



Assessing the nature of crust in the central Red Sea using potential field methods

Wen Shi (1), Neil Mitchell (1), and Lara Kalnins (2)

(1) School of Earth and Environmental Sciences, The University of Manchester, Manchester, United Kingdom
(wen.shi@manchester.ac.uk), (2) School of GeoSciences, The University of Edinburgh, Edinburgh, United Kingdom

The Red Sea is considered an important example of a rifted continental shield proceeding to a seafloor spreading stage of development, and the transition of crustal types there from stretched continental to oceanic should mark the onset of significant mantle melting. However, whether the crust in the central Red Sea is continental or oceanic has been controversial. To address this, we first used Werner deconvolution of marine magnetic data to verify the basement depth interpreted from three published deep seismic reflection profiles. The seismic depths were then used to reconstruct basement depth corrected for evaporite and other sediment loading. Using crustal ages obtained from cross-axis distance by extrapolating at the spreading rates from the more recent magnetic anomalies, we found that the apparent subsidence with age is similar to that of oceanic crust near mantle plumes such as the Reykjanes Ridge. It has also been suggested that the variability of free-air anomalies parallel to the axis is due to crossing oceanic short-offset fracture zones. We assessed this idea by inverting the gravity anomalies for basement relief. Using densities appropriate for oceanic crust and a modified slab formula, we found values for root-mean square (RMS) relief are comparable to those of weakly sedimented regions of the Mid-Atlantic Ridge. Forward calculations using 2D modelling reveal that errors due to the slab approximation are <20% and do not affect this observation. Additionally, the RMS values and the cross-axis basement relief both suggest a different basement rugosity around the axial trough from that near the coast, perhaps supporting a transition in crustal type from stretched continental to predominantly oceanic.