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Oceanic crust formation in the Egeria Fracture Zone Complex (Central Indian Ocean)

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This study aims to analyse in detail the oceanic crust fabric and volcanic features (seamounts) formed for the last 10 million years at the Central Indian Ridge between 19 and 21 latitude south. Multibeam bathymetry and magnetic data has been collected in 2013 as part of the French-German expedition RHUM-RUM (Reunion hotspot and upper mantle – Reunion's unterer mantel). Three long profiles perpendicular on the Central Indian Ridge (CIR), south of the Egeria fracture zone, document the formation of oceanic crust since 10 million years, along with changes in plate kinematics and variations in the magmatic input.

We have inspected the abyssal hill geometry and orientation along conjugate oceanic flanks and within one fracture zone segment where we could identify J-shaped features that are indicators of changes in plate kinematics. The magnetic anomaly data shows a slight asymmetry in seafloor spreading rates on conjugate flanks: while a steady increase in spreading rate from 10 Ma to the present is shown by the western flank, the eastern part displays a slowing down from 5 Ma onwards. The deflection of the anti J-shaped abyssal hill lineations suggest that the left-stepping Egeria fracture zone complex (including the Egeria, Flinders and an un-named fracture zone to the southeast) was under transpression from 9 to 6 Ma and under transtension since 3 Ma. The transpressional event was triggered by a clockwise mid-ocean ridge reorientation and a decrease of its offset, whereas the transtensional regime was probably due to a counter-clockwise change in the spreading direction and an increase of the ridge offset.

The new multibeam data along the three profiles reveal that crust on the eastern side is smoother (as shown by the abyssal hill number and structure) and hosts several seamounts (with age estimations of 7.67, 6.10 and 0.79 Ma), in contrast to the rougher conjugate western flank. Considering that the western flank was closer to the Reunion plume, and therefore prone to more magmatic input, this is a peculiarity that needs further investigations. We also observe that oceanic crustal thickness derived from gravity inversion displays lower values in the Egeria Fracture zone complex compared to northern and southern regions of the Central Indian Ridge. Possible mechanisms linked to both changes in plate kinematics and ridge-hotspot interactions are postulated to have assisted in the formation of thick crust north and south of the Egeria fracture zone complex, including the Rodrigues Ridge volcanic feature.