The structure and evolution of conjugate rifted margins in the South and North Atlantic have been studied mainly based on seismic reflection and refraction profiles, complemented by potential field data and plate reconstructions. All margins exhibit distinct along-margin structural and magmatic changes reflecting both structural inheritance extending back to a complex pre-breakup geological history and the final breakup processes. The sedimentary basins at the conjugate margins developed as a result of multiple phases of rifting, associated with complex time-dependent thermal structure of the lithosphere. A series of conjugate crustal transects reveal tectonomagmatic asymmetry, both along-strike and across the conjugate margin systems. The continent-ocean transitional domain along the magma-dominated margin segments is characterized by a large volume of flood basalts and high-velocity/high-density lower crust emplaced during and after continental breakup. Both the volume and duration of excess magmatism varies. The extrusive and intrusive complexes make it difficult to pin down a COB to be used in plate reconstructions. The continent-ocean transition is usually well defined as a rapid increase of P-wave velocities at mid- to lower crustal levels. The transition is further constrained by comparing the mean P-wave velocity to the thickness of the crystalline crust. By this comparison we can also address the magmatic processes associated with breakup, whether they are convection dominated or temperature dominated. In the NE Atlantic there is a strong correlation between magma productivity and early plate spreading rate, suggesting a common cause. A model for the breakup-related magmatism should be able to explain this correlation, but also the magma production peak at breakup, the along-margin magmatic segmentation, and the active mantle upwelling. It is likely that mantle plumes (Iceland in the NE Atlantic, Tristan da Cunha in the South Atlantic) may have influenced the volume of magmatism but they did not necessarily alter the process of rifted margin formation, implying that parts of the margins may have much in common with more magma-poor margins. Conjugate margin segments from the North and South Atlantic will be compared and discussed with particular focus on the tectonomagmatic processes associated with continental breakup.