The Tasmantid Seamounts: A window into structural inheritance of ocean floor fabric

Fred Richards 1, 2, Lionel Kalucki 3, Tony Watts 1, Benjamin Cohen 2 & Robin basement

1Department of Earth Sciences, University of Oxford, Oxford, UK 2 Bullard Laboratories, Department of Earth Sciences, University of Cambridge, Cambridge, UK 3Department of Earth Sciences, Durham University, UK

Introduction

The Tasmantid Seamounts extend for 2500 km off the coast of Tasmania, comprising over 93 individual seamounts, subparallel spreading mid-plate fracture zones and sub-parallel spreading mid-plate fracture zones, including major seamounts and small seamounts. The seamounts are part of the Tasman Sea spreading system, which is located between 33° S and 53° S latitude. They are characterized by a high degree of mechanical coupling, defined as the ratio of the mechanical coupling between the crust and the mantle. This concept is based on the idea that the mechanical coupling between the crust and the mantle is proportional to the density difference between the two layers. The high degree of mechanical coupling is consistent with slow Tasman Sea spreading rates and low rates of melt production.

Structural Orientations

Figure 1. Structural orientations of all seamounts: (a) axial tracks, (b) trend, (c) trend and strike, (d) Core track, (e) track. The seamounts are oriented in a north-south direction, with a slight deviation to the east.

Volcanic Architecture

Figure 2. Seamount reduction densities plotted against water depth. Seamounts are categorized into four groups: (a) shallow (< 1000 m), (b) intermediate (1000-2000 m), (c) deep (2000-3000 m), and (d) abyssal (> 3000 m). The seamounts are distributed across the entire range of water depths, with the majority occurring in the intermediate depth range.

Deep Structure

Figure 3. Gravity anomaly map of the Tasmantid Seamounts. The Tasmantid Seamounts are characterized by a low gravity anomaly, indicating a low density structure. The anomaly maps show a clear trend of low gravity anomalies, consistent with the high degree of mechanical coupling.

Slope Analysis

Figure 4. Shoreline analysis of the Tasmantid Seamounts. The seamounts are characterized by steep slopes and sharp angles, indicating a high degree of mechanical coupling. The shoreline analysis shows a clear trend of high slopes, consistent with the high degree of mechanical coupling.

Gravity Modelling to Determine Lithospheric Strength

Figure 5. Linear correlation between measured and modelled slopes. The modelled slopes are well correlated with the measured slopes, indicating a good match between the model and the observed data. The linear correlation is highly significant, with a high correlation coefficient.

Conclusions

1. The high degree of mechanical coupling is consistent with slow Tasman Sea spreading rates and low rates of melt production.
2. The seamounts are characterized by high slopes and sharp angles, indicating a high degree of mechanical coupling.
3. The gravity anomaly maps show a clear trend of low gravity anomalies, consistent with the high degree of mechanical coupling.
4. The shoreline analysis shows a clear trend of high slopes, consistent with the high degree of mechanical coupling.

References


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*frd22@cam.ac.uk*