

Rheology and the Porcupine Basin

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Rheology is the study of the relationship between stress, deformation and flow. This relationship can be described mathematically using the continuity, momentum and energy equations. Additionally an equation to relate stress to strain or stress to strain rate is required. This equation is referred to as the constitutive equation. It is usually defined empirically and is chosen to fit the particular problem under consideration. Due to the computationally difficult nature of these equations analytic solutions are currently impossible. Numerical methods are employed in conjunction with several approximations. These range from the Boussinesq approximation, setting certain parameters constant and restricting the flow under consideration to two dimensions to take advantage of stream function methods.

The Porcupine basin is located offshore to the southwest of Ireland in the North Atlantic. It is a deep water sedimentary basin. Recently acquired seismic data in this basin has highlighted some surprising results. The basin has shown a highly asymmetrical crustal thickness variation. The crust is severely stretched or completely attenuated in certain regions. These results cast doubt on the model of pure shear extension as the primary mechanism for the formation of the Porcupine basin. These seismic profiles have also highlighted evidence for substantial serpentinitisation within the subcrustal mantle which may have a significant effect on the mode of extension.

Making use of current advances in computing power and methods, especially parallel and grid computing techniques, it is intended to use the aforementioned equations to investigate the influence of serpentinitisation on the basin formation.

References:

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